US005821933A

United States Patent [19]

Keller et al.

[11] Patent Number: 5,821,933

[45] Date of Patent: Oct. 13, 1998

[54] **VISUAL ACCESS TO RESTRICTED FUNCTIONS REPRESENTED ON A GRAPHICAL USER INTERFACE**

[75] Inventors: **Neal Martin Keller**, Hartsdale; **Clifford Alan Pickover**, Yorktown Heights, both of N.Y.

[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

[21] Appl. No.: **528,376**

[22] Filed: **Sep. 14, 1995**

[51] **Int. Cl.**[6] **G06F 15/00**

[52] **U.S. Cl.** **345/348**; 345/327; 345/332; 707/9

[58] **Field of Search** 395/348, 349, 395/350, 351; 340/571, 653, 666, 691; 380/3, 4, 52; 345/327, 329, 331, 332, 348, 349, 350, 351; 707/1, 6, 8, 9

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,276,314 1/1994 Martino et al. 235/380

5,561,758 10/1996 Hocker et al. 345/348

OTHER PUBLICATIONS

J. McLean et al, Access/Control Icons (Icon Keys), IBM Technical Disclosure Bulletin, vol. 38, No. 04, Apr. 1995, pp. 407–409.

Computers and the Imagination, "Pictorial Password Sustems", Chapter 58 St. Martin's Press: New York, 1993.

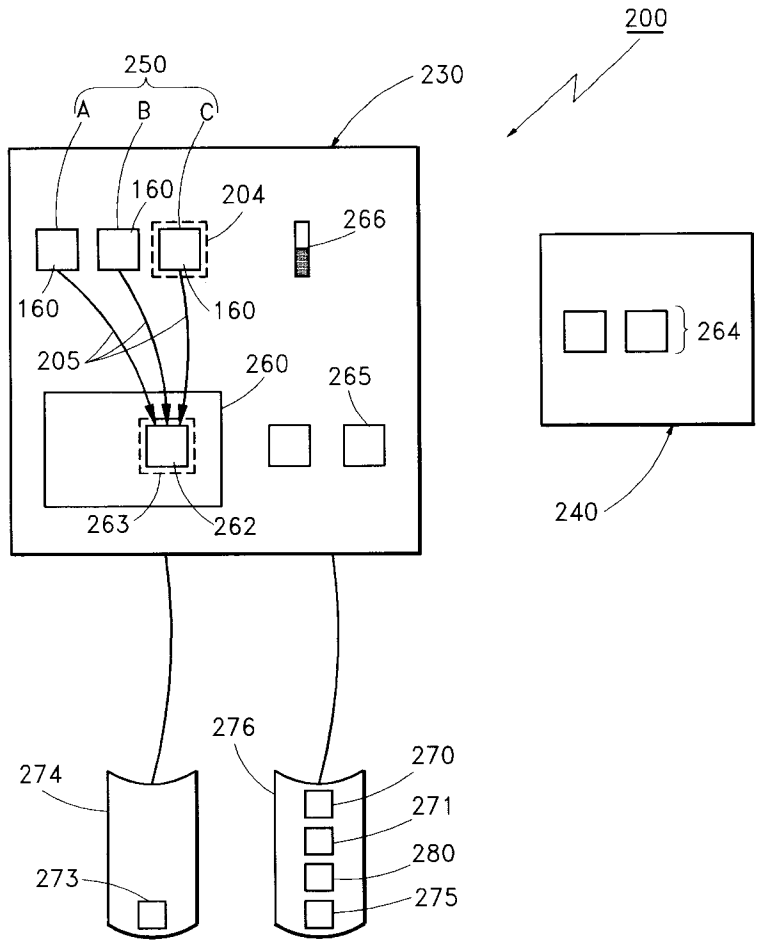
Primary Examiner—Ba Huynh

Attorney, Agent, or Firm—Louis J. Percello

[57] **ABSTRACT**

Computer users access and/or execute a selected restricted function on a computer using a graphical user interface (GUI) by entering an iconic password that is defined by selecting two or more visual icons, called code icons, in a sequence called an iconic password sequence. The entered sequence is compared to a target sequence that represents the restricted function. If the entered sequence matches the target sequence, the user is permitted to execute/access the restricted function. The number of possible combinations in the target sequence, and therefore system security, can be increased by inputting both a code icon and a target site for one or more of the components of the target sequence.

15 Claims, 8 Drawing Sheets



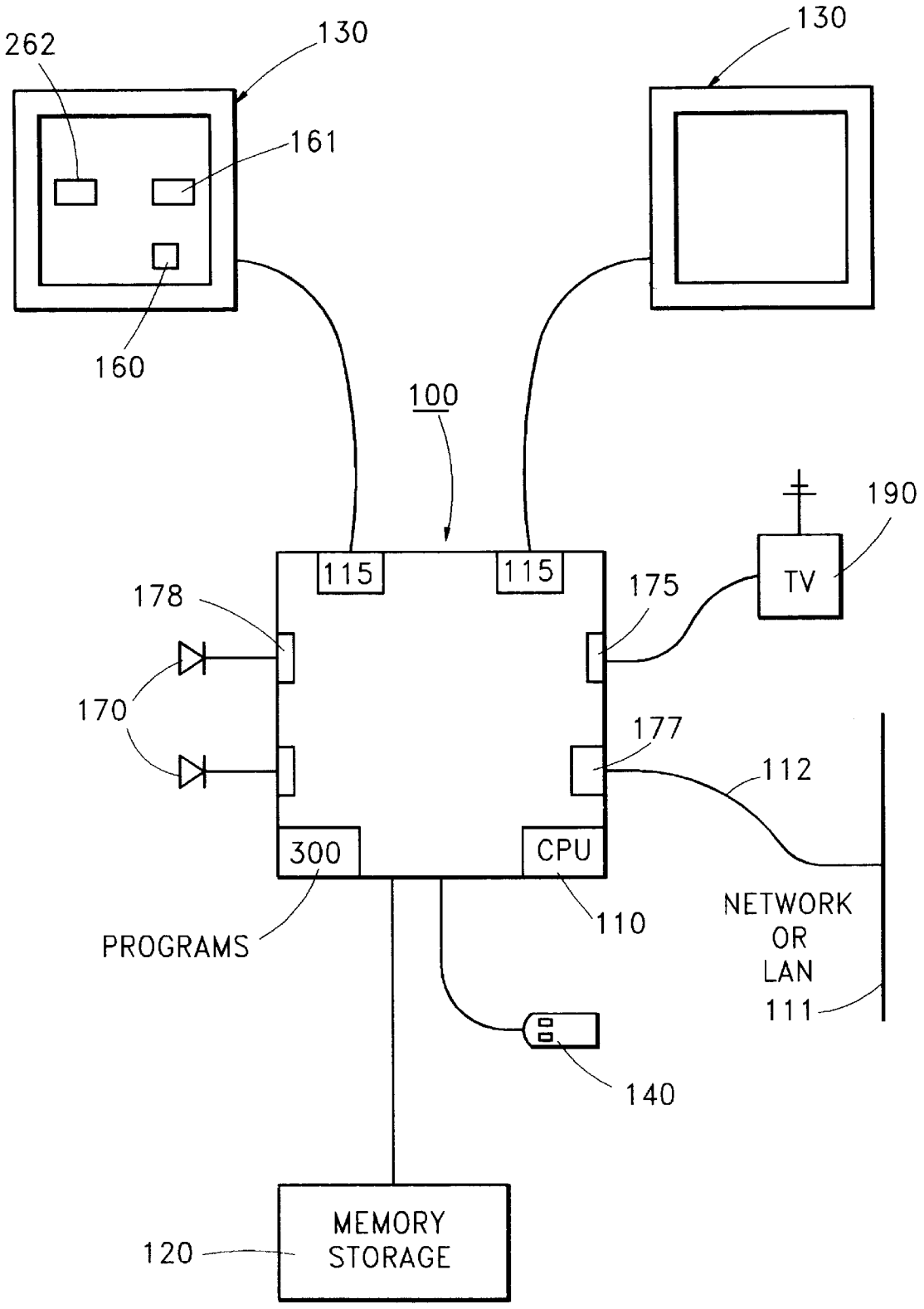

262
130
161
160
130
100
190
TV
115
115
175
178
170
177
112
300
CPU
110
PROGRAMS
NETWORK
OR
LAN
111
140
120
MEMORY
STORAGE

