

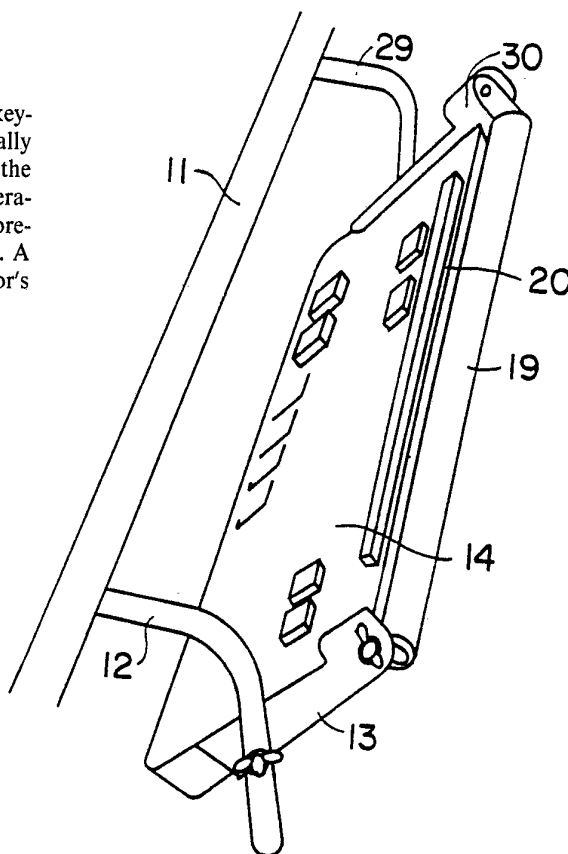


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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**(54) Title:** KEYBOARD POSITIONING SYSTEM**(57) Abstract**

A keyboard positioning system (10) in which the keyboard (14) is positioned with its rear edge (27) substantially lower than its forward, or operator edge (20) in order that the operator might use the keyboard with the plane of the operator's hand parallel to, or below the line of the operator's forearm, this reducing the incidence of carpal tunnel syndrome. A hand support bar (19) is provided to support the operator's hands while keyboarding.



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**KEYBOARD POSITIONING SYSTEM****BACKGROUND OF THE INVENTION**

In the design of alphanumeric keyboards for use in typewriters, computers, typesetters, and certain scientific and technical instruments, it has been generally assumed that the keyboard must be tilted forward, that is, the front or operator edge of the keyboard surface must be lower than the rear edge of the keyboard surface. It will be recognized that the word keyboard in this patent application will generally be used to apply to the above types of keyboards as opposed to the keyboards found in musical instruments. The assumption that this orientation is the proper way to design a keyboard may have many origins. Certainly, from the point of view of mechanical orientation of the mechanical links found in early keyboard systems, this arrangement was probably necessary. Furthermore, for operators who are not "touch" typists, it was generally necessary and desirable that the keys be arranged in such a way that their identity, designated by symbols on the keys, could be easily visible to the operator by tipping the surface of the keyboard toward the operator. Furthermore, a somewhat mechanistic concept of how the human hand operates might well suggest that the forward tipping of the keyboard would be the most efficient way of positioning the keyboard before the operator. For these and other reasons, the forward tipping of the keyboard plane is essentially universal. Such a typical orientation is shown in FIG. 1 of the drawings.

In a separate development, the medical community has become increasingly aware of an extremely irritating, but non-lethal physical affliction, known generally as the "carpal tunnel" syndrome. In this affliction, the median nerve, which extends down the arm and out to the human hand, can be damaged at the point at which it passes through the human wrist joint. The occurrence of this affliction has a large number of unpleasant physical consequences. Generally, the affliction is associated with situations in which the hand and wrist are bent upward and backward and, while in that position, significant weight is applied to the wrist. This phenomenon which

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is very common among serious bicycle riders can result in long term pain and disability.

It has been observed that the carpal tunnel syndrome is frequently associated with persons who are professional keyboard operators. It appears that the forward  
5 tilt of the keyboard, which is universally accepted as the proper design for a keyboard, may well force the operator, on a long term, continuous basis, to arch back the hand and wrist in such a way that, over the many years that the operator may be sitting before the keyboard, permanent work place injury could result. This  
unfortunate circumstance may well be resulting in serious long term human suffering  
10 and, of course, the financial liabilities and difficulties which can be associated with such human suffering. This problem is compounded by another aspect of conventional keyboard design. Ordinarily, the operator is required to sit before the keyboard with hands extended over the keyboard. Holding the hands over the  
keyboard for hours at a time places tremendous stress on the operator's shoulder and  
15 neck muscles. In conventional mechanical typewriters, this uncomfortable and potentially harmful condition was constantly relieved by the peripheral activities required by the mechanical typewriter; i.e., hitting the carriage return bar and changing sheets of paper. With modern word processing systems, the operator can  
literally spend hours without removing his or her hands from the keyboard. The long  
20 term effect of holding one's hands over the keyboard, day after day, year after year, may well cause harmful neck and shoulder muscle stress. In addition, muscle stress and fatigue in the hands are compounded by the fact that some keyboards are not sturdily built. For instance, if the keyboard is not anchored properly, there is  
generally a "springiness" when typing. This bounce in the keyboard exacerbates the  
25 carpal tunnel syndrome. These and other difficulties, experienced with the prior art devices, have been obviated in a novel manner by the present invention.

It is, therefore, an outstanding object of the invention to provide a keyboard positioning system in which the keyboard is tipped backward so that the operator's

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hands and wrist assume a position which does not cause irritation or damage to nerves which pass through the wrist joint.

Another object of the invention is the provision of a keyboard positioning system which holds the keyboard in a position in which it is tipped backwards in order to provide a more comfortable and restful orientation for professional or long term keyboard operators.

A further objective of the present invention is to provide a keyboard system which supports the operator's hands in a proper position over the keyboard in order to minimize neck and shoulder muscle strain.

It is still a further object of the present invention to provide a keyboard system which holds the keyboard in a solid position without any bounce or shake when the user is typing.

A further object is to provide a simple keyboard system which can be easily accessed and stored away below a desk.

Another object of the present invention is to provide a keyboard positioning system in which the keyboard can be easily replaced or taken off of its support on runners.

Another object of the present invention is to provide a keyboard support that adapts to a wide range of keyboard sizes with minimum need for adjustment.

Another object of the present invention is to provide a keyboard support which is easily convertible from a temporary orientation in which ease of installation and minimum permanent effect on the work station is the priority to a permanent orientation in which maximum effectiveness is the priority.

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With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

#### **SUMMARY OF THE INVENTION**

5           This invention is a keyboard positioning system which allows the keyboard to be positioned so that it is tipped backward. By "tipped backward" is meant that the rear edge, or plane, which is away from the operator, is below the forward edge, or edge closest to the operator. By orienting the keyboard in this way, the position of the operator's hand can be moved at least to the point where the plane of the hand is  
10 parallel to the line of the lower arm, thereby eliminating the stress which leads to the carpal tunnel syndrome. It has been found that, in fact, it is sometimes preferred to allow the plane of the wrist to be positioned slightly downward of the line of the lower arm. In fact, the operators have found this to be a very comfortable position in which to function. Obviously, this position is probably not acceptable to amateur  
15 keyboard operators since the visibility of the keyboard, a matter which would be important to amateurs, would be somewhat inhibited.

The keyboard positioning system would be provided with a support bar which supports the operator's hands over the keyboard. In the preferred orientation, the bar would be positioned in front of and below the front edge of the keyboard and would  
20 engage the large fleshy portion which lies at the base of the palm of the operator's hands, hereinafter proximal palm portion. The ideal is a "neutral" position.

In addition, the keyboard positioning system may also contain a stabilizing bar between the securing brackets and a tray to hold the keyboard. These elements will help support the keyboard positioning system when typing. The design allows for  
25 easy movement on a set of runners in or below a desk.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

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The character of the invention, however, may be best understood by reference to one

of its structural forms as illustrated by the accompanying drawings, in which:

FIG. 1 is a perspective view of the prior art keyboard orientation.

5 FIG. 2 is a perspective view of an embodiment of the present invention.

FIG. 3 is another perspective view of an embodiment of the present invention.

FIG. 4 is a perspective view of the holding clamp and positioning clamp which would be employed at the far end of the embodiments shown in FIGS. 2 and 3, but without the keyboard in the way.

10 FIG. 5 is a perspective view of the inside view of the system which has the brackets in the embodiments shown in FIGS. 1 and 2.

FIG. 6 is a perspective view of a preferred orientation of the system.

FIG. 7 is a perspective view of the orientation shown in FIG. 6.

15 FIG. 8 is a figurative view of the preferred orientation of the system and operator's hand.

FIG. 9 is a detailed view of a preferred orientation of the palm support.

FIG. 10 is a detailed view of another orientation of the palm support.

FIG. 11 is a perspective view of a second embodiment of the keyboard system in use.

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FIG. 12 is a close-up perspective view of the keyboard positioning system and angle adjustment capability.

FIG. 13 is a perspective view of a second embodiment of the keyboard positioning system separated from a securing structure.

5           FIG. 14 is a side view of an interchangeable temporary clamp which can be used in the second embodiment.

FIG. 15 is a side view of an interchangeable permanent bracket which can be used in the second embodiment.

10           FIG. 16 is a diagrammatic side view of a keyboard in a conventional position showing the hand extention necessary to reach the far rows of keys.

FIG. 17 is a diagrammatic side view of a keyboard oriented to embody the principles of the present invention, showing the ease by which the user can reach the near keys.

15           FIG. 18 is a diagrammatic side view of a keyboard oriented to embody the principles of the present invention, showing the ease by which the user can reach the mid keys.

FIG. 19 is a diagrammatic side view of a keyboard oriented to embody the principles of the present invention, showing the ease by which the user can reach the far keys.

20

#### **DESCRIPTION OF THE PREFERRED EMBODIMENT**

Referring first to FIG. 2, where are best shown the general features of the present invention, it can be seen that the keyboard positioning system, generally



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denominated by the numeral 10, includes a base or desk surface 11, positioning brackets 12 and 29 (not shown) connected to the base 11, clamping element 13 and 30 (not shown), which is adjustably connected to the positioning brackets 12 and 29, respectively, and a keyboard 14 of the conventional computer keyboard type.

5           The clamping element 13 is shown adjustably locked to the positioning bracket 12 by a wing nut and bolt combination 16 and 17. At the forward, or operating edge 18 of the clamping element 13 is a hand support 19 which extends across the front edge 20 of the keyboard and hand support holder 23 which is attached to the clamping element by means of a wing nut 21 and bolt 22. The clamping element 13 has a  
10 holding element 24 (set-screw) which holds the keyboard in the clamping element 13.

The hands 23 of the operator extend over the wrist support bar and hang downwardly toward the keys 25 of the keyboard 14.

The surface 26 of the keyboard is positioned at an angle of approximately 45° from the horizontal with the rear edge 27 lowered. More specifically, if the keyboard  
15 plan is defined as the plane which approximates the upper surfaces of all of the keys, then the preferred embodiment puts the keyboard plan from 30° to 60° down from the horizontal. The invention appears to be beneficial from 10° to 70° and offers some benefit from 0° to 70°.

Referring now to FIG. 3, it can be seen that both of the hands 23 and 28 of  
20 the operator carry over the hand support bar and downward toward the keys 25.

Referring to FIG. 4, it can be seen that the inside surface of the clamp 30 is provided with an upper clamping flange 31 and lower clamping flange 32 which oppose one another and engage the side edge of the keyboard. A set screw 33 allows the clamping elements to securing engage the keyboard so that it does not slide out.

25           FIG. 5 shows a view of the inside surface of the clamping system and because

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it is a side elevational view, the angularity of the clamp with respect to the vertical and horizontal portions of the positioning element can be more clearly seen.

FIG. 6 shows a perspective view of the system with the wrist support in the preferred orientation, i.e., below the front edge 20 of the keyboard 14. FIG. 7 is a  
5 closer view of the orientation in FIG. 6, showing the operator's hand 23.

FIG. 8 is a diagrammatic view of the preferred orientation of the operator's hand 28, the front edge 20 of the keyboard 14 and the hand support 19. The hand support 19 engages and supports the proximal palm 34. The palm 35 curves over (without touching) the front edge 20 of the keyboard 14 and the fingers 36 reach to  
10 the keys 25.

FIGS. 9 and 10 show the orientations of the hand support 19, the hand support holder 37, and the forward edge 38 of the clamping element 30. The hand support holder 37 (of which there is one at each end of the hand support) is formed of a plate 39 and a pin 40 mounted on the plate and extending outward from the plane of the  
15 drawing. The plate 39 is adjustably mounted to the clamping element 30 by the bolt 41 which extends through the slot 42 in the plate to allow both rotation and radial positioning of the pin 40. The pin 40 is shaped to engage the end of the hand support 19. The hand support 19 is formed of a hollow cylinder which can be easily cut to length and engaged by the pin 40, on one end, and a corresponding pin on the other  
20 end. In this way, the system can be adapted to the various widths of the keyboards.

FIG. 11 is a perspective view of a second embodiment of this invention in use.

FIG. 12 shows the keyboard positioning system 110, shown in FIG. 11, with a downward or backward keyboard slant and tray 142 positioned at the bottom of positioning brackets 143 and 144. The brackets are attached to desk 145.

25 FIG. 13 shows the keyboard positioning system with hand support 19 attached

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by means of adjustment knobs 150 and 151 to tray 142 which holds a keyboard (not shown). The tray 142 is attached by height adjustment knobs 153 and 154 (not shown) on both the left and right sides of two positioning brackets 143 and 144. The positioning brackets may be connected to a pair of runners 154 and 155 which are  
5 connectable to a desk 145 (not shown). A support bar 146 is positioned between the positioning brackets 143 and 144, to make the entire structure very rigid. The positioning brackets 143 and 144 have knobs 152 and 153 which screw into the tray 142 and which allow for height and angle adjustment by slots 157 and 158 in each of the positioning brackets 143 and 144, respectively.

10 One special feature of the second embodiment is the means by which the system is attached to the desk. It has been found that the long-term benefits of the present invention can be best accomplished by maximizing the rigidity of the system as it is attached to a desk. However, the rigid and permanent installation tends to be time consuming and tends to leave permanent disfigurement (i.e., screw holes) in the  
15 underside of the desk. It has been found that these aspects of the permanent installation tend to discourage many potential users from trying the system and receiving its benefits. This embodiment is, therefore, provided with easily interchangeable clamps which allow the system to be quickly and easily attached to a desk for test use. The clamps do not require damage to the desk. In that way, the  
20 user can test the system with minimum objection and thereby discover its benefits.

FIG. 14 shows a side view of the attachment portion of the system. The positioning bracket 144 is rigidly attached to the clamp 162 by a threaded bolt 161, which passes through an aperture in the bracket 144 and engages a threaded aperture in the clamp 162. The clamp 162 has an upper arm 164 which engages the upper  
25 surface of the desk 145. The clamp also has a lower arm 165 which extends a substantial distance under the desk 145. The lower arm has a threaded vertical bore which carries a threaded shaft 166. The lower end of the shaft 166 has a clamping knob 167, which, when turned, allows the upper end of the shaft 166 and a pad 163 thereon to engage or disengage the lower surface of the desk. This clamp 162 and

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a similar clamp 168 (not shown) on the other bracket 143 allow the system to be easily and quickly attached to the desk for test purposes.

Once the benefits of the present invention have become clear to the user during testing, it is possible to replace the clamps 162 and 168 with a more aesthetic and functionally superior attachment means shown in FIG. 15. This alternative arrangement not only provides optimally rigid support for the keyboard, but also allows the keyboard to be slid under the desk surface when the keyboard is not in use.

