10 Inventions on Ergonomically Developed Computer Accessories

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10 Inventions on ergonomically developed computer accessories
-A study based on US patents

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1. Introduction

Today many computer users experience several major physical problems. Various studies have found that people working with computers experience more physical problems than people working without computers. One of the reasons is that the computer user has to work in a fixed position for long hours without having scope to move his body or change his sitting position.

The height, shape and habit of every human being are different. In large workplaces, the construction of computer furniture and accessories cannot be made according these peculiarities of every human being. As a result every computer user has to work on standard computer furniture and standard computer accessories that may not match with his physical construction and peculiarities of that user. This results in reduction of user productivity and increase in workman’s claim for injuries. It is necessary to design ergonomic computer accessories to reduce these problems of computer users.

1.1 Problems caused by prolonged computer usage

The major physical problems caused by prolonged computer usage can be categorized as neck pain and stiffness, low back pain and stiffness, and strain of the wrists. These problems are caused by chairs, computer desks, and keyboard support stands that are unsuitable for the particular computer user.

Many physicians advise computer users to take off for five minutes or so at each 30 to 60 minutes of working time to move about to relieve their neck, back and wrist pain symptoms. In most cases the user fails to do so because of the work pressure. Even if he does so the user productivity is affected.

1.2 Repetitive Stress Injuries (RSI) and Carpal Tunnel Syndrome (CTS)

A primary problem which has been closely associated with the use of the computer is that of carpal tunnel syndrome (CTS). Carpal tunnel syndrome is a debilitating injury to the wrist joint which has been frequently attributed to long term repetitive hand motion activities. A further factor contributing to carpal tunnel syndrome and its symptoms is the strain on the operator’s wrists due to using a keyboard that is too high or too low.

The median nerve and flexor tendons of each hand pass through a small opening in the wrist known as the carpal tunnel. When continuous activities involving strain on the wrist are combined with finger articulation, swelling in the carpal area may occur which, in turn, creates pressure on the median nerve. The resultant pain, tingling and numbness of the fingers are the symptoms typical of carpal tunnel syndrome.

A carpal tunnel syndrome is generally treated with complete rest and immobilization of the wrist for a period of several weeks. The worse cases are treated with surgery. But all these problems may again start when the user starts using the keyboard again after the treatment.
1.3 Problem with keyboards

- The conventional key layout is not scientifically arranged. This leads to more movement of fingers for less work and leads to user fatigue.

- Keyboard is generally positioned on a standard table the height of which is not convenient for many users.

- If the keyboard is too far from the operator’s seat the user may have to lean forward, which causes uncomfortable sitting position.

- Keyboard is generally kept flat on a table where as human arm would prefer to operate in an angle.

- As the keyboard is at lower level than the monitor the user has to move his vision from monitor to keyboard time and again which causes stain to the muscles of the neck and of the eyes.

- The keyboards of small computers and PDAs are not comfortable for typing.

1.4 Problems with monitors

There are frequent complaints from people who view computer monitors for prolonged periods.

- The computer monitor is normally at 16 to 20 inches from the person seated before a desk or a table supporting the computer monitor, eye strain, frequent eye and head movements, focusing problems, and other similar problems tend to occur.

- When the monitor is relatively close to the viewer, there is glare from the screen which affect the eyesight.

- If the monitor is placed too close, there is more glare and radiation which affects the eyesight. If the monitor is at a distance then the user cannot view small fonts. If the user enlarges the fonts then he can see very less items on the screen or only part of the screen. (Contradiction).

- The monitor is generally placed on the table which may not be at a convenient height for every user.

1.5 Problem in chair and sitting position

- The problem of neck and back pain is created by continuously sitting in a difficult position due to the location of the monitor, the keyboard, or both in relation to the position of the operator's chair.
If the monitor is too far or the keyboard is too far then the user may have to lean forward or sit in a difficult position causing various physical problems.

The chair of the user may not be suitable to provide adequate rest to the user.

Most computer chairs are substantially adjustable. The usual practice is to adjust the chair to the comfort of the operator. If the chair is not adjustable then it will substantially contribute to various physical problems.

2. Inventions on ergonomic accessories

2.1 Arm and hand rest for a keyboard (5104073)

Background problem
The keyboard operators have been subject to on-the-job medical conditions of carpal tunnel syndrome (CTS) and repetitive strain injuries (RSI) which causes pain in one’s hands and fingers. It is necessary to provide a device that permits the user to rest the joints of the arm and hand in proper position and posture.

Solution provided by the patent
VanBeek et al. provided an arm and hand rest for individuals (Patent 5104073, assignee-self, issued Apr 1992) while using the keyboard so as to prevent problems like CTS and RSI. The arm and hand rest is three dimensionally adjustable to permit positioning about the approximate height of the keyboard, and provide for spacing of the wrists and for relaxation of the wrists and arms while the fingers can still poised on the keys.

The most significant aspect of the invention is a padded arm and hand rest that provides for support during operating the keyboard. The arm and hand rest is intended for preventing carpal tunnel syndrome and other repetitive strain injuries.
**TRIZ based analysis**

The objective is to provide a method of preventing pain and health problems (Principle-8: Counterweight).