FIG. 1

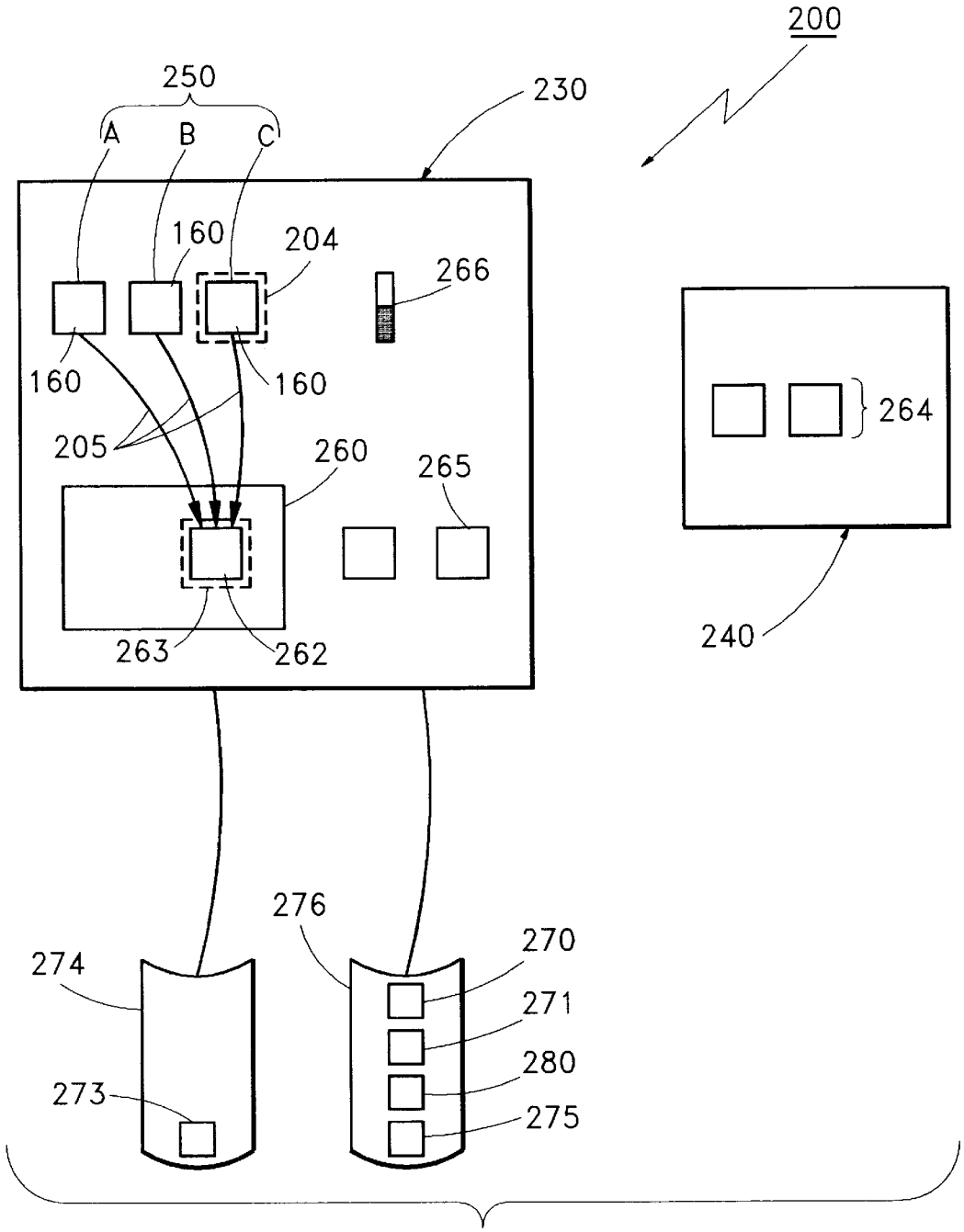

200
250
A
B
C
230
160
204
266
160
160
205
260
265
263
262
264
240
276
270
274
271
280
273
275

FIG.2

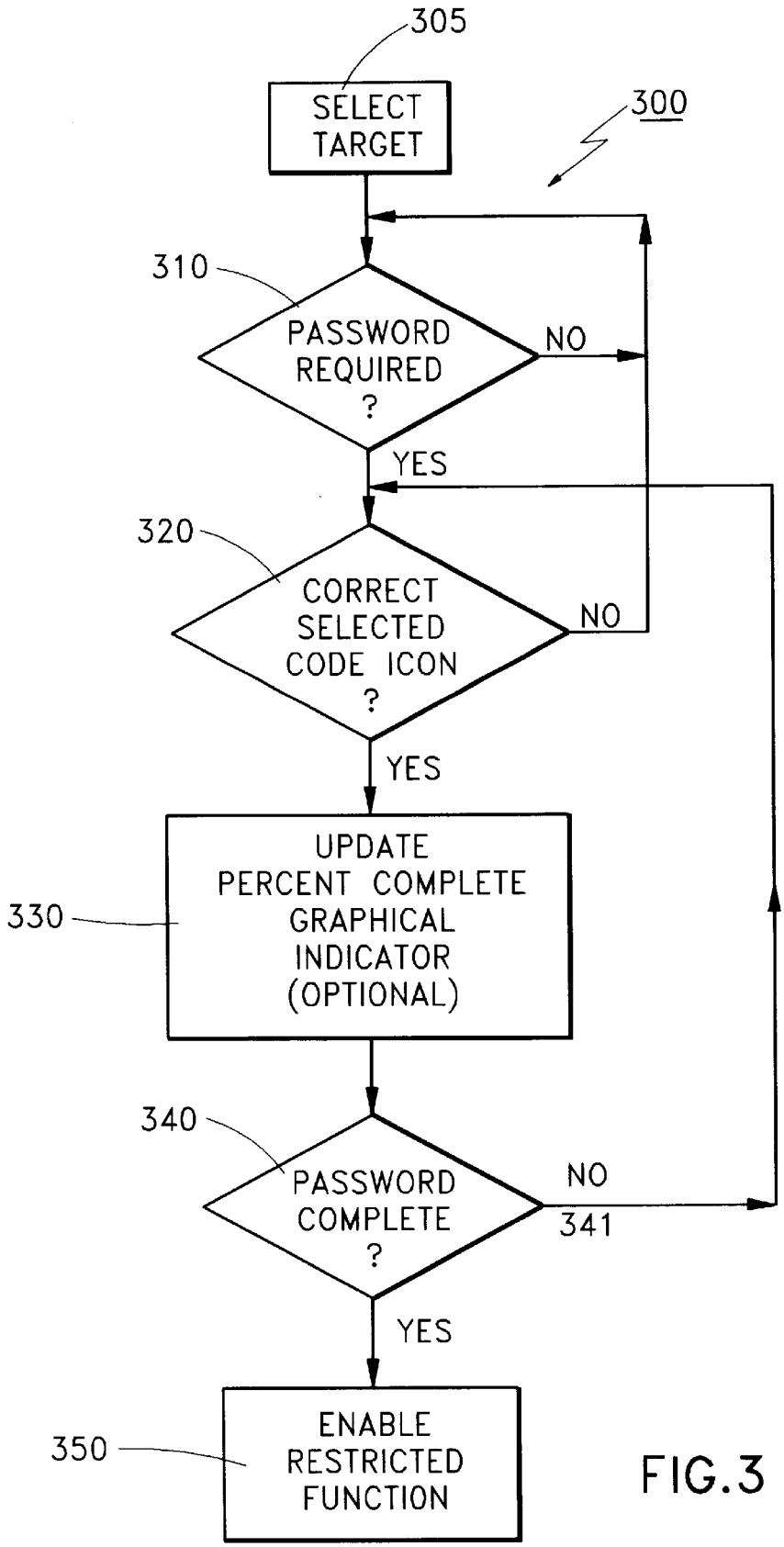

305
SELECT TARGET
300
310
PASSWORD REQUIRED ?
NO
YES
320
CORRECT SELECTED CODE ICON ?
NO
YES
330
UPDATE PERCENT COMPLETE GRAPHICAL INDICATOR (OPTIONAL)
340
PASSWORD COMPLETE ?
NO
341
YES
350
ENABLE RESTRICTED FUNCTION