To convert from the clamp structure shown in FIG. 14 to the bolt-on structure shown in FIG. 15, the clamp 162 is separated from the bracket 144 by removing the bolt 161. The bracket 144 is then attached to the runner or bolt-on bracket 155 using the bolt 161. The bolt passes through the aperture in the bracket 144, through an aperture in the bolt-on bracket 155, and engages a threaded bore in the end of the stabilizing bar 146.

There are bolt-on brackets 154 and 155 for each of the brackets 143 and 144. The bolt-on brackets are mirror images of one another. Bolt-on bracket 155 consists of an elongated frame 171, several flanges (only flange 172 is shown in FIG. 15) which allow the frame to be rigidly bolted to the underside of the desk 145, and a slider 175. The slider is elongated and is slidably mounted in ball-bearings, for horizontal linear movement, in the frame 171. One end of the slider 175 is the part of the bolt-on bracket 155 which is attached to the bracket 144. The sliding action of the bolt-on brackets allows the system to easily move the keyboard from a working position away from the desk to a storage position near and beneath the desk.

The present invention does something no other prior art product can do and that is to place and maintain the hand and wrist of the operator at or near a physiologically neutral position. The emphasis on the neutral position is critical

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because this is the position which really helps dedicated (full-time) keyboard users to minimize the damage caused by the bending of the median nerve and associated wrist structures.

The present invention's use of the sliders, in combination with a very thin  
5 holding tray, allows for the computer keyboard to be pulled up into the operator's lap. This brings recognized comfort, but more importantly, it allows and encourages a medically beneficial sitting position. That position acts to reduce upper torso stresses in the arms, neck, and upper extremities.

The adjustable palm bar, with its unique small diameter (3/4" to 1-1/8" in  
10 outer diameter, preferably 7/8"), allows for minute adjustments of the wrist position in relationship to the keys and for the overall comfort of the hand as it is placed over the computer keyboard.

The backward-tilt holding tray for the computer keyboard helps to dramatically  
reduce the amount of flexing the fingers must do while operating the keyboard. This  
15 contributes significantly to the reduction in overall stress to the associated tendons of the hand and wrist. It also reduces stress on the median nerve. No prior art product can make this claim. Only the unique position of the keyboard and the unique effect of the palm bar appear to achieve this important effect.

One important aspect of the keyboard orientation is the manner in which the  
20 position of the palm rest and the back-tilted orientation of the keyboard allows the

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fingers to reach the most-used keys with a maximum of hand and finger flexion (ventral bending) and minimum of hand and finger extension (dorsal bending). As shown in FIG. 16, the conventional keyboard orientation requires that a hand position which allows contact with the first row of keys also must involve extreme extension  
5 of the fingers to reach the upper row of the main keys. This extension of the fingers places severe strain on the muscles and tendons that cause extension of the fingers and, as a result, the hands are either fatigued or the wrist is forced out of the neutral position. The result, over a long term, is wrist damage and carpal tunnel syndrome.

The present invention, on the other hand, allows reaching the keys while  
10 keeping the fingers in flexure. FIGS. 17-19 show this effect graphically.

The present invention is the first device to be totally adjustable to all operators. The height and keyboard angle can be quickly and easily adjusted by the tightening knobs. The present invention has overall ability to address the unique physiological requirements of any operator, regardless of size. It allows for the  
15 correct straight up-and-down sitting posture for the back, at the same time, adding strong support for the arms. This is because the hands, via the palm rest, act to support the upper torso weight.

The present invention, while appearing similar in some respect to prior art products in the computer keyboard storage tray market, is radically different. The  
20 present invention is designed for one primary function and that is to provide a device to respond to the computer keyboard operator's physical needs. Primarily, this is

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accomplished by placing the operator's wrists in a continuous neutral position while the operator continues to operate the keyboard. This is achieved by three physical aspects, (1) combining a backward tilted holding tray with (2) a moveable approximately 3/4" diameter round palm rest, and (3) attached to computer tray  
5 sliders. The ability of the three movable aspects to be minutely adjusted to the operator's own physical requirements maximizes the benefit.

The present invention develops a new aspect in the ergonomic field with regards to accepted sitting positions for keyboarding. It is generally accepted that the hand and arm should be held between 90 degrees and 70 degrees relative to the  
10 vertical upper arm. The present invention is particularly effective when the hand and arm are positioned at a downward angle of 110 degrees down to 160 degrees relative to the vertical upper arm. No other product has advocated using this extreme position. In field trials, the present invention has won the praise of its operators. The present invention is proving to be innovative in bringing relief with this new,  
15 radical position.

Some prior art units must be fully extended to be operated. That is, the unit must be fully extended from the work station to be operative and to allow the holding tray to be rotated to the desired position. Compared to the critical positions of the present invention in the backward tilt, the prior art units assume only limited  
20 positions. This does not allow for the minute adjustments afforded by the present invention. The critical position for the operator to maintain while operating the computer keyboard is a position which causes the wrist to remain in neutral position

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and reduces the repetitive extension (dorsal bending back) of the wrist. The present invention does this, but the prior art products do not enforce the optimum position of the hand and arm so that the wrist remains neutral throughout the operation of the computer keyboard. The prior art wrist rests serve as support for the wrist, rather  
5 than the palm. The whole wrist must be placed on the prior art support tray. The present invention requires only the distal surface of the base part of the palm to rest on the small diameter round bar. The fatty tissue in the palm allows for a natural cushion. The prior art units require the wrist, with its veins and tendons close to the skin surface, to be in constant and potentially damaging contact with the wrist rest.

10 An important feature of the palm rest is that it allows for greater movement of the hand with less obstruction from the supporting surface of the hand support. With the prior art units, the whole wrist is in contact with the supporting surfaces. The present invention only requires contact between the support and the base of the operator's palms. This allows for a more natural movement of the fingers and hands,  
15 reducing stress and fatigue to the operator.

Vibration is an important aspect to consider when operating the computer keyboard on a continuous basis. It is analogous to being in a rough riding car versus a smooth riding car. For the dedicated keyboard operator, it is important for the keyboard to provide a firm, energy absorbing or "damped" surface. If this is not  
20 accomplished, then the operator cannot fully relax his or her upper torso when his or her hands are placed on the palm rest or wrist rest. The result of not having a secure-



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feeling resting surface for the hands is the tightening of the neck and arm muscles. This is extremely harmful to a full-time keyboard operator.

The prior art units are described as convenient storage systems for the computer keyboard, and they all promoted for the comfort of the computer keyboard operator. However, the majority of the prior art products vibrate to a great degree in use. One of the reasons is the perceived need to have a product that will appeal to everyone's needs. This means products with a wide range of versatility. In the process of trying to achieve this market capability, the products are designed in an unstable form. This unstable form interfere with their ability to be very stable in use and to absorb the continuous vibration from the continuing key strokes.

The present invention has carefully taken into account the need to provide the dedicated (full-time) operator with a sturdy work platform. The present invention is designed much as an athlete's apparatus for a sport would be designed. It must do the job and hold up under duress and provide maximum comfort to the users. An operator who is subject to hand support vibration while using a computer keyboard for extended periods of time, will suffer quickly from fatigue and this may result in the injuries now being experienced in the work place. While the present invention provides for the maximum comfort of the operator, the device is primarily intended to encourage the optimum position for the computer keyboard operator and that is the wrist neutral position. Therefore, the present invention's concept of comfort for the operator includes the long-term comfort which results from the design function of having the computer keyboard operator maintain this neutral, and therefore less

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injurious, hand and wrist posture. The other prior art products do not recognize this specific mode of operation. It is only maximally achievable with the special (approximately) 3/4" diameter adjustable palm bar and backward tilted keyboard holding tray in conjunction with the mechanical design and superior construction of  
5 the materials used to make the present invention.

The present invention also focuses on the "palm only" resting on the palm support. The prior art units show or describe the whole wrist resting on the wrist rest. In order for the operation of the prior art units, the wrist must be moved continuously over the surface to reach the keys. That does not allow for the wrist and  
10 hand to be placed in a continuous neutral position. The fingers must be extended (bent dorsally) for each key stroke of operation. The present invention allows for the fingers to be moved in a non-stress downward movement, without significant need for full extension (dorsal bending) of the fingers.

An important aspect of the key stroke operation on the backward tilted  
15 keyboard is the ability to keep the hand in a semi-cupped position. This allows for the hand to work without being forced to reach, in extension, for the computer keyboard keys. This, incidentally, adds to the speed of the operator's typing ability, because the fingers have less range to travel in the stroking of the keys. Over a short period of time, this adds to the productivity of the operator with much less fatigue.  
20 The present invention, while somewhat similar in overt appearance to some prior art units, is uniquely different from any other prior art product. The present invention is designed to address the dedicated (full-time) keyboard user's physical need for

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ergonomic adjustment while operating the computer keyboard. No other product has been effectively designed to do this.

It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, however, 5 desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

The invention having been thus described what is claimed as new and desired to be secured by letters patent is:

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**CLAIMS**

1. A keyboard positioning system for holding a keyboard in a position with respect to a base and relative to a human operator comprising:

(a) a holding means adapted to hold the keyboard, and

5 (b) a positioning means adapted to connect the holding means to the base and adapted to orient the holding means so that the keyboard is positioned so that the operator's wrists remain in a neutral position while operating the keyboard.

2. A keyboard positioning system as recited in Claim 1, wherein the holding  
10 means includes a support means adapted to engage the palm of the operator and to support the operator's hands during keyboarding.

3. A keyboard positioning system for holding a keyboard in a position with respect to a base and relative to a human operator comprising:

(a) a holding means adapted to hold the keyboard, and

15 (b) a positioning means adapted to connect the holding means to the base and adapted to orient the holding means so that the keyboard is positioned with its rear edge lower than its forward edge.

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4. A keyboard positioning system as recited in Claim 3, wherein the holding means includes a support means adapted to engage the palm of the operator and to support the operator's hands during keyboarding.
5. A system as recited in Claim 3, wherein the upper surface of the keyboard is tipped back in the range of 30° to 60° below horizontal.
6. A system as recited in Claim 3, wherein the upper surface of the keyboard is tipped back in the range of 10° to 70° below the horizontal.
7. A keyboard positioning system as in Claim 3, which includes a tray for holding the keyboard.
10. 8. A keyboard positioning system as in Claim 3, wherein the attachment means includes a slidable runner to attached the keyboard to a desk.
15. 9. A keyboard positioning system as recited in Claim 3, wherein the attachment means is adapted to attach to a desk and the attachment means includes a first attachment means which attaches to the desk without penetrating the desk and a second attachment means which attaches to the desk by penetrating into the desk.
10. A keyboard positioning system as recited in Claim 9, wherein the first and second attachment means are removable and interchangeable.

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11. A keyboard positioning system for use in keyboarding by the fingers on the hands of a human operator, comprising a keyboard, said keyboard having a front edge adjacent the operator and a rear edge which faces away from the operator, and a keyboard holding element adapted to hold the keyboard in such a position that the rear edge of the keyboard is substantially below the horizontal plane which includes the front edge of the keyboard, relative to the operator.

12. A keyboard positioning system as recited in Claim 11 in which the system includes a base and a bracket which physically connects the base to the keyboard holding element.

13. A keyboard positioning system as recited in Claim 11 wherein a hand support bar is provided adjacent the front edge of the keyboard in order to support the operator's hands so that the fingers are supported above the plane of the keyboard.

14. A keyboard positioning system as recited in Claim 11, wherein a hand support is provided to support the operator's hands during keyboarding.

15. A keyboard positioning system as recited in Claim 11, the keyboard includes a right side edge to the operator's right, and a left side edge to the operator's left, wherein the system includes two clamps each of which conforms to the shape of one of the side edges of the keyboard and each of which clamps is adapted to be clamped to one of the keyboard

20 edges.

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16. A keyboard positioning system for holding a keyboard in a position with respect to a base and relative to a human operator, said keyboard having a forward edge facing the operator and a rear edge facing away from the operator, and said keyboard having a keyboard plane including the upper limit of said forward edge and  
5 the upper limit of said rear edge, and said keyboard having a plurality of letter keys, representing the letters of the alphabet, said keys each having an upper surface, and said keyboard having a key plane which is the plane which most closely represents the upper surfaces of the letter keys, comprising:

- (a) a keyboard holding element adapted to hold the keyboard, and
- 10 (b) a positioning bracket adapted to connect the keyboard holding element to the base and adapted to be oriented with respect to the keyboard holding element in such a way that when the positioning bracket is in place, the keyboard holding element can be positioned so that the keyboard is positioned with its rear edge lower than its forward edge.

15 17. A system as recited in Claim 16, wherein the keyboard plane is tipped back in the range of 30° to 60° below horizontal.

18. A system as recited in Claim 16, wherein the keyboard plane is tipped back in the range of 10° to 70° below the horizontal.

19. A system as recited in Claim 16, wherein the keyboard plane is tipped  
20 back in the range of less than 0° to 70° below the horizontal.

(22)

20. A system as recited in Claim 16, wherein the key plane is tipped back in the range of 30° to 60° below horizontal.

21. A system as recited in Claim 16, wherein the key plane is tipped back in the range of 10° to 70° below the horizontal.

5           22. A system as recited in Claim 16, wherein the key plane is tipped back below the horizontal.

23. A system as recited in Claim 16, wherein the key plane is tipped back in the range of 0° to 70° below the horizontal.

24. A keyboard positioning system for use in keyboarding by the fingers on  
10 the hands of a human operator, said operator having wrists and arms, comprising a keyboard having a front edge adjacent the operator and a rear edge which faces away from the operator, and a keyboard holding element adapted to hold the keyboard in such a position that the rear edge of the keyboard is in a position with respect to the front edge of the keyboard, that the operator is able to operate the keyboard while  
15 maintaining the operator's wrists in a neutral position.

25. A keyboard positioning system as recited in Claim 24 in which the system includes a base and a bracket which physically connects the base to the keyboard holding element.



(23)

26. A keyboard positioning system as recited in Claim 24, wherein a hand support bar is provided adjacent the front edge of the keyboard in order to support the operator's hands so that the fingers are supported above the plane of the keyboard.

27. A keyboard positioning system as recited in Claim 24, wherein a hand  
5 support is provided to support the operator's hands during keyboarding.

28. A keyboarding positioning system as recited in Claim 24, wherein the system is oriented so that the keyboard rear edge is substantially below its front edge.

29. A keyboard positioning system as recited in Claim 24, wherein the keyboard has a group of the most used keys with upper surfaces, and a key plane  
10 defines the upper surfaces, and wherein the key plane intersects the operator's arms proximal of the operator's fingers.

30. A method of employing a keyboard by a human operator, having arms, wrists and fingers, to input alphanumeric characters, the method comprising positioning the keyboard so that the operator's wrists are maintained in a neutral  
15 position during use and thereby reducing the likelihood of carpal tunnel syndrome in the operator.

(24)

31. A method as recited in Claim 30, wherein the keyboard has keys with upper surfaces and a key plane which represents the plane of the upper surfaces of the most commonly used keys, and the keyboard is positioned so that the intersection of the key plane and the operator's arm is proximal to the operator's fingers.

5           32. A method as recited in Claim 30, wherein the operator's hand is supported above the key plane.

          33. A method as recited in Claim 30, wherein the operator's hand has a heel on its ventral side proximal of the hand, and the heel has a distal slope, and the method includes positioning the distal slope of the heel of the operator's hand on a  
10 palm support while the fingers are positioned to operate the keys.

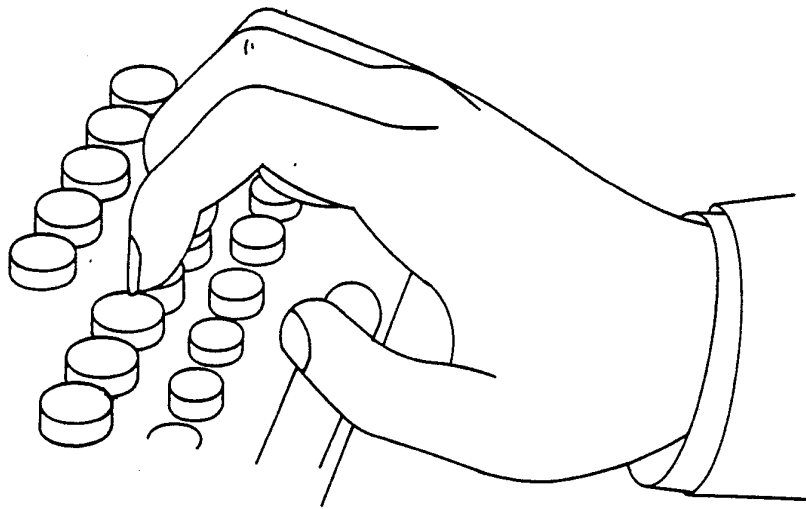


FIG. 1

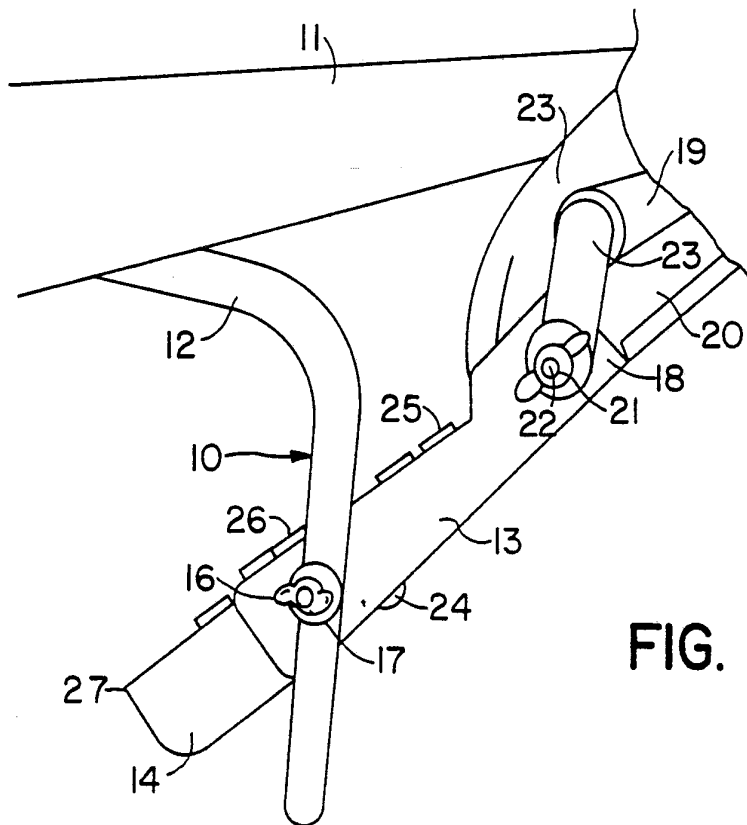


FIG. 2

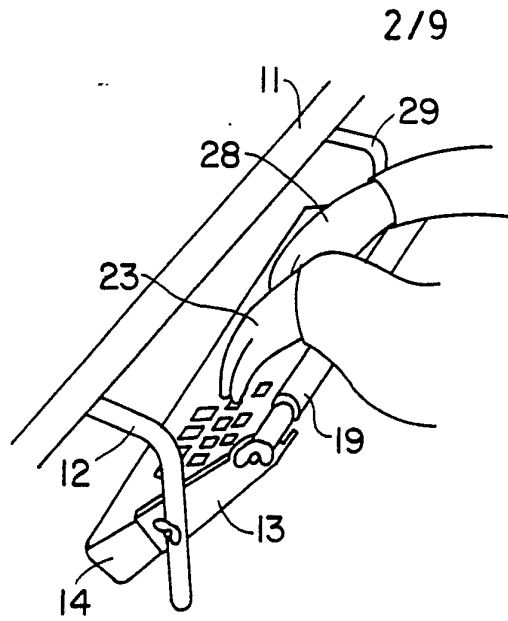


FIG. 4

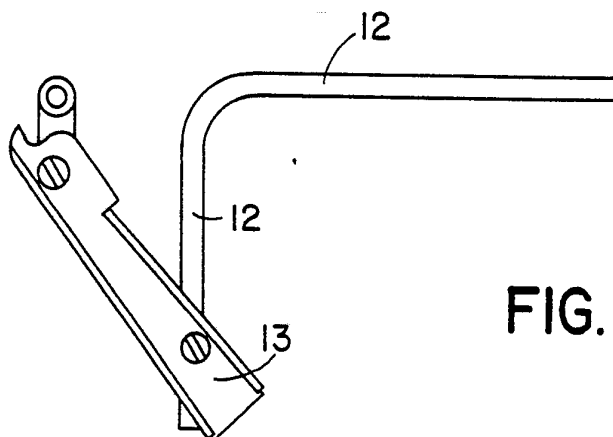
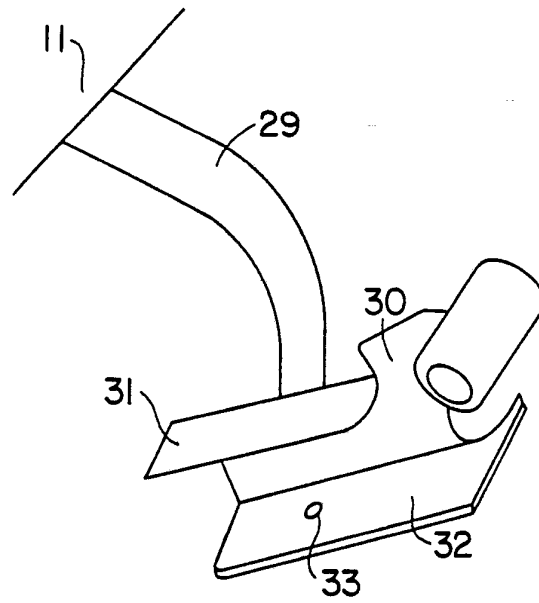


FIG. 5

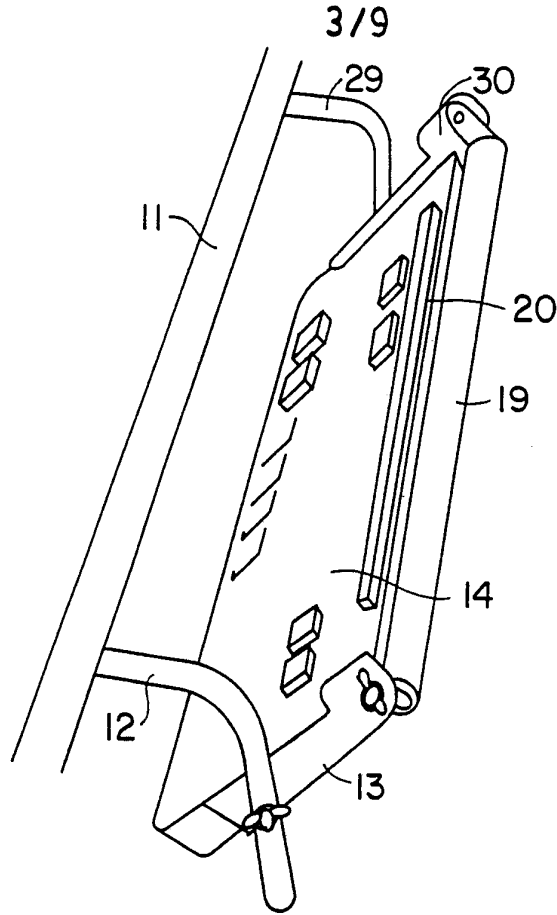


FIG. 6

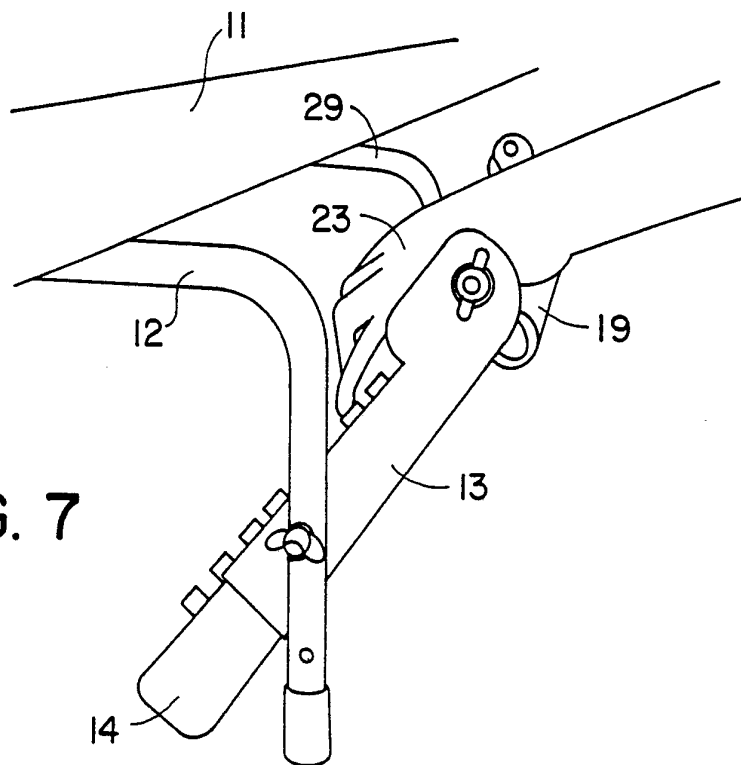


FIG. 7

SUBSTITUTE SHEET

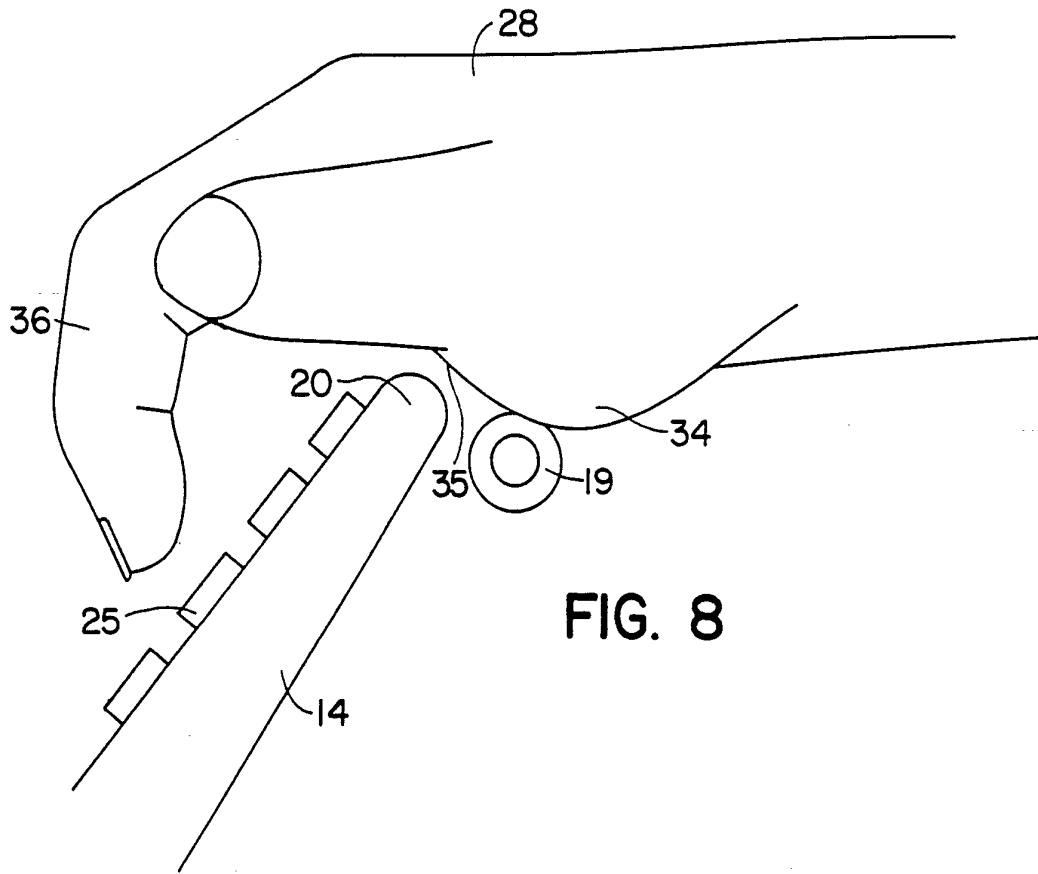


FIG. 8

FIG. 9

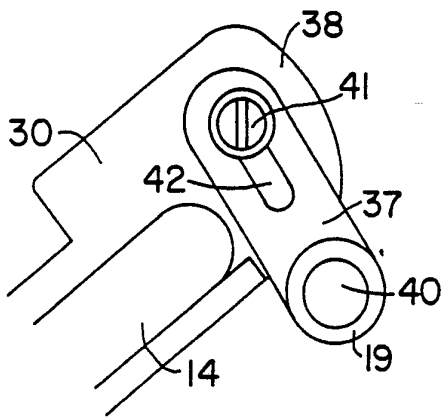
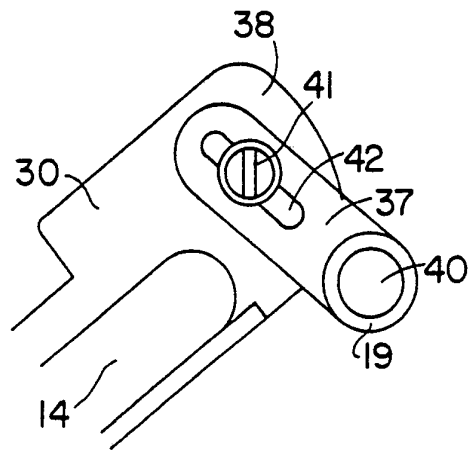


FIG. 10



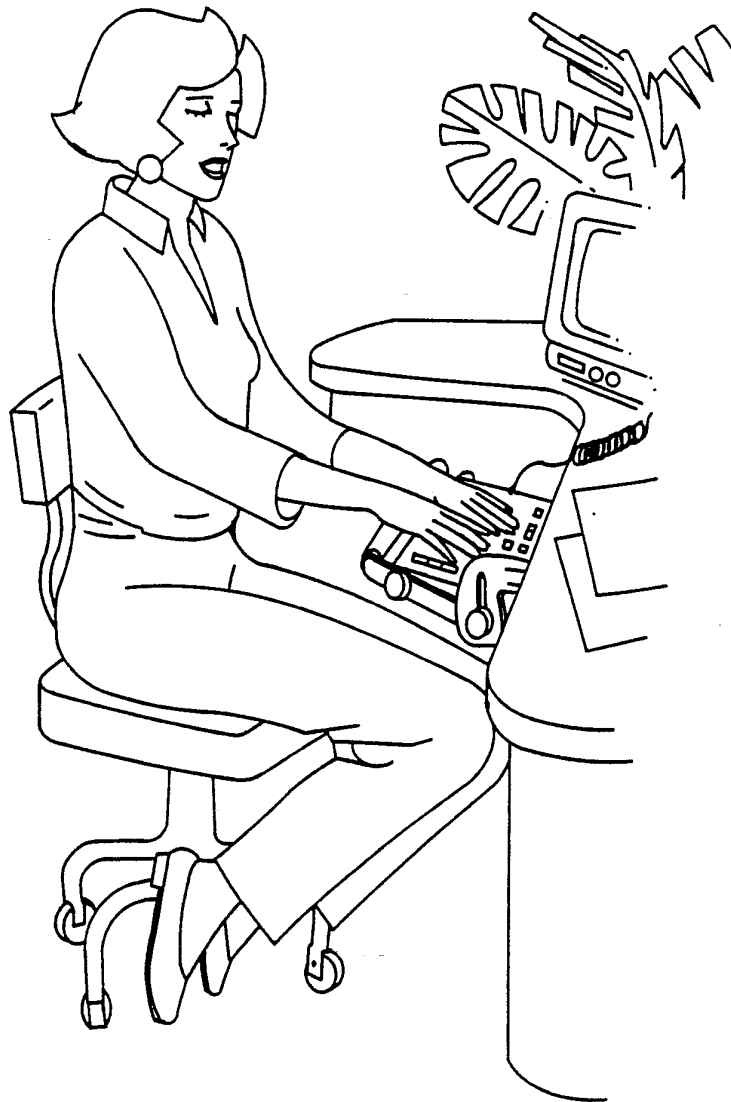


FIG. 11

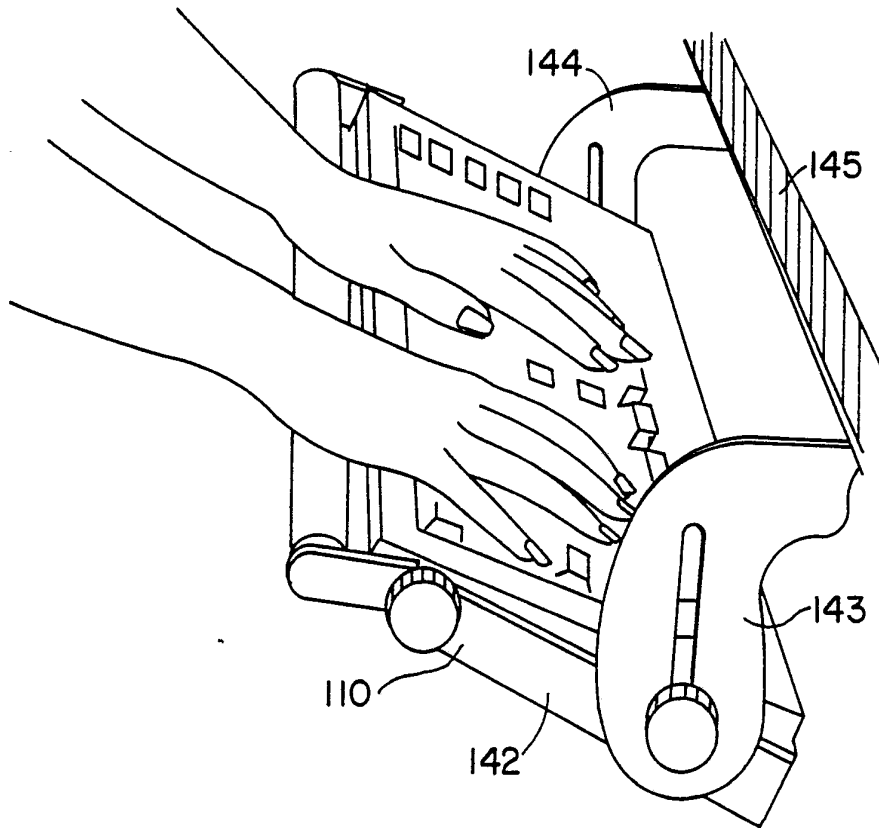


FIG. 12



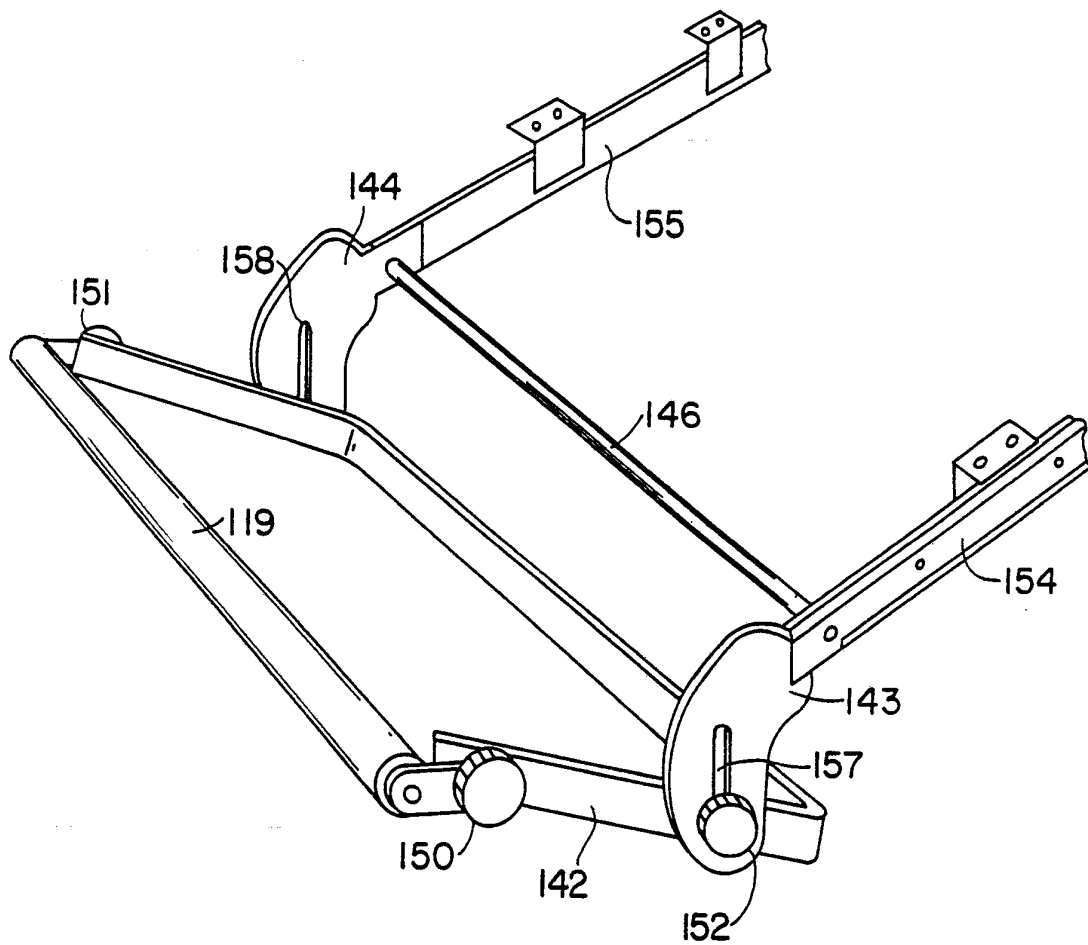


FIG. 13

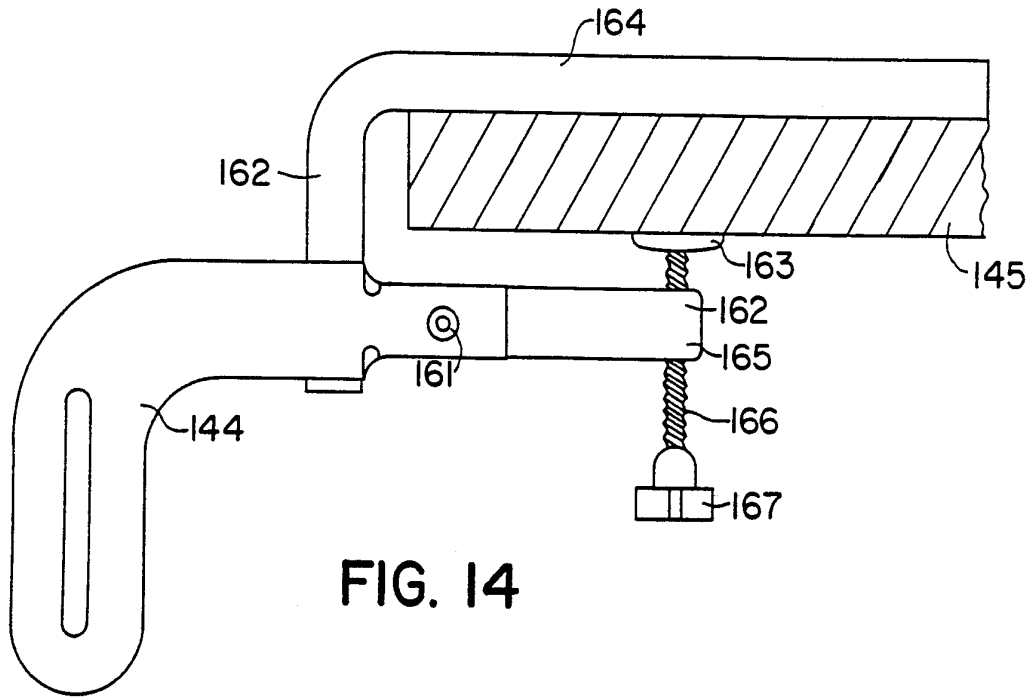


FIG. 14

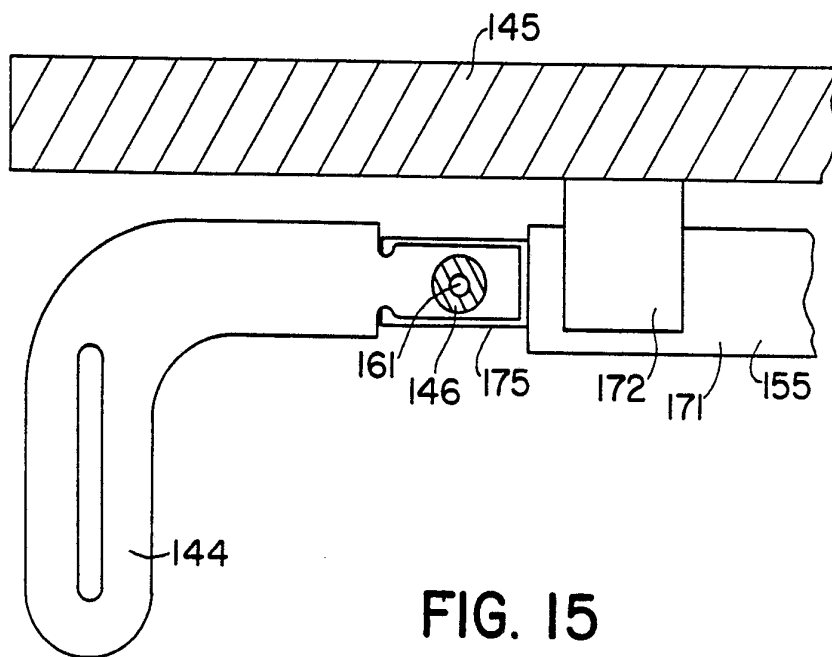


FIG. 15

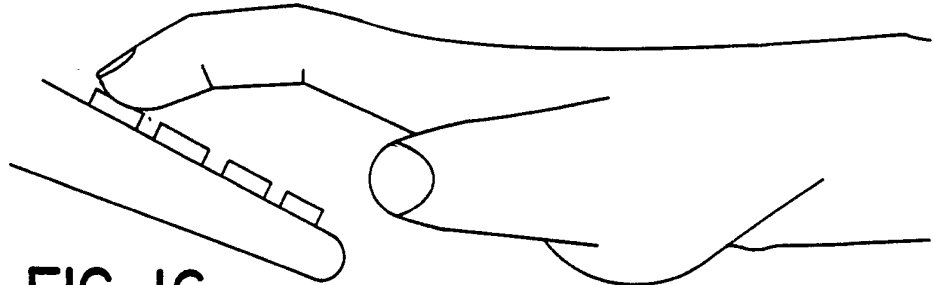


FIG. 16

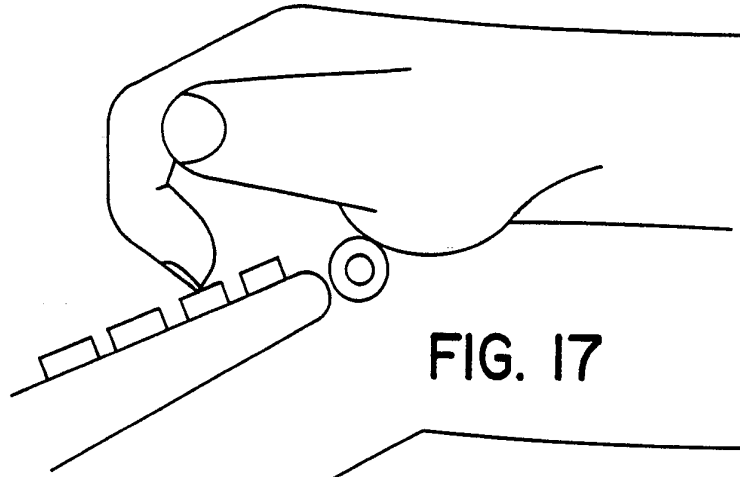


FIG. 17

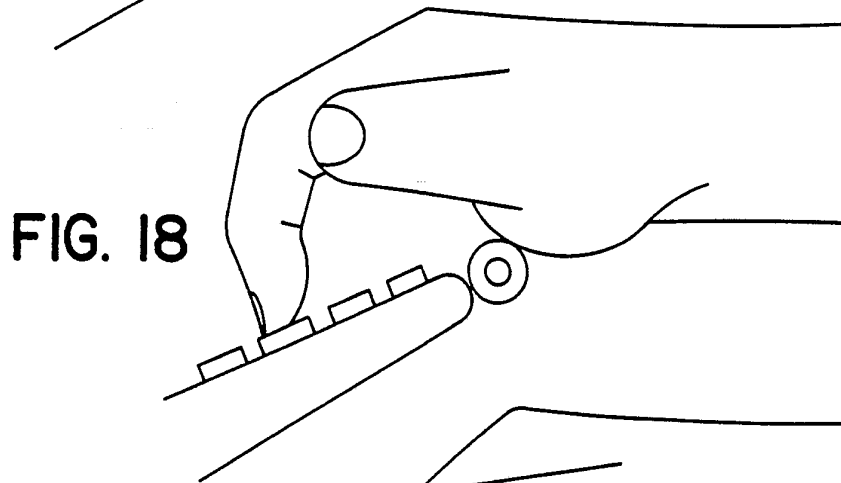


FIG. 18

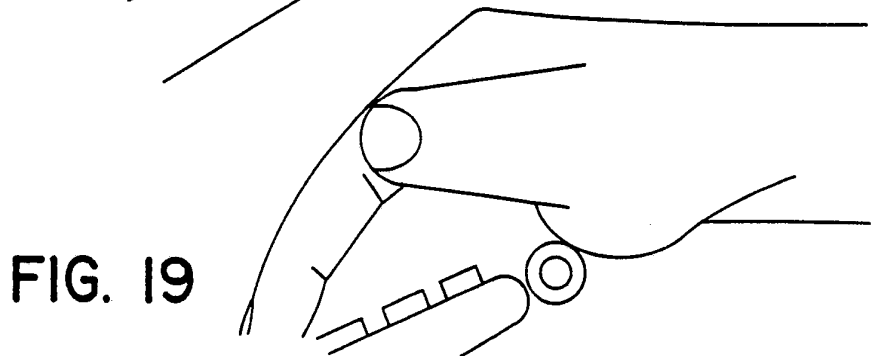


FIG. 19

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US92/00824

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC (5): B41J 5/10		
U.S.C.I.: 400/472		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
U.S.	400/472, 473, 480, 481, 489, 82, 488, 477, 479 235/145A, 146, 145R 248/418, 118, 118.1, 118.3	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y,P	US,A, 5,040,757 (BENAWAY) 20 August 1991 See entire document.	11,13,14 and 24-33
Y	US, A, 3,830,352 (KOLPER) 20 August 1974 See entire document.	1-10, 12 and 15-23
Y	US, A, 4,688,862 (FOWLER ET AL.) 25 August 1987 See entire document.	1-10, 12 and 15-23
Y	US, A, 4,481,556 (BERKE ET AL.) 06 November 1984 See Figs. 1-10.	1-10, 12 and 15-23
A	US, A, 4,779,922 (COOPER) 25 October 1988	1-33
A	US, A, 4,976,407 (SCHWARTZ ET AL.) 11 December 1990	1-33
<p>* Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
01 April 1992		<b>20 APR 1992</b>
International Searching Authority		Signature of Authorized Officer
ISA/US		<i>Nguyen</i> Fu Anthony Nguyen