The apparatus uses three dimensional adjustment to keep the keyboard at a convenient height and position (Principle-17: Another dimension).

The main aspect of the invention is the padded arm and hand rest (Principle-11: Cushioning).

### 2.2 Computer support system (5120117)

**Background problem**

There are several accessories to enhance the efficiency of using a computer and improving the working environment of the computer operator more pleasant and efficient. But a primary problem that is associated with the use of the computer is that of the carpal tunnel syndrome (CTS). It is necessary to create a computer workstation which optimizes the positioning of the keyboard and the monitor for the comfort and efficiency of the user. It is also necessary to create a preformed workstation that may be installed by modifying an existing desk, table or counter.

**Solution provided by the invention**

Williams disclosed a preformed platform (Patent 5120117, issued Jun 1992) for the support of the keyboard and monitor components of a computer terminal. The platform comprises two major sections, one to hold the keyboard (called keyboard section) and the other to hold the monitor (called monitor section). The two sections are positioned according to ergonomic principles to yield maximum comfort of the user.

![Diagram of computer support system](image)

The base of the keyboard is supported at a level below the ordinary desk height so as to allow typing to be done with the wrists substantially level and straight. A wrist support bar is provided to support the wrists and reduce wrist strain. The monitor and the keyboard are positioned with their operative centers at similar heights from the floor and at similar distances from the operator for optimum operator comfort and efficiency.
**TRIZ based analysis**
The invention is to reduce keyboard operation related problems *(Principle-8: Counterweight).*
It provides a preformed platform that can be mounted on an existing table or furniture *(Principle-7: Nested Doll).*
The equipment consists of two sections, viz., a keyboard section and a monitor section, for holding the two devices in an ergonomic angle *(Principle-1: Segmentation).*

2.3 Wrist support for computer keyboard (5125606)

**Background problem**
Individuals who spend long hours at computer terminals can develop repetitive stress injuries (RSI) and carpal tunnel syndrome (CTS). It is necessary to provide a wrist support to avoid this problem.

**Solution provided by the invention**
Cassano, et al. disclosed a wrist support (Patent 5125606, assignee-Wrist-Eze Products, Inc., issued Jun 1992) for use with a computer keyboard including a longitudinally extending rigid board with a foam layer and a cover to compress the foam to form a cushion. A rubber base is placed on the underside of the board. The cushion is placed near a lower edge of a keyboard for support of the wrists. A flat base can be attached to the underside to form a platform on which to rest the keyboard.

2.4 Wrist rest support for a computer user (5131614)

**Background problem**
It is necessary to keep the wrists in a neutral or unflexed position and that vibration from typing be deadened in order to avoid stresses that lead to RSI such as CTS and stiffness of the neck and shoulders.
Solution provide by the invention
Garcia, et al. disclosed a wrist support (Patent 5131614, assignee- Nil, issued July 1992) for operating a keyboard and mouse. The invention uses a base pad that is positioned partially under the keyboard and includes a section extending away from the keyboard that has a top surface above the level of the keys for supporting the wrists. The pad features an antistatic fabric laminated to a foam base and, in one embodiment, has a riser section that is separable from a base section when it is desired to substitute another riser section of different dimensions.

TRIZ based analysis
The invention provides a cushion to the wrist while operating the keyboard and mouse. The base pad comprises foam and is antistatic. (Principle-11: Cushioning).

2.5 Ergonomically designed computer workstation adjustable to various sitting and standing positions (5174223)

Background problem
The comfort and well-being of users of computers have become concerns of growing importance. It is necessary to design the equipments ergonomically which can adapt to working condition and physical need of the user.

Solution provided by the invention
The invention provides a computer stand, stool, footrest assembly and keyboard and forearm support assembly which are all adjustable for permitting the workstation to accommodate different users in various sitting and standing positions. The invention is directed to an ergonomically designed computer workstation having a computer stand with an adjustable keyboard and forearm support.
TRIZ based analysis
The design of the computer workstation should be so ergonomic that it should totally eliminate the sources and causes of any physical problem even if a person uses regularly for long hours. *(Ideal Final Result)*

The invention provides complete flexibility to move the position of computer, monitor and keyboard to suit the need of any user (Principle-15: Dynamize, Principle-17: Another dimension).

2.6 Vision saver for computer monitor (5200859)

Background problem
There are frequent complains about eye pain from people who view computer monitors for prolonged periods. This is because of the fact that the monitor is relatively close to the viewer and there is a glare from the screen.

Solution provided by the invention
This invention by Payner (Patent 5200859, assigned by Ergonomic Eyecare Products, Inc., April 1993) provides a vision saver which eliminates the glare from the monitor and thereby relieves neck, shoulder and eye strain. The user can easily fine tune the positions and viewing angles of reflecting surfaces of the device for optimizing viewing comfort. This vision saver comprises of two reflecting surfaces, the first reflector faces the screen of the monitor and the second reflector faces the first reflector so that the image of the screen is visible through the second reflector.
As the distance of the screen image and eye is more, the users using bifocal glasses can read with the distance lenses without using the reading glass. The image of the screen can also be made bigger by using a concave mirror to suit users having low vision who otherwise had to get very close to the monitor screen to see it.