FIG.3

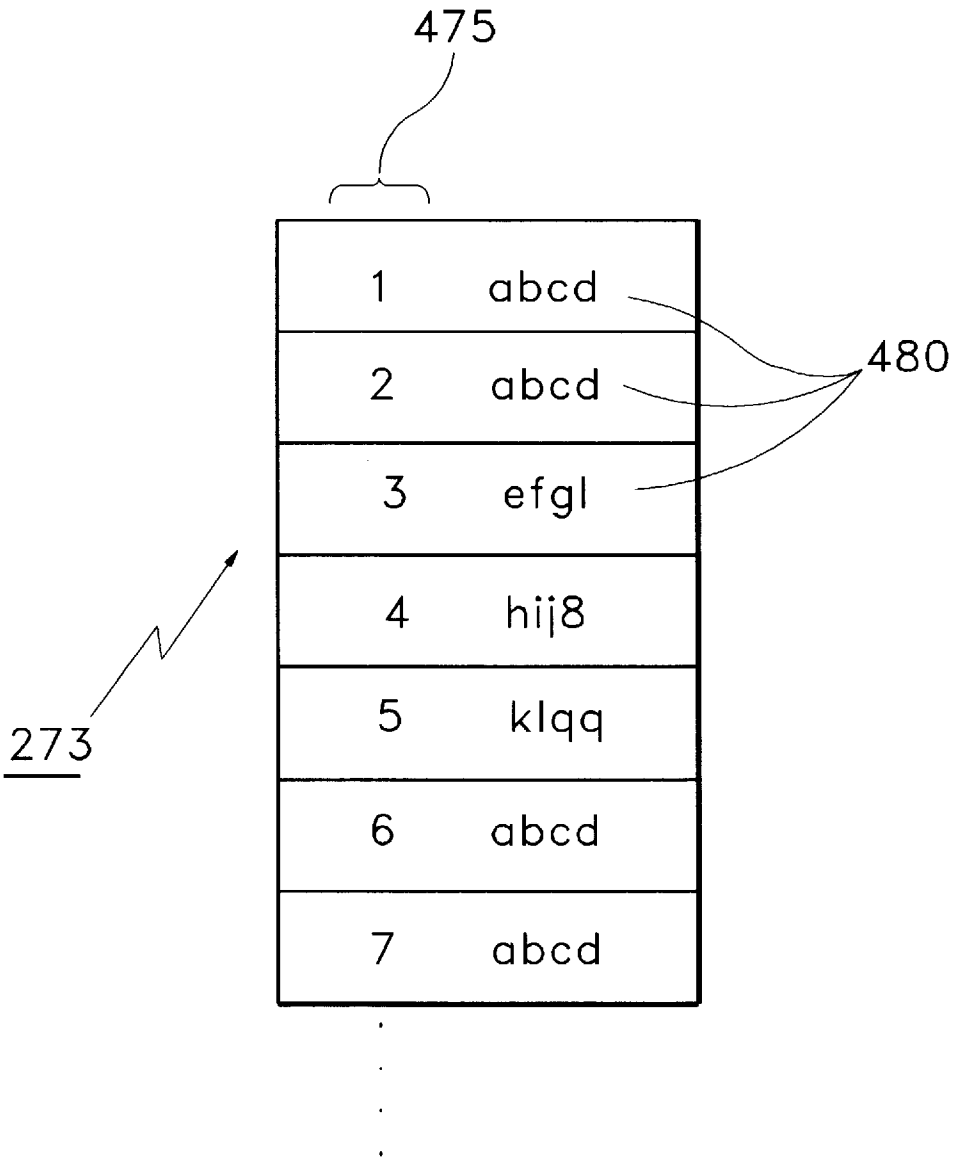


FIG. 4

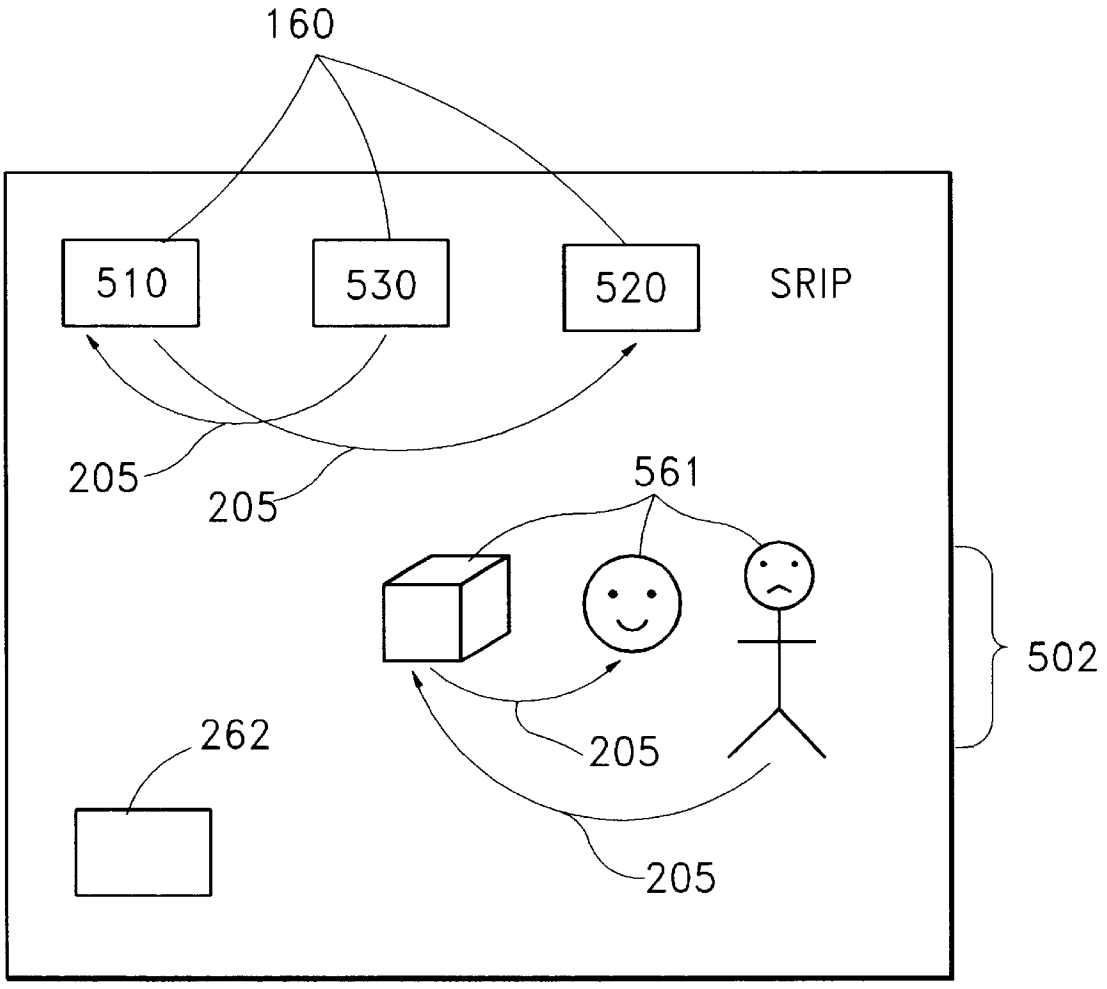


FIG.5

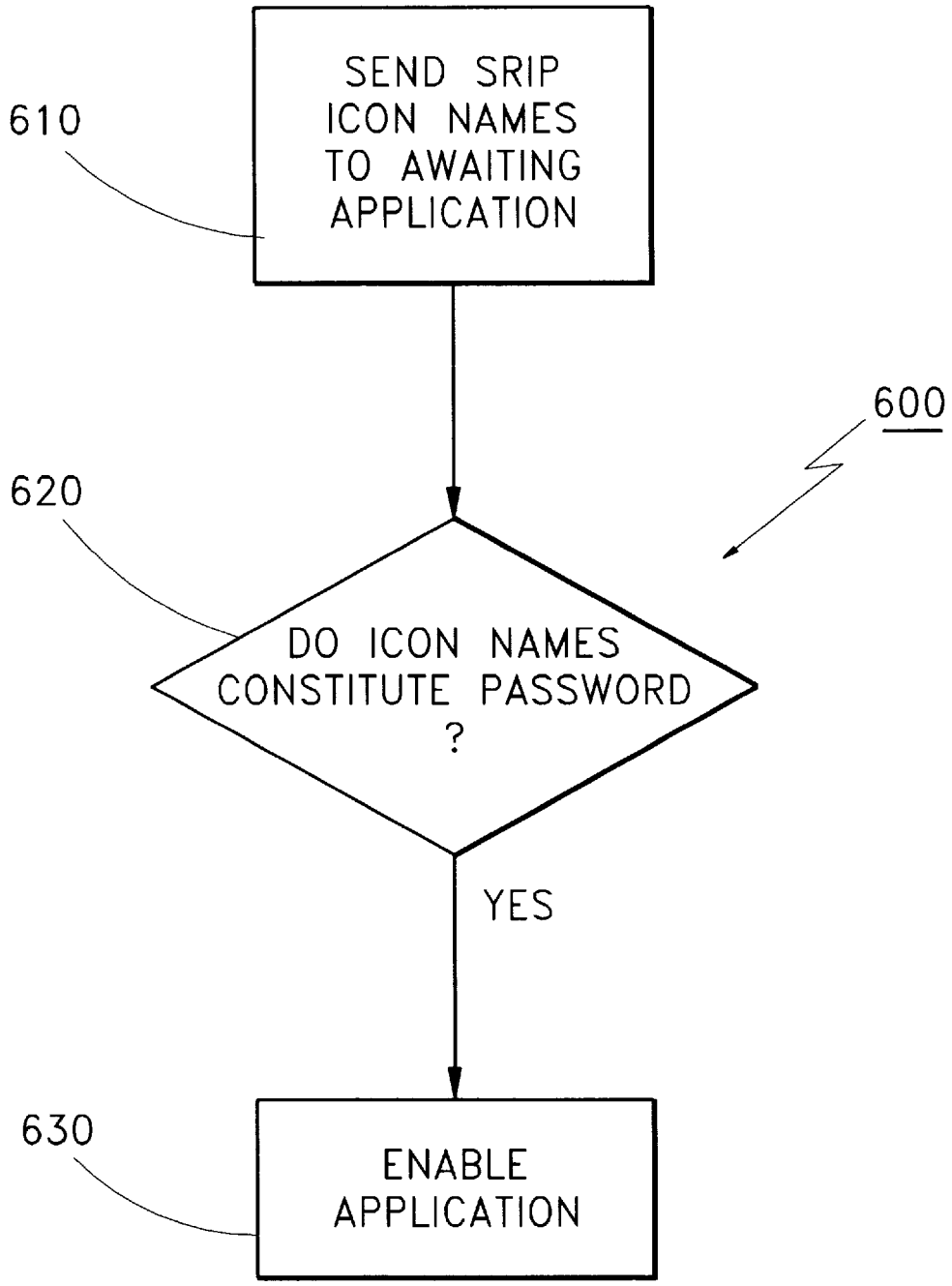

SEND SRIP ICON NAMES TO AWAITING APPLICATION
610
600
620
DO ICON NAMES CONSTITUTE PASSWORD ?
YES
630
ENABLE APPLICATION

FIG.6

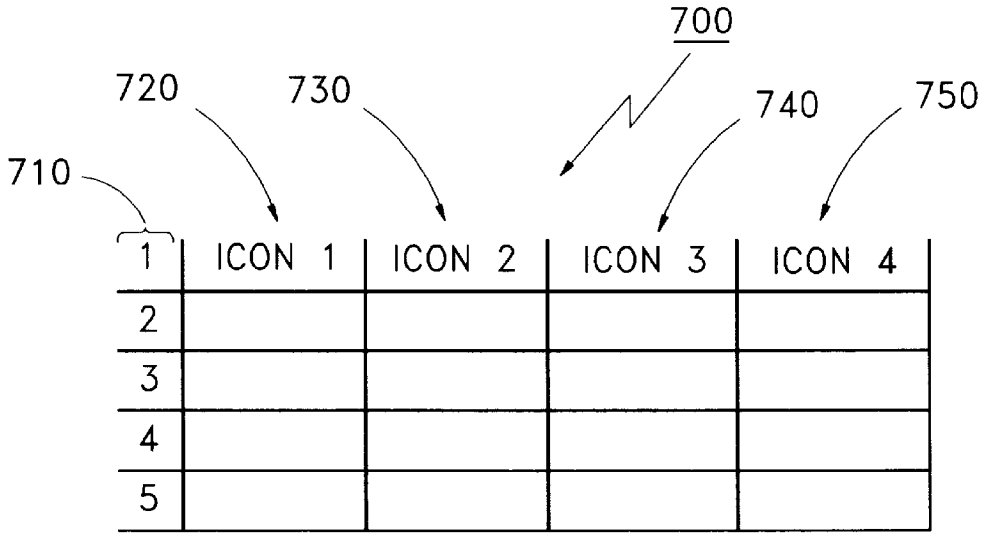

700
720
730
740
750
710
1
ICON 1
ICON 2
ICON 3
ICON 4
2
3
4
5

FIG.7

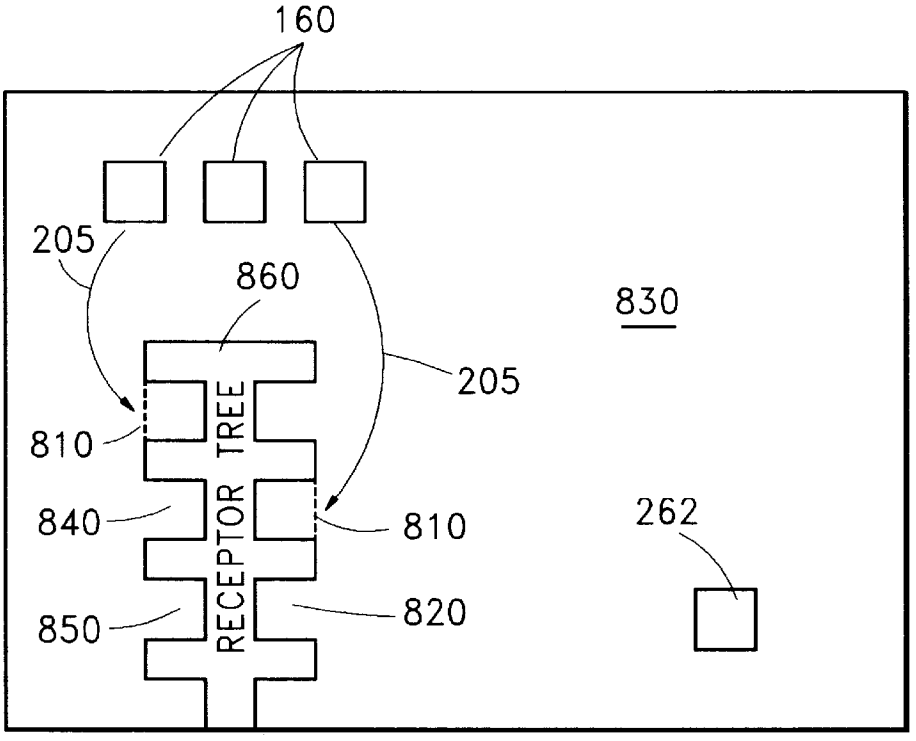

160
205
860
830
205
810
RECEPTOR TREE
840
810
262
850
820

FIG.8

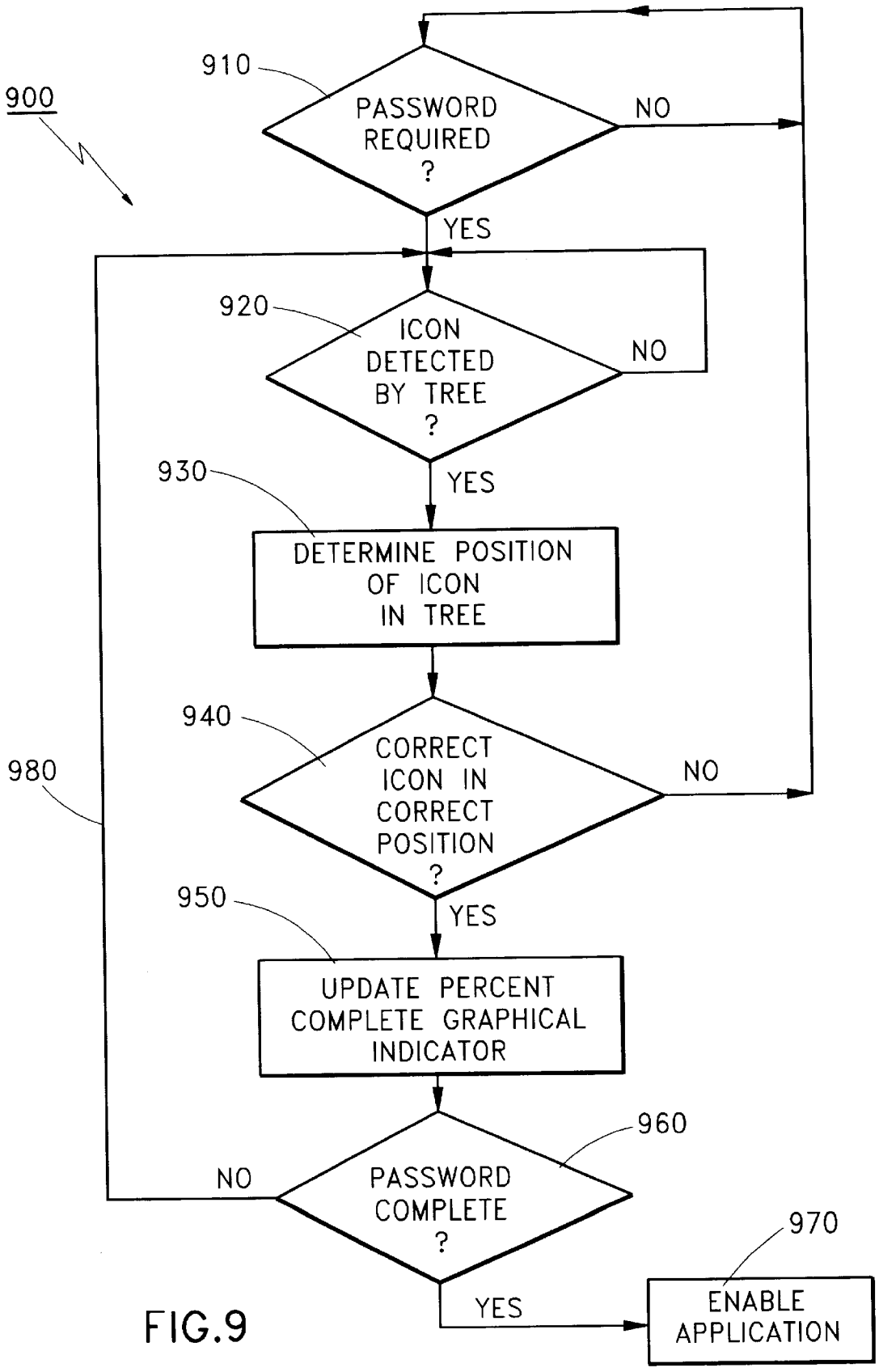

900
910
PASSWORD REQUIRED ?
NO
YES
920
ICON DETECTED BY TREE ?
NO
YES
930
DETERMINE POSITION OF ICON IN TREE
940
CORRECT ICON IN CORRECT POSITION ?
NO
980
YES
950
UPDATE PERCENT COMPLETE GRAPHICAL INDICATOR
960
PASSWORD COMPLETE ?
NO
YES
970
ENABLE APPLICATION

FIG.9

VISUAL ACCESS TO RESTRICTED FUNCTIONS REPRESENTED ON A GRAPHICAL USER INTERFACE

FIELD OF THE INVENTION

This invention relates to computer graphical user interfaces. More specifically, the invention relates to graphical user interface (GUI) allowing users to enter passwords using icons displayed on a computer screen.

BACKGROUND OF THE INVENTION

Graphical user interfaces (GUIs) provide ways for users of computers and other devices to effectively communicate with the computer. In GUIs, available applications and data sets are often represented by icons consisting of small graphical representations which can be selected by a user and moved on the screen. The selection of icons often takes the place of typing in a command using a keyboard in order to initiate a program. In general, icons are tiny on-screen symbols that simplify functions like the access to a program, command, or data file. Icons are usually activated or selected by moving a mouse-controlled cursor onto the icon and pressing a mouse button.

GUIs include graphical images on computer monitors and often consist of both icons and windows. (GUIs may also reside on the screens of televisions, kiosks, and automatic teller machines (ATMs).) A computer window is a portion of the graphical image that appears on the monitor and is dedicated to some specific purpose. Windows allow the user to treat the graphical images on the computer monitor like a desktop where various files can remain open simultaneously. The user can control the size, shape, and position of the windows.

In a drag-and-drop GUI, icons are selected and moved to a target icon to achieve a desired effect. For example, an icon representing a computer file stored on disk may be dragged over an icon containing an image of a printer in order to print the file, or dragged over an icon of a trash can to delete the file. A typical user's screen contains many icons, some of which may require additional validation before they can be used. For example, some of the data accessible using an icon representing employee records may be accessed by an employee, but only a manager with appropriate authority can access all of the information.

The prior art has addressed the initiation of secured or restricted functions. For example, (McLean, Pickover, and Winarski (1995) Access/Control Icons (Icons Keys) *IBM Technical Disclosure Bulletin,* 38(4): 407–408) describes the use of an icon, shaped like a "house key" or polygon, which, when dragged onto a "lock" section of another icon, allows a user to gain access to functions provided by the lock icon. A major limitation of this approach arises from the fact that a visible "house key" can be used by anyone who has access to the GUI desktop on which the "house key" is displayed. Prior art also includes (Pickover (1993) *Computers and the Imagination,* St. Martin's Press: New York, Chapter 58) which describes the use of a static picture (like a photograph of a farm) for password entry. For example, a computer may point to different parts of the photo (cow, barn, hay) in a particular order. This ordered picking constitutes a logon password.

PROBLEMS WITH THE PRIOR ART

Most prior art does not use the desktop environment on a GUI to provide a high level of security to restricted functions

being accessed and/or executed on the computer system. Some prior art providing a "visual" log on procedure has the limitation of not allowing a user to specify a particular target application in a set of applications.

OBJECTS OF THE INVENTION

An object of this invention is an improved system and method for providing a high level of security when accessing restricted functions using a computer system.

Another object of this invention is an improved system and method for visually accessing secured or restricted functions represented on a GUI.

Another object of this invention is an improved system and method for accessing secured or restricted functions represented on a GUI without the use of a keyboard.

SUMMARY OF THE INVENTION

This invention permits computer users, using a graphical user interface (GUI), to access and/or execute a restricted function selected from two or more restricted functions on a computer by entering an iconic password that is defined by selecting two or more visual icons, called code icons, in a sequence called an iconic password sequence. The entered sequence is compared to a target sequence that represents the restricted function. If the entered sequence matches the target sequence, the user is permitted to execute/access the selected restricted function. Code icons can be selected by pointing with a selection device, dragging and dropping to a target site, touch input, or by other means like speech identification. Target sites can be arbitrary locations (e.g. invisible locations) on the GUI, target icons that represent the restricted function, receptor positions on a "tree icon," and/or other code icons. The number of possible combinations in the target sequence can be increased by inputting both a code icon and a target site for one or more of the components of the target sequence. Restricted functions can be selected by selecting a target icon that represents the restricted function along with the iconic password or by matching an entered iconic password sequence to a target sequence corresponding to the selected restricted function where the matched target sequence is on a list of one or more target sequences.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of one preferred system embodiment of the present invention.

FIG. **2** is a drawing of a system with GUIs displaying code icons and target icons.

FIG. **3** is a flow chart showing the steps of one preferred method of the present invention.

FIG. **4** is a block diagram of a data structure that defines the passwords for each icon.

FIG. **5** is a drawing of a GUI used to enter a self-referential iconic password.

FIG. **6** is a flow chart showing the steps performed for a preferred version of the self-referential iconic password entry.

FIG. **7** is a block diagram of one typical preferred data structure that may be used to contain alphanumerical names for each restricted function requiring a password.

FIG. **8** is block diagram showing code icons dragged to positions in or on a "receptor tree".

FIG. **9** is a flow chart showing the steps performed for a preferred version of the receptor tree iconic password.

DETAILED DESCRIPTION OF THE INVENTION

This invention permits users to use a graphical or visual, e.g., an iconic, passwords to access and/or execute restricted functions. These restricted functions can be represented on the GUI by one or more GUI objects **161** that include: icons **161** with static or animated graphics, text, multimedia presentations, and windows displaying TV broadcasts. GUI objects could also include three dimensional images, for example, those used in virtual reality applications. In one preferred embodiment, the restricted function is represented by a GUI object or target icon. The user is required to enter an iconic password in a particular sequence (iconic password sequence) that is the same as a target sequence associated with the restricted function before the system will access and/or execute the restricted function.

The present invention is capable of running on any general purpose computer system or computer controlled GUI (e.g. a television), including GUIs that have the ability to present multimedia and virtual reality information. One preferred embodiment is schematically represented in a block diagram in FIG. **1**. A computer system **100** comprises a central processing unit (CPU) **110**, memory storage device **120**, one or more monitors or graphical interfaces **130**, and selection device **140** such as a mouse or speech recognition system **178**. In one embodiment, a IBM RISC SYSTEM/6000 **100** comprises a control processing unit (CPU) **110**, memory storage device **120**, one or more monitors **130**, and a mouse **140**. The mouse **140** may be used to select GUI objects **161**, like icons **161**. (Note that icons **161** include target icons **262** and code icons **160** described below.) On an IBM RISC System/6000 multiple monitors **130** can be controlled by multiple monitor adaptor cards **115** such as the IBM RISC System/6000 Color Graphics Display Adaptor. The computer system **100** may also have audio input/output capability **170**. An ActionMedia II Display Adapter **175** (described in the IBM ActionMedia II Technical Reference) can be used for audio-video playback **170**.

This invention **175** may also be used to display TV broadcasts/signals **190**, e.g. "picture-in-picture" of TV broadcasts, and other full motion video and sound audio/visual on the monitors **130**.

In addition, speech synthesis or speech recognition **178** may be provided. Recognition may take place using a IBM VoiceType Dictation Adapter.

In an alternative embodiment, the CPU **110** can be connected **112** via a network adaptor **177** to connect the system **100** to the network **111**. Network adaptors **177** are well known. Three examples **177** include token ring adaptors, ethernet adaptors, and modems. The system **100** can be connected to other target monitors **130** through a client/server network (or LAN **111**).

Systems that can be used to display graphical images, like icons and windows, are well known.

GUIs can be used to control any apparatus having a monitor. In the field of television (TV), channel selection can be performed by selecting an icon consisting of the animated video broadcast on a given channel frequency.

FIG. **2** is a block diagram of a system **200** showing a GUI with icons **161** (see FIG. **1**) including target icons **262** (optional) and code icons **160**. Each target icon **262**, optionally displayed on the GUI, represents a restricted function **280**. The user uses a selection device (mouse) **140** to select one or more of the code icons **160** in a sequence **250**, e.g. selecting code icon A first, code icon B second, and code icon C third. If the sequence **250** matches a target sequence (**480** described below) assigned to the restricted function **280**, the user is permitted to access the restricted function **280** and/or the system **100** is permitted to execute or executes the restricted function **280**. Code icons **160** that are selected by the selection device are called selected code icons **204**.

The code icons **160** may or may not be different from other icons **161** on the screen. For example, code icons **160** may look like ordinary application icons in order to heighten the security (user access to the restricted functions **280**) of the system **100**. Alternatively, code icons **160** may be distinguished (e.g. highlighted, blinking, special shape, special text, number) from the other icons on the GUI to facilitate usage.

The sequence **250** is defined by selecting the selected code icons **204** in any number of ways. In one preferred embodiment, the sequence **250** is defined by selecting the selected code icons **204** with the selection device **140** and dragging **205** each selected code icon **204** to a code target site **260** on the GUI (**230**, **240**). For example, the code target site **260** might be the location of a target icon **262** representing the restricted function **280**. In this example, the sequence **250** is the sequence of drags **205** of the selected code icons **204** to the target icon **262**.

A restricted function **280** is a program and/or data file that requires the user to provide a password (e.g. target sequence **480** in FIG. **4**) before the user can access the restricted function **280** or before the system **100** can execute the restricted function **280**. The restricted function **280** requires a password (target sequence **480**) if, for example, the name of the restricted function **280** is stored in a data file **273** as described later in the description for FIG. **4**.

A target icon **262** is an icon displayed on the GUI that represents a restricted function **280**. In some preferred embodiments, target icons **262** are not used. However, in other preferred embodiments, target icons are selected by the selection device **140** to designate which of two or more restricted functions **280** are to be accessed/executed before or after the user enters the sequence **250** of selected code icons **204** that matches the target sequence **480** of the restricted function **280** represented by the target icon. The target icons **262** that are selected by the selection device **140** are called selected target icons **265**. Target icons **262** and/or selected target icons **265** can be specially designated **263**, e.g. by highlighting. In addition, some of the icons **264** (either code icons **160** or target icons **262**) may reside on remote monitor **240** connected to the same computer (local) or connected over a computer network **111**.

Once a code icon **160** is selected **204**, it may be dragged **205** to a restricted function and/or application **262** represented by a target icon **262**. (Note that dragging the code icon **160** to the target icon **262** selects the target icon **265**.) After the code icons **160** are selected and dragged in the proper sequence **250** to the target icon **262**, the restricted function/application becomes accessible; that is, the restricted function **280** is performed, e.g. accessing a database, initiating a program, or placing an order.

The act of selecting a code and/or target icon may not be done by dragging **205**, e.g. actually visibly move code icons **160** to target icon **262**, but rather the selection of the icons may be static, where only the mouse driven cursor moves from code icons **160** to target icon **262**. Alternatively, the mouse can select a target icon, i.e. a restricted function, and then merely point to the selected code icons in the proper sequence **250**. By doing this, it becomes more difficult for an

unauthorized person to observe the (iconic) password being entered by the icon selection. In virtual reality application, the selection can be done by touching, looking at, and/or pointing to one or more virtual objects in the virtual space.

The sequence **250** of selections (drags) **205** of specific code icons **160** comprises an "iconic password." A graphical indication of the degree to which an icon password is complete may be given by a graphical indicator **266** such as a thermometer-like symbol in which the interior color rises with each correct iconic password entry. Other indicators may be used, including: graphical dials, sliders, and icons which change size, shape, or color, and audible sounds including speech synthesis **178**. The indicator can be used to assist people unfamiliar with password entry, e.g. children. Alternatively, the indicator **266** can be omitted.

The correct passwords to be used by the restricted function (**280**, target icon **262**) are defined by the application program **270** residing in memory **271**. The application program **270** may be the application represented by the target icon **262**, or it may be a separate master program **276** which contains one or more passwords to be checked against. All appropriate application programs **270** may communicate with the master program to determine whether a proper password is entered. Alternatively, an encrypted data file **273** on disk **274** may contain one or more encrypted passwords, much like the "/etc/password" file encrypted passwords which is standard on UNIX systems to be checked by the application program **270** (master program **276**.)

FIG. **3** is a flow chart showing the steps **300** performed for a preferred version of the iconic password entry executed by system **100** or **200**.

In step **305**, a selected target icon **265** is selected. The selected target icon **265** is selected by any selection method: e.g., pointing and clicking, dragging one or more selected code icons on a code target site **260** (e.g. the selected target icon **265**), or by the application program **270** matching an entered iconic password to a target sequence **480** of a restricted function **280** as described below.

In step **310**, the application program **270** checks the file in FIG. **4** to determine if a password is required for the restricted function **280** represented by the selected target icon **265**. If the restricted function **280** name is not in the file, it does not require a password.

Step **320** detects the selections of a code icon **204**. The detection of a selected code (dragged) icon **204** by the application program **270** is well known. For example, selection by a drag-and-drop interface is encoded using standard OS/2 PM programming, (Technical Library: Programming Guide Volume II Chapter 33). OS/2 will issue the following messages to an application program **270** when a selected code icon **204** is dragged and dropped on a code target site **260**: DM_DRAGOVER, DM_DRAGLEAVE, DM_DROP, DM_DROPHELP. Generally, when an icon is dropped on code target site **260**, the Operating System invokes that application with the name of the dropped object as a parameter. The code icon name may be an alphanumeric designator. However, in this invention, before a restricted function **280** (as identified in table **273**) is permitted to execute, the proper sequence **250** of selected code icons **204** must be used, i.e., the iconic password must be entered.

In step **320**, the application program **270** determines if the correct selected code icon **204** in the sequence **250** has been selected (dropped) by comparing the selected code icon name with an alphanumeric value in a target sequence position of the target sequence **480** of the restricted function **280**. This comparison is done **341** for each selected code icon **204** in the entered sequence **250**. If a graphical indicator **266** of the degree to which a password is complete is used, then this graphical indicator is sent a signal to update its appearance (step **330**) after the comparison **320** is made.

If the password is complete **340**, i.e., if the entered password matches a target sequence associated with the restricted function, then the application program **270** permits the restricted function **280** to be enabled **350**, e.g. accessed and/or executed. Otherwise **341** the application program **270** waits for the next selected code icon **204** to be selected.

FIG. **4** is a block diagram of one typical preferred data structure **273** that is used to contain alphanumerical name **475** for each restricted function **280** having a target sequence **480**. In one preferred embodiment, target sequences **480** are encrypted to prevent unauthorized use of the target sequences **480** in the data structure **273**. Encryption and description in passwords is known to those skilled in the art. In the UNIX operating system, the coding scheme is one-way. In other words, there is no way to decode the encoded target sequence **480** to determine the iconic password to be entered to execute the restricted function **280**. Therefore in order to test the iconic password sequence (e.g. generated by dragging icons) against the passwords **480**, the entered sequence **250** is encoded and then the two encodings are compared in step **320**.

FIG. **5** is a block diagram of an alternative preferred embodiment for increasing the number of possible combinations in the iconic password while still using a relatively small number of code icons. In this embodiment, one or more of the components of the iconic password comprise both a selected code icon **204** and a target site **260** on which the selected code icon is placed. In this embodiment, there does not have to be a single target site **260**, or even a specific target site that represents the restricted function **280**. In fact, icons on the GUI can alternate in function between being a target site **260** and a code icon **160**.

For example, the code icons **160** are dragged **205** on top of one another rather than being dragged to the target site **260** (target icon **262**) in order to create an iconic password. This is called a "self-referential icon password" (SRIP). For the SRIP, the application program **270** or the master iconic password manager **276** may determine whether the proper password has been entered in a correct sequence **250** of steps using process **300**. However, here the correct sequence **250** includes both the selected code icons **204** and the target site **260** on which the selected code icon **204** is placed. This process can be repeated for one or more selected code icons **204** (target sites **260**) as the sequence **250** is entered. Further, as the sequence is entered, the icons used as selected code icons **204** and the target sites **260** can change.

In an preferred embodiment, the application program **270** monitors each of the selected code icons **204** and the target site on which it was placed, i.e. pairs of icons (selected code icon and target site) are used in the entered sequence **250**. If the sequence of selections **250** is correct **340**, then the application is enabled **350**.

Using this embodiment greatly increases the number of possible iconic passwords by using a minimal number of GUI icons. For example, a 5-icon iconic password created simply by selecting from three code icons in any particular order (without the drag-and-drop SRIP), produces 3^5 or 243 different passwords. However, using 5 drags in the SRIP, these same three code icons can potentially produce $3^5 2^5$ or 7776 different passwords because each icon can be dragged to either of two other icons. If there are 10 code icons to

choose from, 5 selections produces 100,000 different iconic passwords in the non SRIP case while producing 0.5904900×10^{10} different passwords in the SRIP case.

FIG. **5** shows one embodiment where the act of dragging **205** icon **510** on top of **520** and then **530** on top of **510** creates an SRIP password for the restricted function represented by icon **262**. Graphical objects **561** may be used instead of two-dimensional icons **160** in a three-dimensional virtual reality environment.

FIG. **6** is a flow chart showing the steps **600** performed for a preferred version of the self-referential iconic password entry executed by system **100** or **200**.

Each time an SRIP code icon **510** is dropped on another SRIP code icon **520**, then the alphanumerical names for **510** and **520** are sent **610** to the restricted function icon **262**. Waiting application program **270** compares **620** the names with a table **700** containing a list of names **710** for each restricted function. This list of names constitutes a password which is entered by the drag-and-drop SRIP. (Table **700** is described below in the description of FIG. **7**) If the names are correct for a particular restricted function represented by icon **262**, it is enabled **630**.

FIG. **7** is a block diagram of one typical preferred data structure **700** that may be used to contain alphanumerical names **710** for each restricted function requiring a password. In the SRIP, icon**1** is dragged to icon**2** (as described for FIG. **6**) and the names of icon**1** and icon **2** (**720** and **730**, respectively) are broadcast to the restricted function represented by icon **262** which compares these names with icon**1** and icon**2** (**720** and **730**, respectively) in the table. Additional pairs of icon names (e.g. **740** and **750**) are compared until a password is complete.

When implementing the iconic password, the application program **270** needs to distinguish that an iconic password is being entered as opposed to drag-and-drop request used for other actions. Therefore, selected code icons that initiate specific actions should be avoided for the iconic passwords described above. For example, dragging a file icon on top of a trash can icon (representing a delete function) would not normally be part of an iconic password sequence to enable the deletion of files. Instead, code icons **160** would be specific icons not normally received by the restricted function icon **263**.

FIG. **8** is block diagram of another embodiment in which code icons **160** are dragged **205** to positions **810** in or on a "receptor tree" **620**. A receptor tree **620** is any graphical image to which icons can be dragged. In a preferred embodiment, the drop positions **810** are visually distinguished, such as with a cutout **820** so that the plurality of possible receptor positions **810** is evident to the user. The act of dragging code icons **160** into the appropriate positions **810** on the receptor tree **860** constitutes a "receptor tree iconic password" **830**. A receptor tree may be colored, 3-dimensional, and animated. Note that some or all of the receptor positions **810** may be filled. Further, a first receptor position **840** can be filled with a first icon and then later that icon can be moved to a second receptor position **850**. This allows for complicated passwords to be entered with relatively few icons **160** and receptor positions **810**. Even icons with specific actions, e.g. a trash can, can be used in this receptor tree **620** embodiment because the specific action will not be invoked when the icon representing the specific action is placed in one of the receptor positions **810**.

In a virtual reality space, a "virtual tree" can be created as a virtual object. For example, virtual objects can be placed in drop positions **810** of the virtual tree, e.g., by setting a table (the virtual tree), decorating the virtual tree, etc. In these applications the virtual tree can be animated and/or change with time.

FIG. **9** is a flow chart showing the steps **900** performed for a preferred version of the receptor tree iconic password executed by system **100** or **200**. If an application **270** requires **910** a password, it waits for a code icon **160** to be dragged into receptor tree **860**. In step **920**, the tree determines if an icon has been dropped by methods described in the explanation for FIG. **3**. The code icon's drop position **810** is determined in step **930** by known graphical methods, and if **940** it is in a "correct" position, a signal is sent to the percent complete graphical indicator **266** so that it is graphically updated **950** (optional). When the password is complete **960** then the restricted function represented by icon **262** is enabled **970**. Otherwise **980** the application program waits for the next correct code icon **160** to be dropped into the tree (step **920**.) It is possible to determine in step **940** whether the correct code icon **160** is in the appropriate receptor position **810** because each restricted function (denoted by icon **262**) may contain a table in memory that lists valid receptor positions. These positions are made available to the receptor tree software using methods of interprocess communication known to those skilled in operating system programming. In addition to appropriate position **810**, the receptor tree software determines if the correct icon **160** is in place by comparing the code icon name with an alphanumeric value in the restricted function's memory. Of course, such tables of values may also exist as encrypted value on disk and can be accessed accordingly.

The data file(s) **273** can be made portable and moved from machine to machine or otherwise used to customize a machine's GUI for a particular user, or to provide a common "base" data file for a company or organization. The data file (or shared memory file) can accessed across a LAN, WAN, or other network. For example, in the UNIX operating system, it is standard procedure to access remote file systems via NFS (network file system) protocols. In particular, remote files can be accessible via "loctl( ) function" calls.

There are many applications of the iconic password system. Consider a TV home shopping system where a parent may order certain items by dragging and dropping a sequence of icons on top of an iconic representation of a product or on top of an icon receptor tree with a pictorial representation of the product. Children would be unable to order the product because, although they may see the password icons on the screen, they will not know the sequence to use them in. The icons may be presented in a random arrangement on the screen each time they appear if desired. In this case the characteristic of the icon (e.g. color) determines the password, not the relative position in a sequence of icons.

Consider a TV movie distribution system. The parent drags and drops a sequence of icons on top of an iconic representation of a movie. The methods here would permit adults to order movies which children could not. In a similar way, access to the World Wide Web and/or other network available information (e.g. bulletin boards) can be controlled. For example, certain material available over the network would require an iconic password so that unauthorized users, e.g. children, would not have access.

This iconic password scheme is preferable to a keyboard password scheme in situations where the icons are readily accessible. If the icons are always presented in fixed locations on the screen, users may find that it is easier to remember a series of movements than a series of keystroke.

It is also easier to grab a joystick or other graphical input device, in many cases, than to reach for a keyboard.

There are applications when a keyboard is inaccessible, or even totally removed from a system and the only way to enter the password is through the icons. There are several other situations where this idea may be useful. For example, in: medical operating theaters, the cockpit of an airplane, power-plants, cars, large scale manufacturing one may have access to the icons with no keyboard. In demonstration settings (e.g. museum exhibits) there may be no keyboard available. It is possible that the gross movements required in an iconic password are easier for people with certain manual dexterity deficits, since a keyboard password requires fine movements.

Since the drag-and-drop icons may be used at anytime (i.e. the system need not be prompting the user for a password if they are always on screen) the icons could permit a hidden request for a password to privileged users. In an application program, in the normal stream of events, several icons could be present. In the normal, user-friendly mode, the user would do as suggested: select an option, hit enter to continue, etc. At this point, if a user were to point to the proper icons in password order, then he could enter a totally different part of the application program. This is useful for system maintenance and debugging. This would also be a good way to differentiate classes of users without letting one class of users even know about other classes of users. In this capacity, this is a hidden password.

Icons with images on them may be more easily remembered then numerical passwords, and this could be 'sold' as a user-friendly feature. It would be easier for the occasional user to remember a picture instead of random numbers/letters that we are so often presented with today. If an 8×8 grid of code icons were presented, choosing 10 icons in correct order would give $P(64,10)=(64!/54!=5.5\times 10^{**}17>2^{58}$ ordered combinations. This number is vastly increased using the SRIP concept.

Given this disclosure alternative equivalent embodiments would become apparent to one skilled in the art. These embodiments are also within the contemplation of the inventors.

We claim:

1. A computer system with a computer memory and a central processing system operating under an operating system with a graphical user interface having icons representing various functions to be performed, said computer system being characterized by having a security code access system comprising:

a) code selection means including:

i) a plurality of code icons appearing of the graphical user interface,

ii) a plurality of target sites and

iii) selection means for use in a security process which includes selecting two or more code icons among the plurality of code icons in a selection sequence and moving them to at least one target site of the plurality of target sites,

b) a security code access sequence, including at least one target site, stored in the computer memory;

c) comparison means for comparing the selection sequence to the access sequence; and

d) a restricted function capable of being executed on the central processing unit only when the comparison means indicates that the selection sequence matches the access sequence so that access to and use of the restricted function is limited to users who select the code icons in the security code access sequence.

2. The computer system of claim **1** wherein said at least one target site is one of said code icons.

3. The computer system of claim **1** including an additional icon other than a code icon and said target site is said additional icon.

4. The computer system of claim **3** wherein the additional icon is not representative of said restricted function.

5. The computer system of claim **3** wherein said additional icon is a receptor tree icon.

6. The computer system of claim **3** wherein said additional icon is representative of the restricted function.

7. The computer system of claim **1** wherein said selection means is means for dragging and dropping the code icons on said at least one target site.

8. The computer system of claim **7** wherein said at least one target site is receptor tree icon in which there are more receptor locations than the number of code icons in the selection sequence to be placed in the receptor locations to match the security code sequence.

9. The computer system of claim **8** wherein said security code sequence includes placing each code icons in only a preselected one of said receptor locations.

10. The computer system of claim **7** wherein said security code access sequence includes a subsequence involving placing in sequence one or more code icons on a target site and said security code sequence includes said subsequence combined with at least one more target site or one more code icon.

11. In a computer system with a computer memory and a central processing system operating under an operating system with a graphical user interface having icons representing various functions to be performed, said computer system being characterized by method for a security code access procedure comprising:

a) providing a plurality of code icons and target sites on said graphical user interface and having selection means for use in a selection process involving choosing two or more of the code icons and moving them to at least one of the target sites among the plurality of code icons and target sites in a selection sequence;

b) storing a sequence constituting a security access code of two or more code icons and at least one target site in the computer memory;

c) comparing the icons and at least one target site selected and the order of their selection in the selection sequence with the sequence constituting the security access code;

d) allowing access to a restricted function only when the comparison indicates that the icons selected and the order of their selection in the selection sequence matches the access sequence to limit access to the restricted function to users selecting the code icons in the access code sequence.

12. The method of claim **11** including dragging and dropping the selected code icons on the at least one target site in the selection sequence.

13. The method of claim **12** including using a receptor tree icon which has more receptor locations than the number of code icons in the selection sequence to be placed in the receptor locations to match the security code sequence.

14. The method of claim **13** including the placement of each code icons in only a preselected one of said receptor locations.

15. The method of claim **13** wherein the security access code sequence includes a subsequence involving placing one or more code icons on a target site, wherein the security access code sequence includes combining said subsequence with at least one more target site or one more code icon in the security code sequence.

* * * * *