**TRIZ based analysis**

The invention uses image of the monitor screen through the mirror rather than the screen itself (Principle-26: Copy).

There are two reflectors which are adjustable to an angle suitable to the user (Principle-15: Dynamize).

### 2.7 Adjustable stand for a keyboard (5868079)

**Background problem**

It is monotonous for the user to sit on a particular position for long time to use the computer. Sometimes a prolonged use may create health problems.

**Solution provided by the invention**

Gad Charny disclosed a flexible stand (Patent 5868079, assigned to Finish Group Ltd, Feb 99) to hold a computer monitor and keyboard so that a human operator may comfortably use the computer in a variety of positions, including sitting in a conventional chair and standing. The invention includes two shelves, one for the monitor and another for the keyboard, which can be adjusted as necessary for the operator’s comfort. Depending on operator’s position, the monitor is held at eye level, while the keyboard is held at the level of the operator's hands.
TRIZ based analysis
The monitor, keyboard and other devices should be placed in an appropriate position according to user’s convenience (Desired result).

The invention discloses an adjustable stand to place the keyboard at a desired height that is convenient to the user (Principle-15: Dynamize).

The keyboard positions can be adjusted for the user to work on sitting position and on standing position as well (Principle-15: Dynamize).

2.8 Computer keyboard light system (5868487)

Background problem
With the increasing use of computers, more number of PCs are found outside the office such as in dormitories and bathrooms etc. where lighting is found to be a problem. It is necessary to keep a lighting system for convenience in using the keyboard.

Solution provided by invention
Polley, et al. invented a lighting system for the keyboard (Patent 5868487, assigned to Catalina Lighting, Feb 99), which uses a small lamp mounted on a flat plate on the computer keyboard or pc monitor. The lamp arms are telescopeable and are rotatable by rachet connections to allow for adjustment of the lights. The arms could also be adjusted to illuminate either the keyboard, or monitor screen or a copyholder as required.
TRIZ based analysis
The keyboard should illuminate itself (IFR).

The invention provides a lighting system along with the computer (Principle-38: Enrich).

The arms of the lamp are flexible to change the lighting position (Principle-15: Dynamize).

2.9 Adjustable computer keyboard support mechanism (5878674)

Background problem
There is a need for an improved adjustable support mechanism for a computer keyboard. There are so many methods disclosed by different inventors. Some of these patents describe a support mechanism employing a parallel arm type mechanism that allows adjustment of the keyboard support. But the mechanism needs to be improved.

Solution provided by the invention
An adjustable keyboard support mechanism is disclosed by McConnell (US patent 5037054), which teaches a keyboard support mechanism using nonparallel arms to support the keyboard platform. This mechanism thus has the benefit that when the keyboard platform is stored under the table, the platform is reoriented to provide greater access to the kneehole of a desk.

Allan Scott disclosed a keyboard support assembly (patent 5878674, assigned to Waterloo Furniture Components, March 99) that comprises a platform having one end of the arm pivotally mounted to the platform and the other end pivotally mounted to a mounting bracket which is attached to the underside of a work surface. The platform is moved to and from a storage and use position. This allows the platform to be tilted and locked in a tilted position.
TRIZ based analysis
The keyboard should remain in a position of user’s comfort without blocking useful space (Ideal Final Result).

The invention uses an adjustable keyboard support mechanism to provide flexibility (Principle-15: Dynamize).

2.10 Dimensional adjusting device for computer keyboard racks (5901933)

Background problem
A conventional computer desk includes a retractable drawer for supporting the keyboard. The keyboard is pulled out when used and pushed back under the desk after usage is over. This mechanism gives only one directional motion of the keyboard adjustment, i.e., inward and outward. It does not give upward or downward adjustment, or angular adjustment. It’s necessary to position keyboard at a position of convenience according to the height of chair, height of the user and his personal convenience.

Solution provided by the invention
Lin invents (US Patent 5901933, May 99) a fully adjustable rack for computer keyboard. The invention includes a displacement device, a rotary device, an elevation device and a positioning device. All these devices give a complete freedom to position the keyboard plate, facilitating rotation, elevation and horizontal movement.
TRIZ based analysis
The keyboard support plate should be adjustable in all directions to hold the keyboard at any position suitable for the user (Desired result).

The invention uses various devices to make the keyboard support completely adjustable to any direction. The keyboard can move front and back, upward and downward and even rotate as well (Principle-15: Dynamize, Principle-17: Another Dimension).

3. Summary and conclusion
Many manufacturers are changing their focus from the technology to the customer. There is increasing importance on ergonomic products. The manufacturers have realized that the equipments are made for the user and the user will not accept the equipments unless they are suitable to user requirement. There are many more inventions on improving the ergonomic aspect of various computer equipments and accessories, including keyboard, monitor, mouse and other equipments.

4. Reference:


