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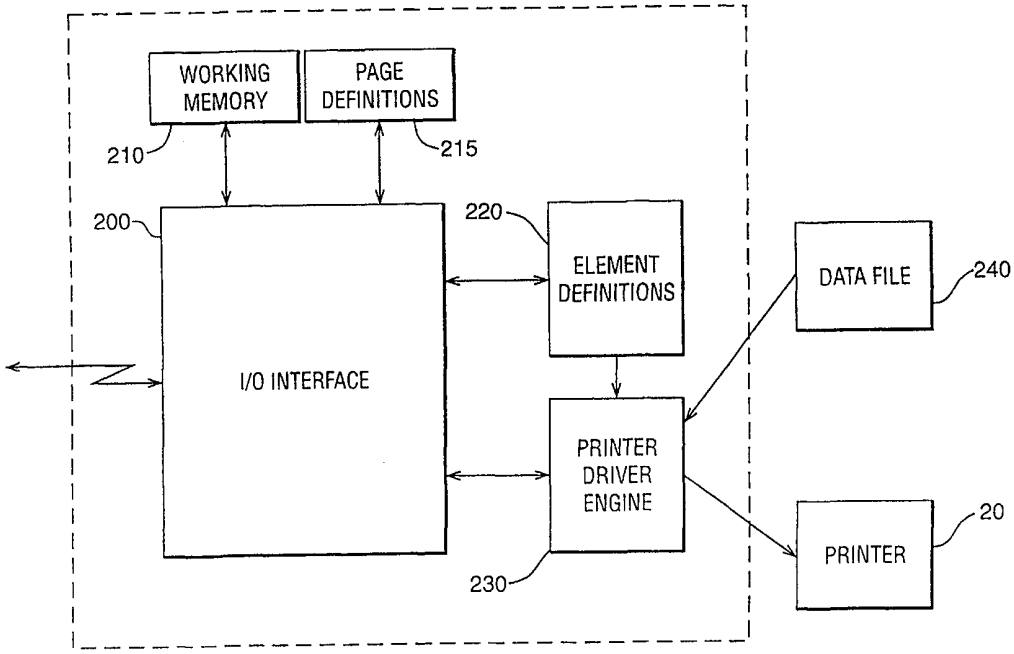

(57) Abstract

A device driver is provided in which the user interface is arranged so as to appear in a similar fashion to that of an Internet browser. From within the device driver, products relating to the driven device may be ordered preferably via a message sent over the Internet. The internal structure of the driver is arranged as two groups of data defining pages and elements allowing versatility in the design of the driver. The invention has particular application in the field of printer drivers.

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GRAPHICAL USER INTERFACE

The present invention relates to device drivers for the interfacing of data between a personal computer and a peripheral and has particular, although not exclusive, application to printer drivers.

Personal computers may typically be interfaced to a number of peripherals such as printers, modems, scanners and the like. Each of these peripherals may be configurable in different manners (e.g. a printer may be able to print at various resolutions). Furthermore each peripheral may have different capabilities in comparison to peripherals of the same type (e.g. a printer may or may not be able to print in colour). It is therefore necessary, in certain cases, for the user to be able to specify the configuration of the peripheral for the particular job in hand. This may also require different processing of the data before it is output to a peripheral. The output of this user defined configuration information to the peripheral and the necessary processing of the data before outputting to the peripheral is carried out by the device driver.

As stated above, device drivers perform in essence two

functions, the first being to convert data from the form used by the computer to a form usable by the driven device. Their second function is to provide various command and control parameters to the driven device. Both the above functions are under the control of the user who communicates with the device driver via a user interface.

The Windows (Trademark) Graphical User Interface (GUI) is now the most commonly used user interface for personal computers. This GUI may be by way of an adjunct to the operating system (e.g. Windows 3.x and Windows 95/98) or be integral to the operating system (e.g. Windows NT). The Windows GUI causes controls to be displayed on the personal computer's display and these controls can be selected or varied using a pointing device, typically a mouse, in conjunction with one or more buttons for confirming that the control pointed at is to be selected. These controls may include buttons, radio buttons or sliders.

However, there is a lack of flexibility in a system designer's choice of controls, as a system designer is confined to a choice of a small number of different types of controls in the design of the user interface for a

device driver. This choice may restrict the functionality that a designer is attempting to achieve. It also makes a device driver less "user friendly". Although a developer may create Windows custom controls, these require a good working knowledge of Windows system programming.

A problem therefore arises as the present scheme of constructing a device driver is complex, offers little choice in how the display will appear to a user and the architecture available means that such construction requires very specialist skills.

The present invention addresses the above problem by providing a device driver architecture which contains two separate but related sets of data, the first set defining the functionality of the features of the driver and the second set, how those features will be presented by way of graphical interface. Such an architecture provides the designer of a device driver with increased flexibility in the design of the appearance of the user interface without affecting the functionality of the driver.

Additionally with the advent of Windows 98 and the

Windows NT, it is desirable that the user's view of the system should be in the form of a browser interface such that the distinction between the user's view of the local machine and the World Wide Web may become amalgamated into one seamless view. The basis for defining such a user interface would be a hypertext based system as used over the Internet. HTML (Hyper Text Mark-up Language) is such a system which defines certain user interface mechanisms and conventions and is presently used across many platforms including Windows 95/98, Windows NT and UNIX based systems.

There remains a problem within the field of device drivers in that they continue to adhere to the legacy conventions of earlier operating systems and do not make use of the facilities offered by the newer systems. HTML technology allows many user interfaces which each have their own look and feel to be created using the same underlying structure which is in itself heavily extensible. The invention brings the appearance of a device driver interface into line with that which any user who has browsed the web will be familiar with.

The present invention provides a device driver for interfacing a personal computer to a peripheral, the

device driver comprising: a device driver engine for driving the peripheral in accordance with control commands; means for defining a plurality of elements, each element having at least one state, each state having an associated image for display to a user for user selection and at least one of a pointer to one or more associated elements or a control command to be output to the device driver engine; means for defining a plurality of pages, each page being associated with a state of an element and listing at least one of said one or more associated elements; and means for (i) receiving a user selection of a current state of a current element; (ii) reading the page associated with the current state of the current element; (iii) generating a display using the associated image of each element identified in the page list for the current state of the current element; and (iv) outputting the control command, if any, of the current state of the current element to the device driver engine.

An embodiment of the invention will now be described with reference to the accompanying figures in which:

Figure 1 shows a computer system including a personal computer and peripherals including a printer and a modem;

Figure 2 is a simplified block diagram of a printer driver according to the embodiment of the present invention;

Figure 3 is a simplified diagram showing a hierarchical structure of a set of elements forming part of the printer driver shown in Figure 2;

Figure 4 is a simplified diagram showing the data structure defining the ink options element shown in Figure 3;

Figure 5 is a simplified diagrammatic representation of a home page output as it would appear to the user of a printer driver according to the embodiment of the invention;

Figure 6 is a simplified diagrams showing the data structure defining the home page;

Figure 7 is a simplified memory map of the working memory of the I/O interface shown in Figure 2;

Figure 8 is a much simplified flow diagram which illustrates the I/O interface of the printer driver

according to the embodiment of the invention;

Figure 9 is a flow diagram showing the events triggered by a single click of the left mouse button;

Figure 10 is a simplified diagrammatic representation of a screen output page as it would appear to the user following a selection of the colour ink element of Figure 5 using a single click of the left mouse button;

Figure 11 is a flow diagram showing the events triggered by a double click of the left mouse button;

Figure 12 is a simplified diagrammatic representation of a screen output page as it would appear to the user following a selection of the colour ink element of Figure 5 using a double click of the left mouse button;

Figure 13 is a simplified diagrammatic representation of a screen output page as it would appear to the user following a selection of the colour ink element of Figure 10 using a double click of the left mouse button; and

Figures 14A and 14B are a flow diagram of the events triggered by a single click of the right mouse button.

Figure 1 shows a personal computer 10 comprising a processor unit 12, a visual display unit (VDU) 14, a keyboard 16 and a pointing device which in this embodiment is a mouse 18. In this embodiment the mouse has two buttons to allow the user to confirm a selection, namely a right and a left button. The need for two buttons will be described in more detail below. The processor unit 12 includes a floppy disc drive 13, which may read a floppy disc 13a in addition to the usual components of RAM, ROM, CPU, hard disc and the like (not shown). Connected to the personal computer system 10 are two peripherals, namely printer 20 and a modem 30. The modem is connected to a telephone line (not shown) using cable 32. The personal computer system 10 can, therefore, communicate with outside devices such as the Internet. In this embodiment, the printer 20 is a colour ink jet printer.

The processor unit 12 is effective to run under the command of software instructions which are stored in the RAM of the unit. A group of these instructions form the printer driver. This software may initially be provided upon a floppy disc 15 (or other storage medium) or downloaded from a data network (e.g. from the Internet) via modem 30.

Figure 2 is an overall block diagram of the printer driver 199 of this embodiment together with the printer 20 and a data file 240 to be printed. The printer driver engine 230 is a set of software instructions which instruct the CPU on the process which it must conduct in order to convert the data file 240 so that it can be interpreted by the printer 20.

The type of conversion process to be performed by the printer driver engine 230 and other of its general functions are under the control of I/O interface 200. This I/O interface 200 is a set of software instructions which attend to input and output to and from the user (via the keyboard 16, mouse 18 and the display 14 previously described) and pass control parameters to the printer driver engine 230 in accordance with the user's input. The I/O interface performs the above operations in accordance with two predefined groups of data, the first of which is a group of element definitions 220 and the second of which is a group of page definitions 215, both of which will be described more fully below. In overview, however, elements contain the control information for the printer driver engine whereas pages contain information on how that control information should be displayed to a user.

Further details of the element definitions 220 will be described with reference to Figure 3 which shows a number of such elements. As will be seen from the Figure these element definitions are interconnected in a hierarchical manner. A number of the elements (which can conveniently be termed branch elements) act as a passage to one or more children, an example of such an element being colour/black ink element 40. Elements at the bottom of the hierarchy (which can conveniently be termed leaf elements) determine a printer action, that is to say they are effective to control the printer driver engine 230.

In Figure 3, the home element 25 is positioned on the far left of the Figure and represents the overall "parent" element. In the embodiment, the home element 25 has a single state and has four children, namely a colour/black ink element 40, a halftone element 60, a resolution element 65 and an ordering element 70. All these elements have multiple states as indicated by a numeral in square brackets in the element.

Colour/black ink element 40 is effective, via its children, to set the ink type options for the printer 20, that is to say whether the printer will print using plural colour inks or only black ink.

Both states of the colour/black ink element 40 are shown explicitly in the Figure from which it will be seen that the children of this element are dependent upon its state. The element 40 has three children in its colour ink state (elements 41-43) and two (different) children (elements 47 & 48) in its black ink state. In the colour state, these children are brightness element 41, contrast element 42 and saturation element 43. Of these three elements, the brightness element 41 and contrast element 42 are leaf elements in all states as they have no subsequent children. Saturation element 43, has two states, namely manual (state 0) and automatic (state 1). In its manual state it has three children, yellow element 44, magenta element 45 and cyan element 46. In its automatic state it has no children. It will thus be noted that an element may be of a hybrid nature, that is to say, a branch element in some states and a leaf element in others.

It will be appreciated that certain elements have a large number of states (e.g. the colour contrast element which has 50 states). In the embodiment, this is displayed by presenting a graphic the content of which varies as it is clicked on, i.e. as the states are cycled through. However, in a modification, such an element could be

implemented by fewer states each representing intermediate values such as 25%, 50%, 75% and 100% (0% being in this case of no practical use) with a further state for a custom setting which may be entered via the keyboard. Such a modification may be preferable in the case of an element having a high number of states in particular one exceeding 100 states to avoid a user needing to click on an element an excessive number of times. Furthermore, as an alternative to keyboard entry of the custom setting, this could have a child element having the multiple states so that no recourse to the keyboard is necessary.

The Halftoning element 60 is used to allow the setting of various halftoning options (e.g. ordered dither, error diffusion and the like). The Resolution element 65 is used to allow the setting of various printer resolutions, usually expressed in dots per inch (dpi) for example, 300 dpi, 600 dpi etc. The Ordering element 70 allows the ordering of printer orientated supplies via the Internet (e.g. paper, ink and the like).

This is achieved in the embodiment using identification information stored in the printer driver which is sent to the supplier when the ordering of supplies is selected.

This identifies the type of printer as well as relevant configuration information for that specific printer (e.g. whether it has been upgraded in any manner) Additionally, the printer driver may be pre-programmed with the address of a suitable supplier which may be the manufacturer.

As the device driver is peripheral specific, these supplies can be specific to the peripheral. This information, to give an example, will ensure that the correct ink for the printer will be ordered. Furthermore, this facility will also allow a user to order new printer models from the manufacturer or to upgrade hardware or software. In the case of a software upgrade this may be downloaded immediately over the Internet.

The above elements have an arrangement of children dependent upon their state in a similar manner to the colour / black ink element and thus will not be described in detail. It will be appreciated that a number of other different printer options may also be accessible via appropriate elements, the four elements listed above being exemplary only.

Each of the elements shown in Figure 3, has its own element definition which contains details of its logical

position relative to other elements that is to say it defines the above described hierarchical structure. The definition also contains the control information for the printer driver engine 230. This element definition will now be described with reference to Figure 4 which shows by way of example the definition for the colour/black ink element 40.

The element definition comprises two portions a basic definition portion 110 and a state definition portion 120, 130. In colour/black ink element 40 there are two states and therefore two state definitions, one for colour ink (state 1) 130 and another for black ink (state 0) 120.

In this embodiment, the basic definition portion 110 contains three pieces of information. The first is information concerning the parent of the element, which in the case of this element is the printer home element 25. The second piece of information is termed the "state ribbon" and contains a pointer to a series of images for display to the user. As described more fully below, this allows an image indicating the present state of the element to be presented to the user. This series contains an image for each state of the element in a

sequential order. Thus in this case, there are two images, one for state 0 (black ink) and the other for state 1 (colour ink). The final piece of information is the default state of the element being that which the printer driver is set upon first activation, in this case, the colour state.

As previously described, this element has two states and thus two state definition sections 120, 130. In the black ink definition 120 (state 0), is information defining the "base page" associated with that state, in this case ink-options-black. This base page information is used in determining the user interface display in a manner which will be described later. Also defined in the state definition 120 are the children associated with that state, in this case brightness element 47 and contrast element 48. As will be appreciated, each of these children will have an element definition of its own.

Similarly, in the colour ink state definition 130 comprises information defining its base page (ink-options-colour) and its children (C-brightness element 41, C-contrast element 42 and saturation element 43).

It should be noted that the element definition does not differentiate whether these children are leaf elements or whether they have subsequent children themselves.

In a leaf element (e.g. brightness element 47) the state definition will not include a list of children but instead will include command data to be passed to the printer driver engine 230 corresponding to the action to be performed.

As has been explained above, the user interface structure is defined by a group of element definitions. These definitions are, however, separate from a group of page definitions which define how the information will be presented to the user on the VDU 14.

These page definitions will now be described with reference to Figures 5 and 6.

Figure 5 shows the home page of the user interface, being that which is displayed to a user upon selection of the printer driver. The display comprises essentially two parts and is in certain respects similar to a web browser. These two parts are the tool bar 36 for navigating around the driver and the browsing space 34 in

which a variety of elements can be displayed. The tool bar 36 has a backward arrow 36a and forward arrow 36b for navigating through the hierarchical structure of the driver and home control 36c which will return the browsing space 34 to the home page. In the Figure, back arrow 36a is presently deactivated because the browsing space is presently on the home page. The arrow is therefore greyed which is a known technique to indicate that the option cannot be selected.

Cursor 100 can be moved around the browsing space 34 by movement of the mouse 18. In the browsing space 34 are images representing the functional elements which can be accessed, in this case, colour/black ink element 40a, halftoning element 60, quality resolution element 65 and order supplies element 70. As will be seen, three of these are elements which have multiple states and an image corresponding to the current state is displayed. Two static elements, printer image 25 and logo image 27 which cause no function to be performed but are definable by the device manufacturer and may therefore be tailored to its house style are also displayed. In the figure the images are shown diagrammatically as areas having printed labels but they will preferably be images indicative of the function. For example, the image showing the state

of the colour element 40a could display a rainbow of colours or a pie chart showing different colours or the like.

Figure 6 shows the page definition of the home page shown in Figure 5. This definition includes a list of elements to be displayed, the list including the name of the element, the X, Y coordinates at which it should be displayed on the VDU and whether that element is static, active or greyed. It will therefore be appreciated that any number of elements can be displayed on each page and each element can be placed at any position on the screen. As previously explained, each element may be specified as static, active or greyed for that particular page. A static or greyed element is one which is merely displayed but causes no action to occur. An active element is one which may be selected by the user and may act as a gateway to its children or cause an action to take place. It should be appreciated, however, that greyed and static elements are not equivalent. A static element remains so on all pages whereas a greyed element is only non-selectable on particular pages and will be active on other pages. Greyed elements are displayed by fading their image, that is to say reducing the image saturation of the appropriate area of screen.

In Figure 6 the first listed element is the company logo element 27 which is to be positioned at position X = 5, Y = 5 on the page, it being noted that, in the embodiment, the X coordinate is measured from the left of the page and Y coordinate from the top of the page. The company logo element 27 is a static element. The next element is the printer home element 25, is to printed at position X = 10, Y = 85 and is also to be a static element. The third element on the page is the colour/black ink element and is to be displayed at position X = 55, Y = 10 and is to be an active element, that is to say that it may be selected by a user and will cause an event to occur as will be described below. Likewise there are active elements positioned at defined places for the halftone element 60, the resolution options element 65 and the order supplies element 70.

The working memory 210 of the I/O interface of the printer device 199 will now be described with reference to Figure 7. An identification number of the present page, i.e. that currently displayed on the screen, is stored in a first memory location 211. In a second location 212, an identification number of the presently selected element is stored. Finally, in a third group of memory locations 213 one for each element, the current

numeric state of each element is stored.

The operation of the I/O interface 200 of the printer driver 199 will now be described with reference to the flow diagram of Figure 8. In step 300, the home page is read and displayed to the user on the VDU. In step 302, the I/O interface 200 detects whether the user has clicked on an image thus selecting an element. In the embodiment, the cursor 100 will change its appearance to the user so as to indicate that it lies above an element which may be activated (i.e. not above a static or greyed element or an unused portion of the screen).

Once the user has selected an element, in step 304 the I/O interface determines whether the type of selection is one indicating that the user wishes to change the state of the selected element or instead whether the user requires expansion of the element to display the elements available further down the hierarchical structure. As will be described more fully below, the I/O interface 200 distinguishes between the above two possibilities in dependence upon the type of mouse button click (single left click, double left click or single right click). It also takes into account the relationship between the selected element and the presently displayed page (that

is to say whether the selected element is a parent or child type element in relation to the other elements on that page).

In the case where the user has selected an element for a change of state, in step 306 the I/O interface 200 changes the state of that element and updates the working memory 213. The new state may be a single increment from the previous state (cycling round to the first state again if the previous state was the numerically highest state) or may be selected precisely by the user depending upon which of the mouse buttons were used to make the selection as will be described more fully below. In step 308, the I/O interface 200 determines how the display should be changed. This may require a new page to be displayed or merely the updating of the current page, fuller details of which are described below. In step 310, if there is a printer control command associated with the new state selected then this is output to the printer driver engine 230. The new or updated page is then displayed in step 314 and the page pointer 211 updated if necessary. The user interface then returns to step 302 to await the selection of the next element.

In the alternative situation where an element has been

selected for expansion the process branches to step 312 where I/O interface determines the new page to be displayed which will be that which corresponds to the expanded element. This new page is determined by reading the base page details corresponding to the present state of the element from its element definition as will be described in greater detail below. The new page is then displayed at step 314 and the page pointer 211 is updated. The process then returns to step 302 as before.

In order to explain the above described process more fully, the process steps performed by the I/O interface upon three different categories of user selection of an element will now be described. These three categories are a single left mouse button click, a double left mouse button click and a single right mouse button click.

Figure 9 shows the process steps carried out by the I/O interface upon the single click of the left mouse button on a selected element.

At step 400 the single click of the left mouse button is detected. At step 402, the I/O interface detects whether the cursor 100 lies over a static element. If it does lie over a static element (or a greyed element), the

process branches to step 414 as the process is considered complete. If an active element has been selected, the process branches to step 404 where the I/O interface determines whether the selected element in its current state is a leaf element. This is achieved by reading the portion of the element definition 220 of the selected element corresponding to its presently selected state. If this state definition has no children then the element is a leaf element.

Describing first the situation where the element is not a leaf element, the flow branches to step 406. In step 406, the base page is read from the current state of the selected element. The page listed as the base page will contain the children of the element selected for expansion. Once the new page to be displayed has been read, in step 408 this is displayed on the VDU and the page pointer 211 is updated.

An example of the above operation, from the point of view of a user, will now be described. In this example, it is first assumed that the presently displayed page is the home page shown in Figure 5. It is further assumed that the user has located cursor 100 to lie on top of colour ink element 40a and has selected this using a single

click of the left mouse button (step 400). Following the process described above, the I/O interface will read at step 404 the element definition for the ink options element (shown in Figure 4) and thus determine that the presently selected state has children. The process will thus proceed to step 406 where the base page of the present state of the selected element will be read which, in this case is named ink-options-colour. Thereafter the contents of the ink options colour page (not shown) will be read and page will be displayed. In this case, a page corresponding to Figure 10 will be displayed.

Explaining Figure 10 in greater detail, tool bar 36 and browsing space 34 are as previously described. The four elements 40a, 60, 65, 70 on the right hand side of the browsing space 34 in Figure 5 are now presented at the left of the browsing space 34. As an optional feature, a scrolling movement may be used to effect this. Children of the element 40a and, in this embodiment, grandchildren have now been displayed on the screen. Children brightness element 41 and contrast element 42 which are both leaf elements are displayed. Also displayed is saturation element 43 and (as manual saturation control is currently selected) grandchildren elements yellow 44, magenta 45 and cyan 46 are

additionally displayed. As the selection of colour is currently of interest to the user, the elements 60, 65 and 70 which remain on the browsing area in this example are greyed, meaning that they cannot be directly selected from the screen. As will be appreciated, a return to the home screen of Figure 5 will be necessary in order to select these elements which can be achieved using the back arrows 36a or the home icon 36c. It should be noted that the parent page in the element definition allows the back arrow feature to be implemented.

Returning to Figure 9, the process where the selected element is a leaf element will now be described. In such a event, the process will branch to step 410. In this case the user will have selected the element in order to change its state. The user interface, therefore, reads the current state of the selected element from the state definition block 213. This is then incremented by one to the next numerically higher state. In the event that the numerical value of the state exceeds the number of possible states, it is reset to state zero. Thus the state selection is cyclic in nature. As will be apparent, in the case of an element having only two states, this effectively achieves a toggling between the two states. The numerical value of the new state is then

stored in the appropriate memory location 213. In step 412, the appearance of the new page is determined. The page to be displayed is already known and stored in location 211. As previously described, that page definition includes the position of all the elements. However, as a state change has occurred, an updated image must be displayed corresponding to the selected element. This is read from the state ribbon of the selected element. As previously described, this state ribbon contains a series of sequential images, one for each numeric value of the state. In this manner, the page definition defining the elements to be displayed will be updated to display the image of the element in the presently selected state. The process also determines, from the current state portion of the selected element whether an action is to be performed and, if so, performs that action. The process ends at step 414.

The process steps when an element has been double clicked using the left mouse button will now be described with reference to Figure 11. This is commenced at step 500 by the left mouse button double click. At step 502 it is detected whether the element is static (or greyed) and if so the flow branches to step 520 where the process ends. Otherwise, at step 504 it is detected whether the element

is a leaf element or not in the manner previously described. If the element is a leaf element, then its state is changed at step 506, and updating performed in the same manner as that employed for a leaf element when a single click has occurred which will not, therefore be explained again.

In the event that the selected element is not a leaf element, the flow branches to step 510 where it is detected whether the current page is the base page for the element. This is necessary because an element may be displayed either with its parent or its children. In the event that it appears with its children it will be necessary to change the page with the change of state so as to display the new children. On the other hand, if the selected element appears with its parent it is only necessary to update the page with the new state of the selected element. The processes by which these two options are achieved will be described in greater detail below.

In order to determine whether the current page is the base page for the selected element, the user interface reads the base page from the element definition of current state of the selected element and compares this

with the present page stored at memory location 211. In the event that the current page is not the base page, the process branches to step 516 and increments the state of the element. As previously explained, it is cycled to state zero if necessary. In step 518, the current page is updated with the new state image for the element using the state ribbon for the new state as previously described.

Again using the home page shown in Figure 5 as an example this process will be described as it appears to a user. In this case, a double click on colour ink element 40a is an indication that the user wishes to change the state of this element rather than expanding it. The process will have branched to step 510 where it will have determined that the present page does not correspond to the base page of the selected element (see reference numeral 130 of Figure 4). The process will thus have branched to step 516 where the state of the element is changed. In this case there are only two states and so this state is cycled to state zero. The image for the element is read from the state ribbon and the updated page is then displayed on the browsing space 34 of the VDU. Figure 12 shows the displayed output on the VDU following the above process.

As shown in Figure 12, the displayed output is similar to that of Figure 5 except that a black ink element image 40b is displayed instead of the colour image element 40a. As will be appreciated, the expansion of black ink element 40B will subsequently give different children options to those which would have been presented had the alternative state of colour image of 40a been selected.

Returning to Figure 11, if at step 510 it is determined that the page is the base page for the element then the process branches to step 512 where the state of the element is incremented in the same manner as described above. In this case, however, the new base page for the new page is read from the state information of the selected element and it is this new base page which is displayed. The page pointer 211 is updated accordingly. The process thereafter terminates at step 520.

Using the page displayed in Figure 10 as an example the above process as it would appear to a user will now be described. It is assumed that the user has double left clicked on colour image element 40a. It will be appreciated that the current page will be the base page for that selected element. The process of Figure 11 will thus have branched to step 512 and changed the state of

the ink options element to black ink (state 0). The new base page will have been read and displayed. This will result in a user display as shown in Figure 13.

Figure 13 shows tool bar 36 and browsing space 34 as previously described. To the left of browsing space 34 now appears black ink element 40b (in place of colour ink element 40a) below which are greyed halftoning element 60, quality/resolution element 65 and order supplies element 70 as before. On the right of the browsing space 34 are the two children of black ink element 40b namely monochrome brightness 47 and monochrome contrast 48 which replace the children of the colour ink element 40a.

The actions performed by a click of the right mouse button will now be described with reference to Figures 14A and 14B. In overview, however, a similar process is followed to that of a single left mouse click except that instead of the present state of the element being incremented by a single state, the user may select the new state of the element from a list of all possible states using the mouse. In the embodiment, the current state of the element is indicated by a tick adjacent to it.

Referring to Figure 14A at step 600 a single right click of the mouse button is determined. At step 602, it is determined whether the element selected is a static element in which case the process ends at step 636. Otherwise, at step 604 it is determined whether the selected element is a leaf element. The manner of this detection has been previously described and will not be repeated.

If the element is a leaf element, the process branches to step 606 where the context menu for that element is displayed. A context menu is a portion of the displayed screen which temporarily over writes the previous image and contains a list of all possible states for that element. In a modification, however, the space allocated to the context list may be of predetermined size and may be scrollable if the number of state images are too great although this is considered non-preferable. Continuing to Figure 14B, the context menu is highlighted so as to indicate the current state. In the embodiment this is by means of a tick adjacent to the image but other forms of such indications could be used (e.g. by making the image flash or larger than the other state images). At step 610 it is detected whether the user wishes to change the state of the element. The user does this change by

moving the cursor to the desired new state and confirming the selection by clicking a mouse button, this being a known procedure for choosing an item from a menu. If the user does not change the state of a element then the process ends at step 616. If the user does change the state of the element then updating steps (steps 612 and 614) as previously described with reference to a left mouse button click are performed. At step 616 the process terminates.

Returning to step 604, if the element is not a leaf element then a context menu for the selected element is displayed at step 618 in a similar manner to the context menu of a leaf element. Again current state of the element is indicated in step 620 using a tick adjacent to the current state of the element. At step 622 it is determined whether the user wishes to change the state of the element and if no change is required, the process branches to step 634 and the process ends. Otherwise, the process branches to step 624 where it is determined whether the current page is the base page for the element in the same manner as that previously described (see step 510, Figure 11). If the current page is not the base page for the element then the state of the element is changed to that selected by the user (step 630) and the

current page updated with the new state image for the element is displayed at step 632 using the state ribbon information as previously described. The process thereafter ends at step 634. Conversely if at step 624 it is determined that the current page is the base page for the element then the state of the element is changed to that specified by the user at step 626 and, at step 628, the base page of the new state is displayed. This is done in the same manner as described above. The process thereafter ends at step 634.

The other options presented in the tree diagram of Figure 3 will not be discussed in detail as the architecture and functionality is the same as that described above. However, with reference to element 70, it will be appreciated that the printer device driver can be used in conjunction with a modem in order to place orders directly with a supplier for consumables such as paper, ink cartridges or the like. Furthermore, the architecture of the present invention allows the images of these elements to look like the consumables on offer. Thus the user may be presented with a picture of a colour ink jet cartridge and, merely by clicking on that cartridge, will be able to forward the selected article. Indeed, the architecture of the present invention will

allow an original equipment manufacturer to personalise the device driver so as to maintain a house style with its products and its website.

In the embodiment, a driver for a colour ink jet printer was described. The invention may, however, be used to drive any type of printer such as ink jet printers in general, laser printers, dye sublimation printers or thermal wax transfer printers.

In the embodiment, a printer driver was described. The invention is, however, suitable for all types of device drivers and could, therefore, be employed in device drivers for modems, scanners, monitors or the like.

In the embodiment described above, a state ribbon has been used in order to define the images corresponding to each state of an element. This need not be the case and the state definition portion of each element could contain the image information. An advantage with the state ribbon is simplicity but there is a disadvantage that all of the images must be of the same size. The use of individually defined images for each state allows different size images to be used for different states.

In the embodiment, a single image has been displayed to represent and indicate the state of an element. However the invention is not so limited and the displayed image may, in fact, be animated and thus comprise a series of images so as to present a moving image to the user. Additionally sound may accompany the image. Alternatively the image representing the state of an element could be handled by a "plug in" which is an external piece of software which functions or appears to function as an integral part of the system and takes the responsibility for implementing a plurality of additional features for an on behalf of the system, those features appearing to the user as if they were provided by the system itself.

In the embodiment specific events have been triggered by specific mouse button clicks. The described relationship is not intended to be limiting and other mouse events could be tied to the triggered event. Furthermore a three button or wheel-mouse could be used as could any other type of pointing device.

In the embodiment, the size of each image to be displayed is dependent upon the stored bit image. However, it would be possible to include a scaling parameter into the

element definition so that the same bit image could be used for different pages but displayed in different sizes. For example, when the element is a parent the size could be larger than when it is a child. Scaling of images may also be necessary in order to improve the presentation of the elements on a page.

A further modification is the introduction of a cursor which can be customised. As previously explained, it is known to change the appearance of the cursor from a first appearance when it does not lie over an activatable element to a second appearance when it does lie over an activatable element. A new image for the cursor when it lies over an activatable element could be stored in the element definition. This would allow a different cursor to appear dependent upon what type of element the cursor was lying over. An example of a suitable element would be an ink pot when the cursor lay over the ink options element.

A further alternative is the provision of a tool known as an agent within the printer driver. Agents are an enhanced interface between a user and system help information but are not currently in use in device

drivers. Agents may take the form of an animated character to whom users may ask questions in a natural language in order to obtain technical information and help on the system. In the case where the invention is embodied in a printer driver, a suitable agent would be a character constructed from a simplified stylised image of a printer.

In a further modification to the embodiment, the printer driver would monitor the remaining amount of consumables, such as the amount of ink or paper. Monitoring could be carried out by the printer being capable of sending consumables depletion messages to the driver. Upon the remaining amount of consumables falling below a preset amount, the printer driver would cause a prompt to be displayed to the user requesting the user to indicate whether a replacement consumable should be ordered. In a further alternative, the driver could order a replacement consumable automatically, without the need for user confirmation. In a further alternative, the driver could cause an order form to be generated and printed by the printer. The order could then be sent by conventional mailing service to the service location. Further, the "order supplies" element 70 could have a child element depending therefrom, selection of which

causes presentation of an options interface to a user, so that the user can enter details of a supplier of the printer consumables.

In a further modification, the driver would keep a record of the age of the driven printer and would call the attention of the user to new products after a predetermined passage of time (e.g. two years). Information on these new products would be downloaded from the Internet.

In the embodiment, each display screen consists of parents on the left of the browsing space and children on the right allowing a left to right scrolling effect to be performed upon navigation through the elements. However, this need not be the case and the image representing the home element or the present parent could be in the centre of the browsing space with the children arranged in a circular fashion around it. In fact, any type of page display may be achieved merely by customisation of the page data.

In the above description, elements having one state have not been described in detail. One state elements would be leaf elements which perform a single function, e.g.

nozzle cleaning. The selection of an element would cause the I/O interface 200 to instruct the printer driver 230 directly to perform the function.

Other modifications and variations will be apparent to those skilled in the art.

CLAIMS:

1. A computer apparatus comprising a peripheral device driver, said device driver being capable of being set into any one of a plurality of different configurations;

a device driver command module including a plurality of control commands for setting the device driver selectively into said different configurations;

means for storing a plurality of graphical elements for use in a graphical user selection interface;

means for selectively associating a graphical element of said plurality with one of said control commands; and

means for displaying on a display means, a graphical user selection interface comprising a subset of said plurality of stored graphical elements, and means for monitoring user selection of a graphical element associated by said associating means in response to which said corresponding control command is generated, thereby causing said device driver to be configured in accordance with said corresponding configuration.

2. Apparatus in accordance with claim 1 and operable to display at least one stored graphical element for user selection, wherein said associating means is operative to

associate a graphical element, not associated with a corresponding control command, with one or more further graphical elements, such that said apparatus is responsive to user selection of a displayed graphical element associated with one or more further graphical elements, to cause display in use of said one or more further graphical elements so as to be available for user selection.

3. Apparatus in accordance with claim 1 or claim 2, wherein said storage means is operable to store, in respect of a stored graphical element, two or more different graphical forms, said apparatus further including means for associating each stored graphical form with a respective one of said configurations, such that the graphical element is displayed, in use, in the form corresponding with the configuration of said device driver.

4. Apparatus in accordance with any preceding claim, wherein said device driver is operable to cause said apparatus to generate a peripheral configuration signal, said signal being operative to configure a peripheral in accordance with a user selection.

5. Apparatus in accordance with claim 4, wherein said device driver is operable in a first configuration to cause said apparatus to generate a first peripheral configuration signal operative to configure a peripheral printing device to operate in a monochrome printing mode, and is further operable in a second configuration to cause said apparatus to generate a second peripheral configuration signal operative to configure a peripheral printing device to operate in a colour printing mode.

6. Apparatus in accordance with claim 5, wherein said control means is operable to generate a colour option control command, for configuration of the device driver to change from the first configuration to the second configuration or from the second configuration to the first configuration, said colour option control command being associated, in use, by said associating means with a colour option graphical element having a first state indicating selection of the first configuration and a second state indicating selection of the second option, wherein said apparatus is operable to display the first state of said colour option graphical element when the device driver is configured in the first configuration, and in the second state when the device driver is configured in the second configuration.

7. Apparatus in accordance with any preceding claim, wherein the means for displaying a graphical user selection interface is operable to include, in said graphical user selection interface, a home graphical element associated with a predetermined group of graphical elements, said predetermined group of graphical elements being associated in use with a set of basic control commands, said home graphical element being selectable to cause display of said predetermined set of graphical elements.

8. Apparatus in accordance with any preceding claim including graphical user selection interface usage storage means operable to store information defining groups of graphical elements successively displayed to a user, and including a forward graphical element and a backward graphical element, selection of said backward graphical element being operable to cause retrieval of information from said usage storage means and display of a most recently viewed set of graphical elements instead of an existing set of graphical elements, and subsequent selection of said forward graphical element being operable to cause redisplay of said existing set of graphical elements.

9. Apparatus in accordance with any preceding claim and further comprising means for generating a communication signal for communicating with a remote location, said interface configuration means being responsive to one of said control commands to cause said signal generating means to generate a signal for procuring a consumable product of a peripheral device with which the device driver is operative to communicate in use.

10. Apparatus in accordance with claim 9, wherein said device driver is responsive to a signal input from a peripheral representative of a depletion of a consumable to cause said signal generating means to generate said consumable procuring signal.

11. Apparatus in accordance with claim 9 or claim 10, wherein said associating means is operable to associate a graphical element with said one of said control commands such that user selection of a graphical element so associated is operable to cause generation of said consumable procuring signal.

12. A method of defining a peripheral device driver, including the steps of storing a plurality of graphical elements for display to a user, associating with each

stored graphical element either a plurality of further ones of said stored graphical elements or one of a plurality of control commands, each control command in use being operable to configure said peripheral device driver in accordance with a corresponding one of a plurality of predetermined configurations, and displaying a subset of said plurality of graphical elements such that, on selection of a stored graphical element associated in said associating step, either an associated subset of graphical elements is displayed, or an associated control command is operated upon said interface.

13. A method in accordance with claim 12 and further including the step of storing, in respect of each stored graphical element, a plurality of graphical representations and associating each said representation with a respective one of said predetermined configurations, said step of displaying including the steps of referring to said configuration of said interface and displaying the corresponding representation of said element.

14. A method in accordance with claim 12 or claim 13 including the step of associating one of said graphical

elements with one of said control commands, said control command being operable to cause generation of a communication signal for communicating an order for a consumable product for use with a peripheral.

15. A method in accordance with claim 14 including the steps of monitoring for user selection of said graphical element associated with said signal generating control command and, on user selection thereof, generating said signal.

16. A method in accordance with claim 14 or claim 15 and including the step of monitoring for receipt from a peripheral of a signal indicating depletion of a consumable by said peripheral and, on receipt of said signal, generating said communication signal.

17. A computer apparatus comprising a peripheral device driver, said device driver including means for controlling and configuring a peripheral device, and means for generating a signal for transmission to a third party, for ordering a supply of a consumable product for use with said peripheral device.

18. Apparatus in accordance with claim 17 wherein said

device driver includes means for receiving a consumable depletion message from a peripheral, said signal generating means being responsive to receipt of a consumable depletion message by said receiving means.

19. A computer apparatus comprising a peripheral device driver, the driver including means for controlling and configuring a peripheral device, means for monitoring said peripheral device for depletion of a consumable product thereof; and means for generating a document in response to depletion of a consumable product, said document being for use in ordering a supply of said consumable product.

20. A device driver for interfacing a computer to a peripheral, the device driver comprising:

a device driver engine (230) for driving the peripheral in accordance with control commands;

means (220) for defining a plurality of elements, each element having at least one state, each state having an associated image for display to a user for user selection and at least one of a pointer to one or more associated elements or a control command to be output to the device driver engine;

means (215) for defining a plurality of pages, each

page being associated with a state of an element and listing at least one of said one or more associated elements; and

means (200) for (i) receiving a user selection of a current state of a current element; (ii) reading the page associated with the current state of the current element; (iii) generating a display using the associated image of each element identified in the page list for the current state of the current element; and (iv) outputting the control command, if any, of the current state of the current element to the device driver engine.

21. A device driver according to claim 20, wherein said means (200) for generating a display using the associated image of each element identified in the page list for the current state of the current element generates a display using the associated image for the current state of the each identified element.

22. A device driver according to claim 20 or claim 21 adapted for the driving of a printer.

23. A method of interfacing a computer to a peripheral, the method comprising the steps of:

providing an engine for driving the peripheral in

accordance with control commands;

defining a plurality of elements, each element having at least one state, each state having an associated image for display to a user for user selection and at least one of a pointer to one or more associated elements or a control command to be output to the device driver engine;

defining a plurality of pages, each page being associated with a state of an element and listing at least one of said one or more associated elements; and

receiving a user selection of a current state of a current element;

reading the page associated with the current state of the current element;

generating a display using the associated image of each element identified in the page list for the current state of the current element;

outputting the control command, if any, of the current state of the current element to the device driver engine.

24. A method according to claim 23, wherein said step of generating a display using the associated image of each element identified in the page list for the current state of the current element generates a display using the

associated image for the current state of the each identified element.

25. A method according to claim 23 or claim 24 adapted for the driving of a printer.

26. A printer driver for interfacing a computer to a specified printer, the printer driver comprising:

means for inputting a user command to order supplies associated with said specified printer; and

means for causing the computer to output a signal addressed to a supplier indicative of the user's desired supplies.

27. A printer driver according to claim 26, wherein said means for causing the computer to output a signal is adapted to output said signal to the Internet.

28. A printer driver according to claim 26 or 27 further comprising means for presenting the user with the options to order at least one of:

an ink cartridge specific to the specified printer or a process cartridge specific to the specified printer.

29. A method of generating signals for ordering printer

specific supplies comprising the steps of:

providing a printer driver of the type used for interfacing a computer to a specified printer;

inputting a user command to order supplies associated with said specified printer; and

causing the computer to output a signal addressed to a supplier indicative of the user's desired supplies.

30. A method according to claim 29 further comprising the step of presenting the user with the options of ordering at least one of an ink cartridge specific to the specified printer or a process cartridge specific to the specified printer prior to the input of the user command.

31. A method of inputting commands to a device driver, said device driver interfacing a computer with a peripheral, the method comprising the steps of:

providing a plurality of element definitions, said elements being interconnected in a hierarchical manner, each element having at least one state, each state defining a display image and at least one of a pointer to one or more associated elements or a control command to be passed to the device driver;

providing a plurality of page definitions, each of said pages being associated with a state of an element

and each said page definition containing a list of elements;

reading the list of elements from the page definition of the presently selected page;

displaying the display image corresponding to the present state of each of said elements on the list on a display device;

inputting a user selection of a displayed element;

upon a first type of user selection, reading the page associated with the present state of the selected element and displaying the display image for the present state of each of said elements on the list of that page definition;

upon a second type of user selection (i) changing the state of the selected element, (ii) determining whether there is a page definition associated with the new state of the selected element and if so reading said page definition and displaying the display image for the present state of each of said elements on the list of that page definition; or if not displaying the present page with the display image of the selected element updated so as to correspond to the new state.

32. A printer driver for interfacing a computer to a printer, the driver comprising:

means for driving an Internet browser style user interface so as to cause the display of user definable printer parameters and so as to receive user definitions;

means for storing information specific to the printer to be driven;

means for receiving a purchase command from the user via said Internet browser style user interface; and

means for outputting purchasing data to the Internet for ordering the supply of a printer related item from an external supplier in dependence upon said received purchase command and said stored information.

33. A printer driver for interfacing a computer to a printer, the driver comprising:

means for displaying user definable printer parameters and for inputting commands from a user;

means for storing information specific to the printer to be driven;

means for receiving a purchase command from the user via said input means; and

means for outputting purchasing data for ordering the supply of a printer related item from an external supplier in dependence upon said received purchase command and said stored information.

34. A printer driver according to claim 32 or 33, wherein said purchasing command relates to a printer consumable.

35. A printer driver according to claim 34, wherein the driver further comprises means for monitoring the current amount of the printer consumable and means for prompting the user to consider a purchase command upon the current amount of the printer consumable falling below a predetermined value.

36. A method of ordering printer specific consumables comprising the steps of:

providing a printer driver of the type used for interfacing a computer to a specified printer;

monitoring the current amount of at least one printer consumable; and

causing the computer to output a signal addressed to a supplier so as to order a replacement consumable upon the current amount of the consumable falling below a predetermined value.

37. A printer driver for interfacing a computer to a printer, comprising:

means for monitoring the current amount of at least

one printer consumable; and

means for causing the computer to output a signal addressed to a supplier so as to order a replacement consumable upon the current amount of the consumable falling below a predetermined value.

38. A computer apparatus comprising a peripheral device interface means and communication means, the peripheral device interface means including signal receiving means for receiving a signal from a peripheral representative of depletion of a consumable of said peripheral device, and said peripheral device interface means being responsive to receipt of said signal to cause said communication means to transmit a message to a remote location for ordering of further supply of said consumable.

39. A computer apparatus comprising a peripheral device interface means for control of a peripheral device, and communication means, the peripheral device interface means including display means operative to display to a user a graphical element, said apparatus further including a user input device operative, in response to user selection of said graphical element, to generate an input signal, said peripheral device interface means

being further operative in response to said input signal to cause said communication means to generate a message for transmission to a remote location for the ordering of a supply of a consumable of said peripheral device.

40. A computer apparatus including a driver in accordance with any one of claims 20 to 22, 26 to 28, 32 to 35 and 37.

41. A computer program product comprising processor executable instructions operable to cause a computer to become configured as apparatus in accordance with any one of claims 1 to 11, 17 to 19 and 38 to 40.

42. A computer program product comprising processor executable instructions operable to cause a computer to become configured to operate in accordance with any one of claims 12 to 16, 23 to 25, 29 to 31 and 36.

43. A computer readable storage medium storing a computer program product in accordance with claim 41 or claim 42.

44. A signal bearing computer readable information comprising a computer program product in accordance with

claim 41 or claim 42.

FIG. 1

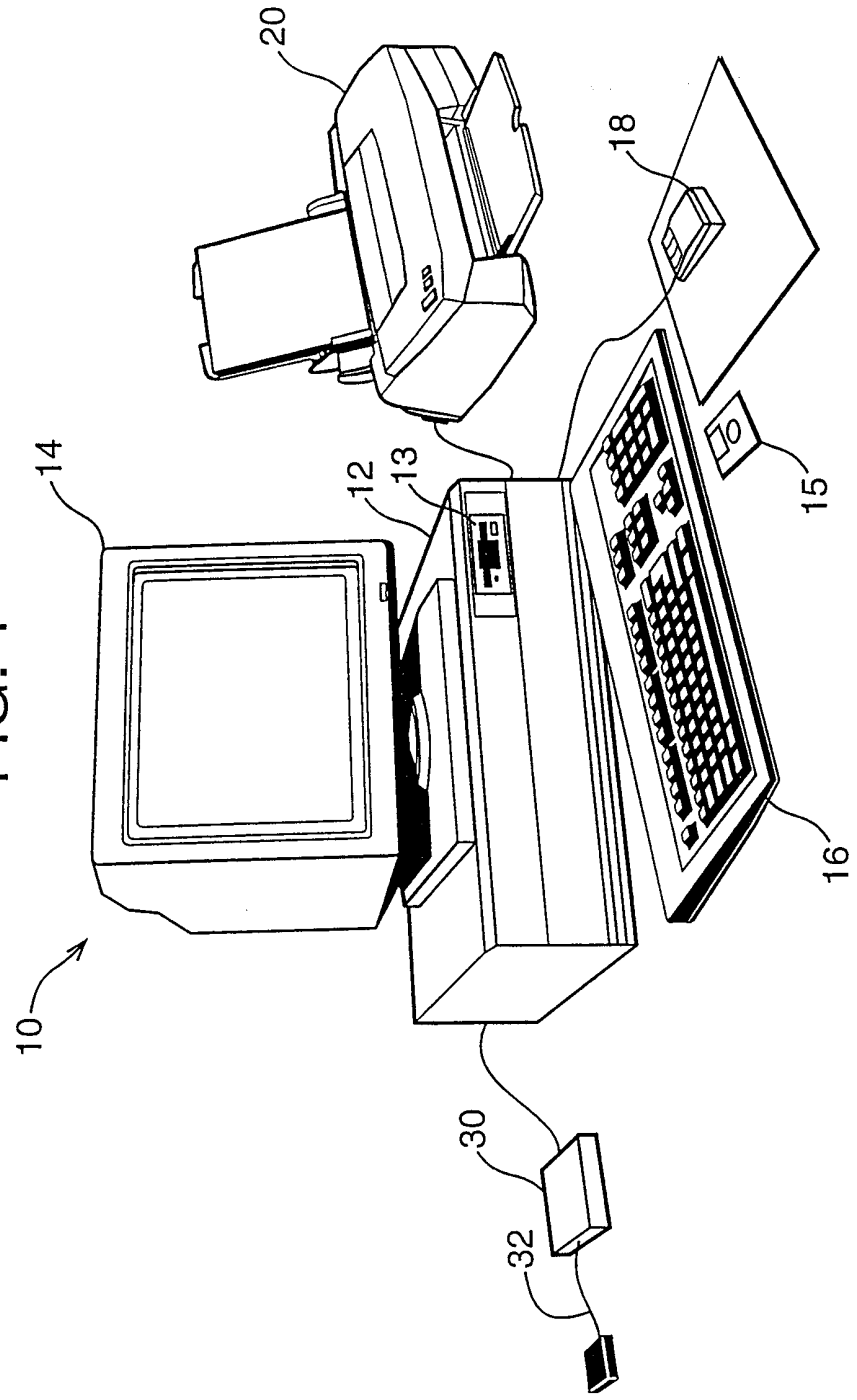
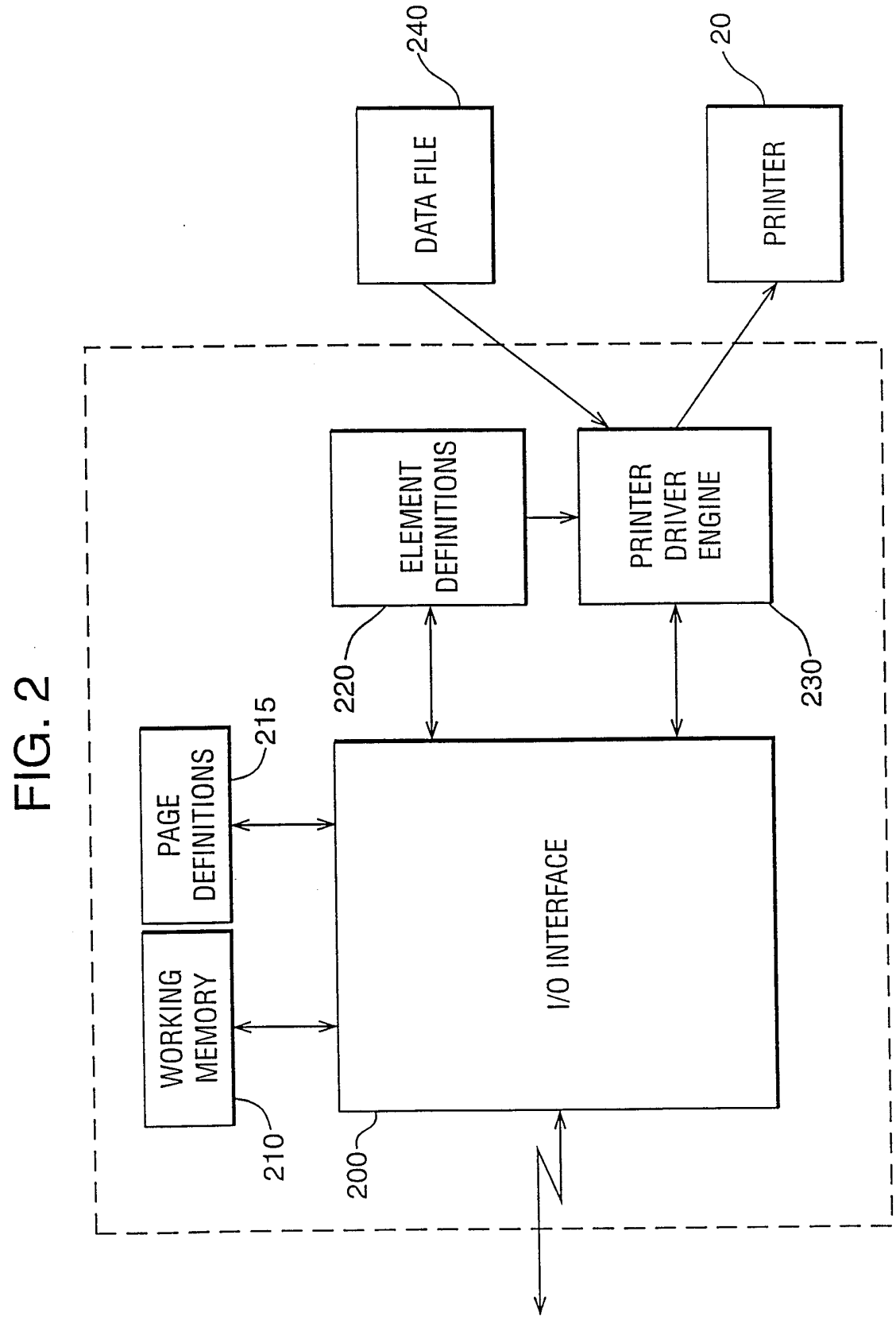


FIG. 2


240
DATA FILE
20
PRINTER
ELEMENT DEFINITIONS
PRINTER DRIVER ENGINE
220
230
215
PAGE DEFINITIONS
WORKING MEMORY
I/O INTERFACE
210
200

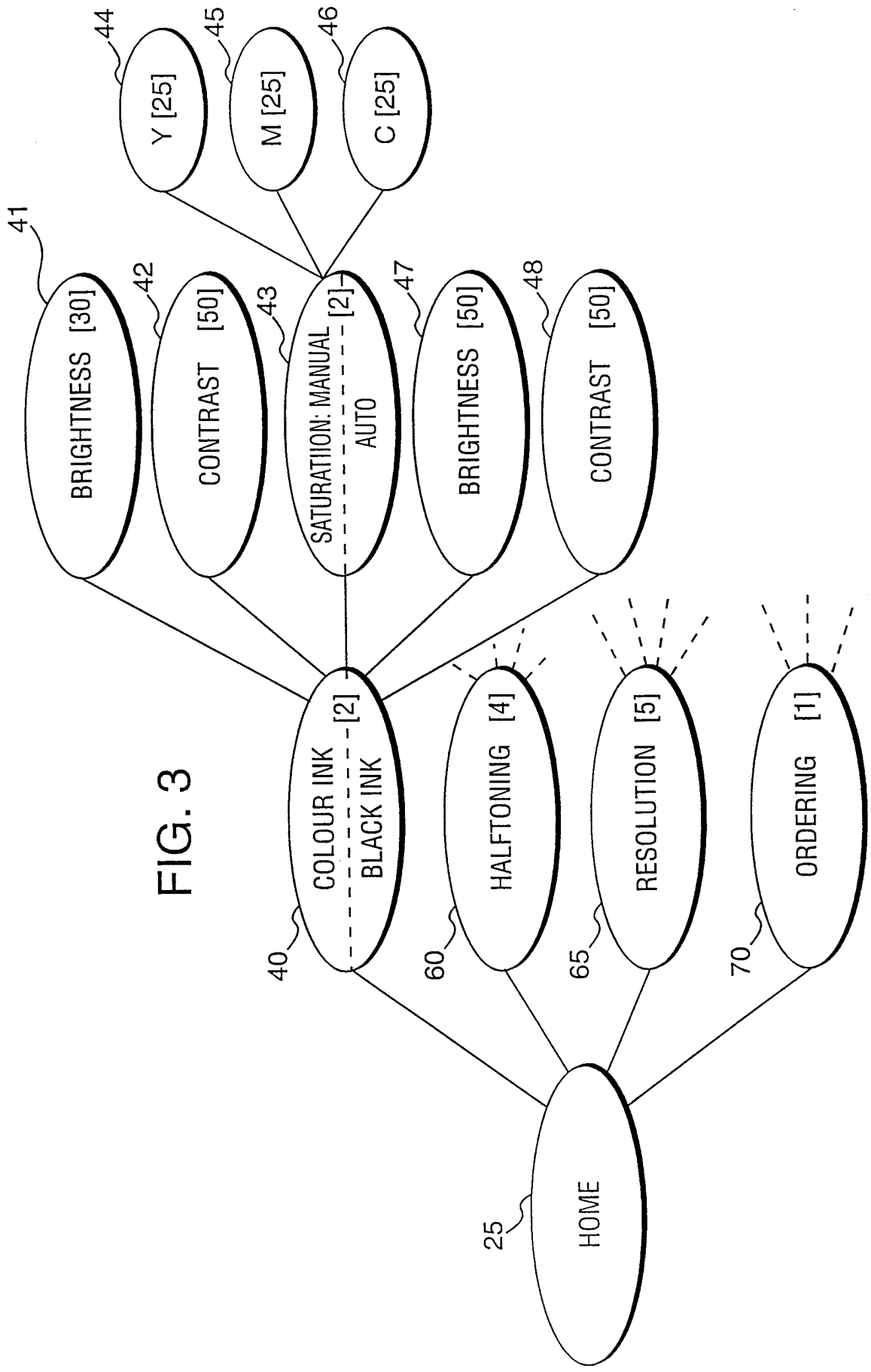

HOME
25
COLOUR INK
BLACK INK
[2]
40
HALFTONING [4]
60
RESOLUTION [5]
65
ORDERING [1]
70
BRIGHTNESS [30]
41
CONTRAST [50]
42
SATURATIION: MANUAL
AUTO
[2]
43
BRIGHTNESS [50]
47
CONTRAST [50]
48
Y [25]
44
M [25]
45
C [25]
46

FIG. 3

FIG. 4

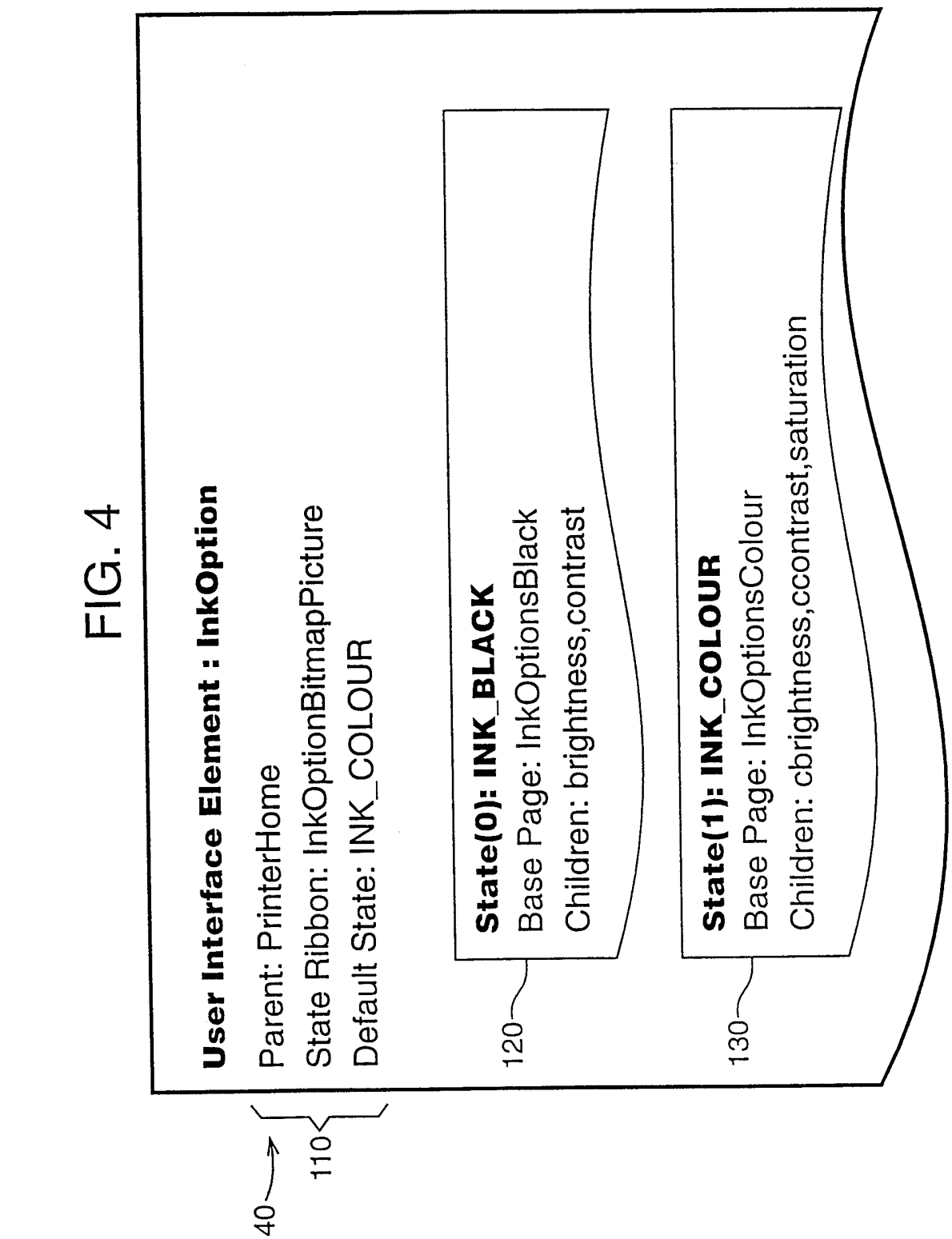

User Interface Element : InkOption
Parent: PrinterHome
State Ribbon: InkOptionBitmapPicture
Default State: INK_COLOUR
State(0): INK_BLACK
Base Page: InkOptionsBlack
Children: brightness,contrast
State(1): INK_COLOUR
Base Page: InkOptionsColour
Children: cbrightness,ccontrast,saturation
40
110
120
130

FIG. 5

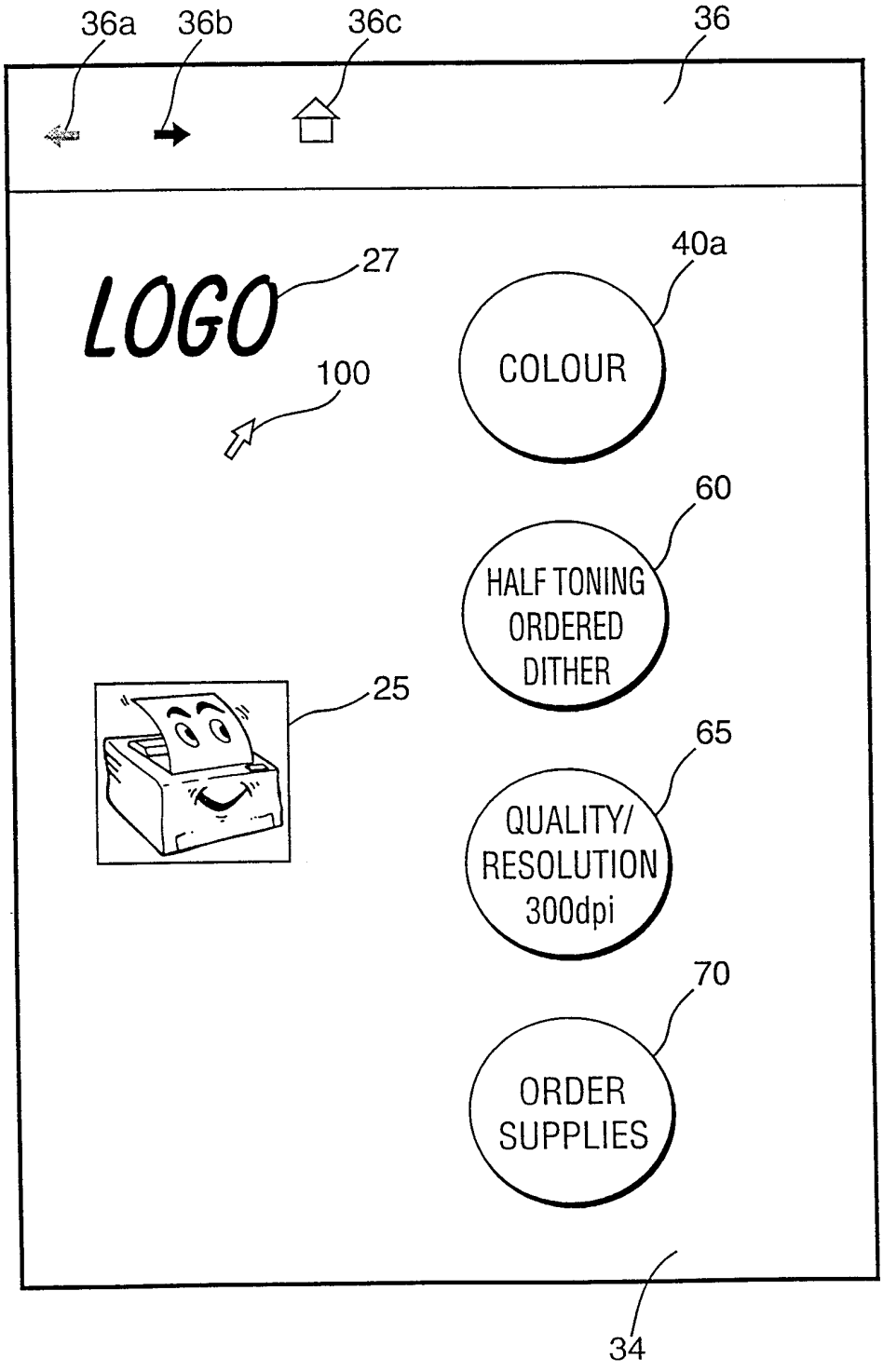

36a
36b
36c
36
LOGO
27
100
40a
COLOUR
60
HALF TONING
ORDERED
DITHER
25
65
QUALITY/
RESOLUTION
300dpi
70
ORDER
SUPPLIES
34

FIG. 6

Page : Homepage

Element=CompanyLogo, 5,5, STATIC
Element=PrinterHome, 10.85, STATIC
Element=InkOption, 55,10, ACTIVE
Element=HalfToneOption, 55,60, ACTIVE
Element=ResOptions, 55,110, ACTIVE
Element=OrderSupplies, 55,160, ACTIVE

FIG. 7

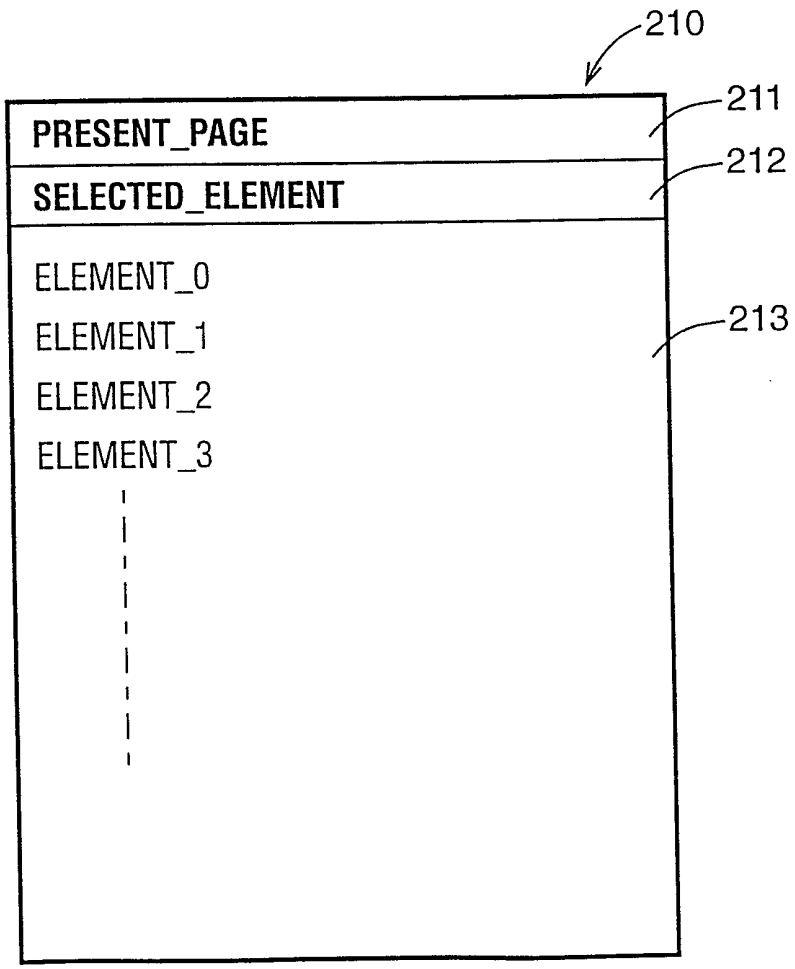


FIG. 8

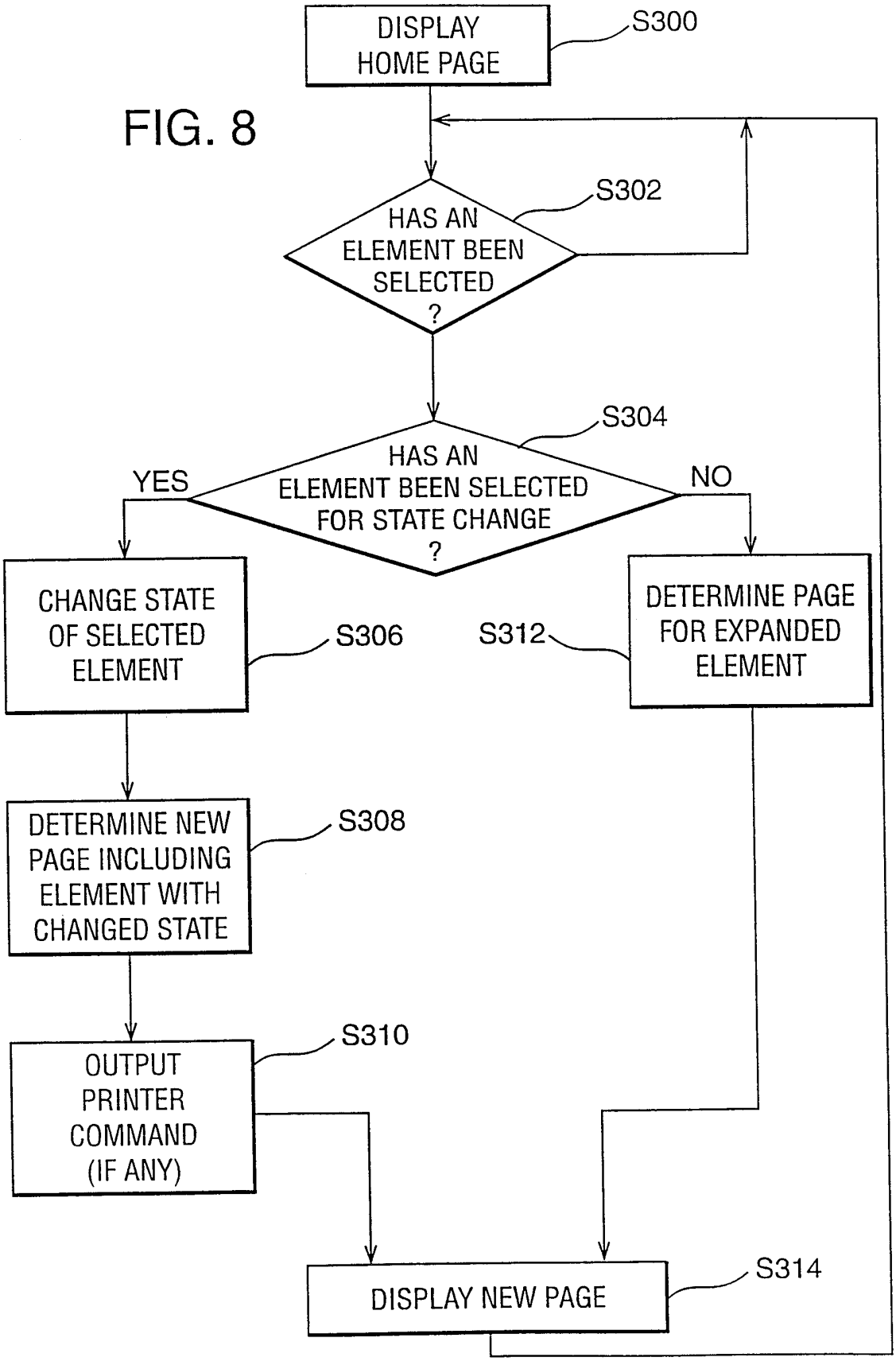

DISPLAY HOME PAGE
S300
HAS AN ELEMENT BEEN SELECTED ?
S302
HAS AN ELEMENT BEEN SELECTED FOR STATE CHANGE ?
S304
YES
NO
CHANGE STATE OF SELECTED ELEMENT
S306
DETERMINE NEW PAGE INCLUDING ELEMENT WITH CHANGED STATE
S308
OUTPUT PRINTER COMMAND (IF ANY)
S310
DETERMINE PAGE FOR EXPANDED ELEMENT
S312
DISPLAY NEW PAGE
S314

FIG. 9

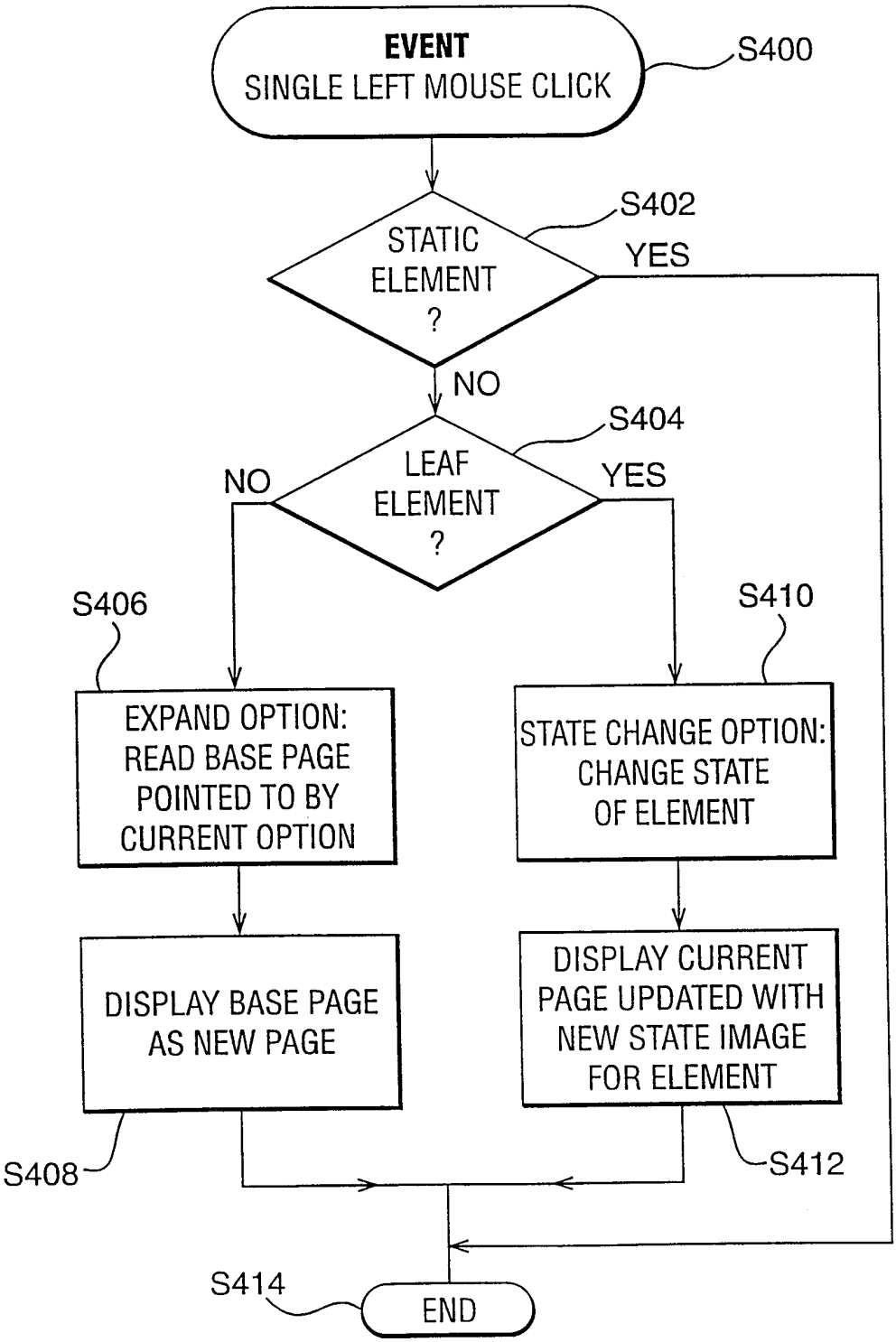

EVENT
SINGLE LEFT MOUSE CLICK
S400
STATIC ELEMENT ?
S402
YES
NO
LEAF ELEMENT ?
S404
NO
YES
S406
EXPAND OPTION: READ BASE PAGE POINTED TO BY CURRENT OPTION
S410
STATE CHANGE OPTION: CHANGE STATE OF ELEMENT
DISPLAY BASE PAGE AS NEW PAGE
DISPLAY CURRENT PAGE UPDATED WITH NEW STATE IMAGE FOR ELEMENT
S408
S412
S414
END

FIG. 10

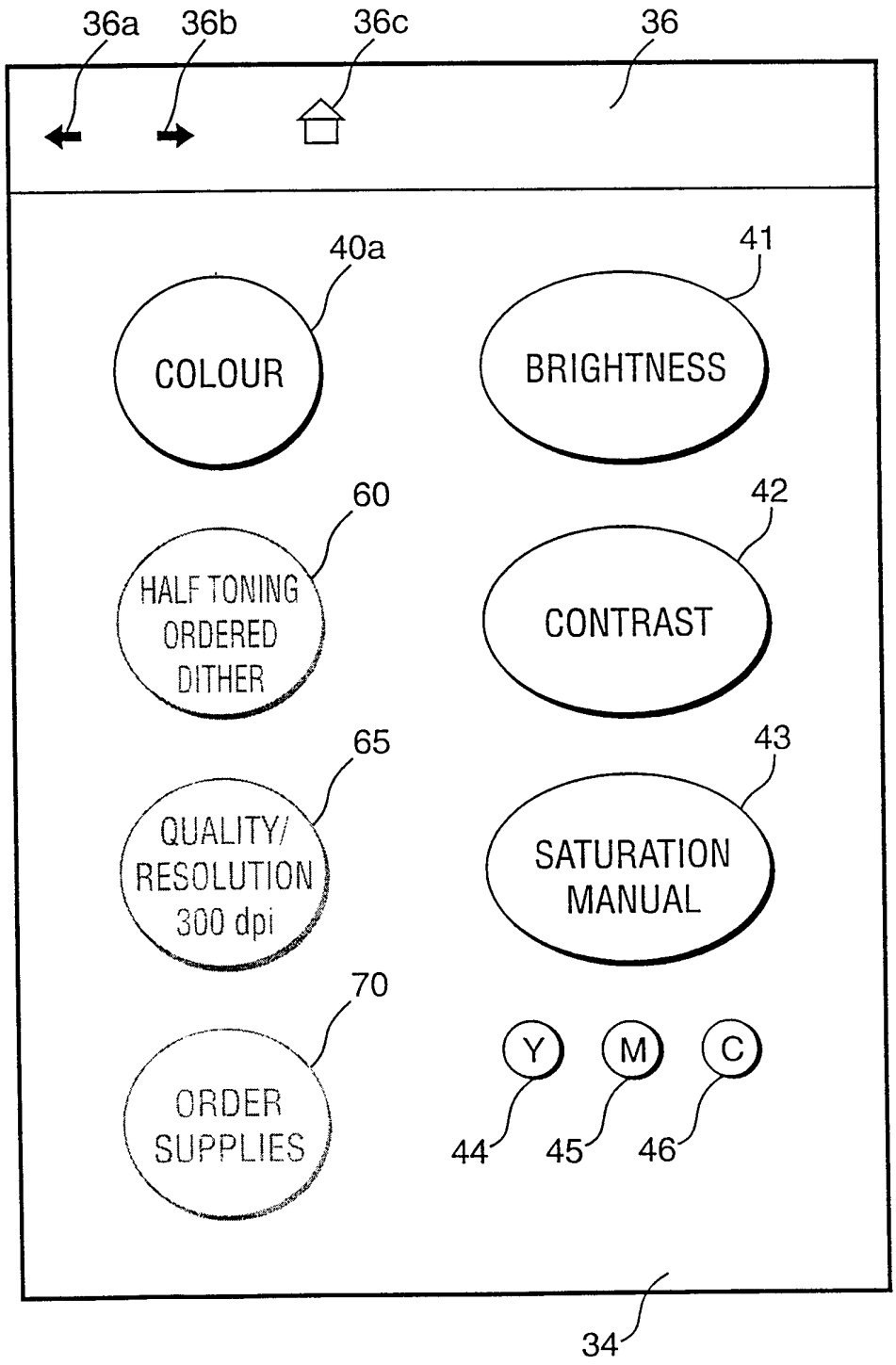

36a
36b
36c
36
40a
COLOUR
41
BRIGHTNESS
60
HALF TONING
ORDERED
DITHER
42
CONTRAST
65
QUALITY/
RESOLUTION
300 dpi
43
SATURATION
MANUAL
70
ORDER
SUPPLIES
Y
M
C
44
45
46
34

FIG. 11

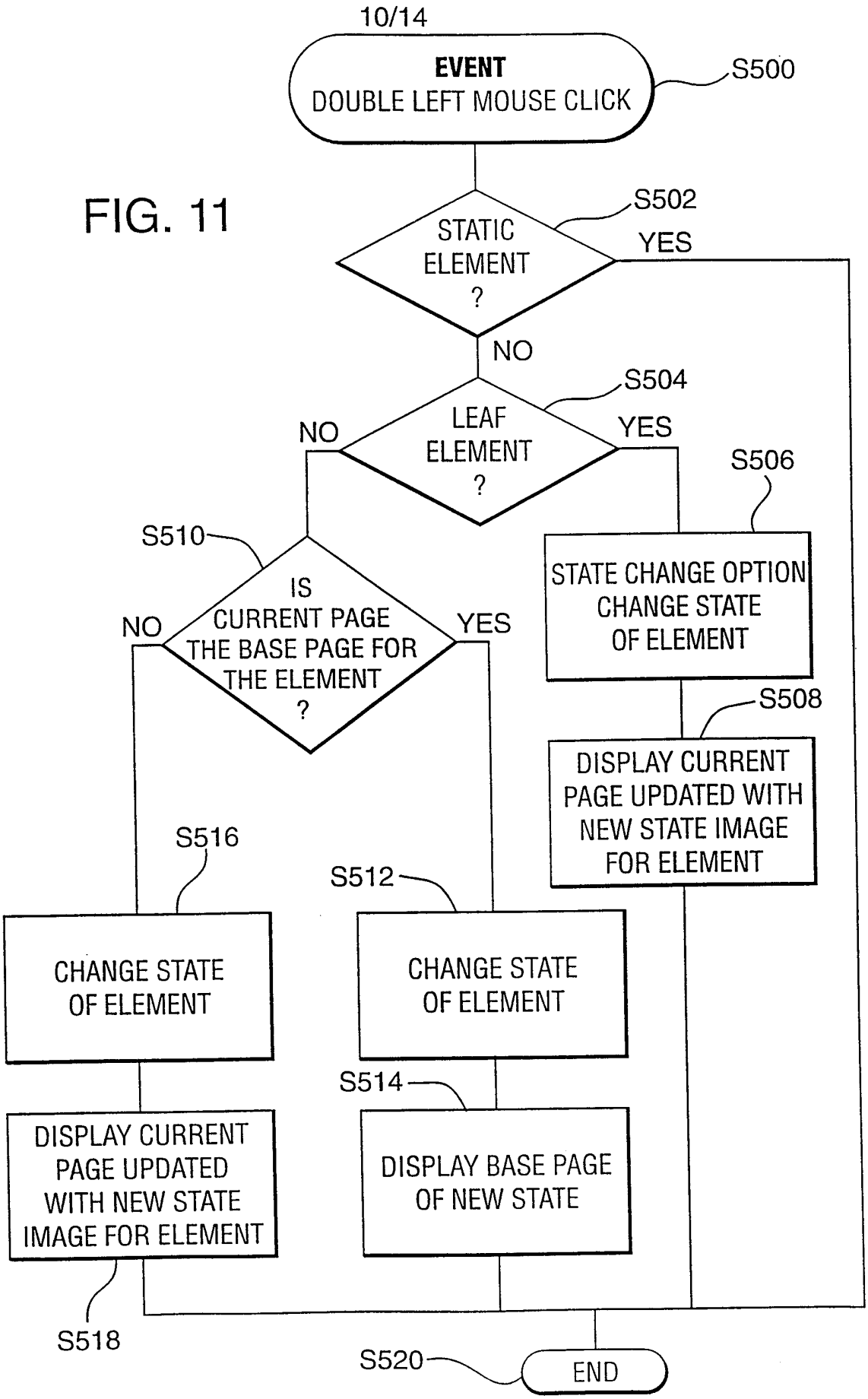

EVENT
DOUBLE LEFT MOUSE CLICK
S500
STATIC ELEMENT ?
S502
YES
NO
LEAF ELEMENT ?
S504
NO
YES
S506
STATE CHANGE OPTION CHANGE STATE OF ELEMENT
S508
DISPLAY CURRENT PAGE UPDATED WITH NEW STATE IMAGE FOR ELEMENT
S510
IS CURRENT PAGE THE BASE PAGE FOR THE ELEMENT ?
NO
YES
S516
CHANGE STATE OF ELEMENT
S512
CHANGE STATE OF ELEMENT
S514
DISPLAY CURRENT PAGE UPDATED WITH NEW STATE IMAGE FOR ELEMENT
DISPLAY BASE PAGE OF NEW STATE
S518
S520
END

FIG. 12

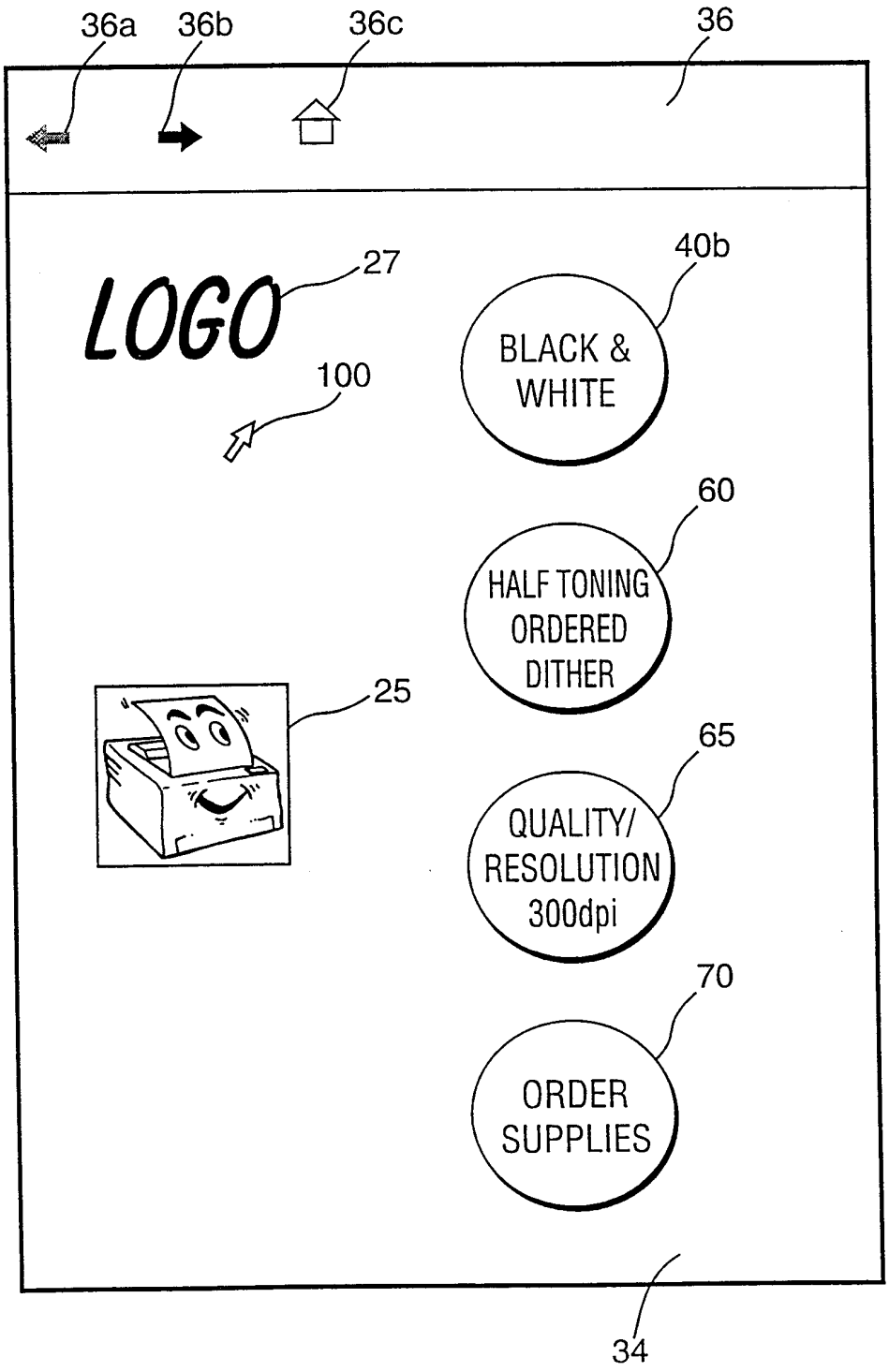

36a
36b
36c
36
LOGO
27
100
40b
BLACK & WHITE
60
HALF TONING ORDERED DITHER
25
65
QUALITY/ RESOLUTION 300dpi
70
ORDER SUPPLIES
34

FIG. 13

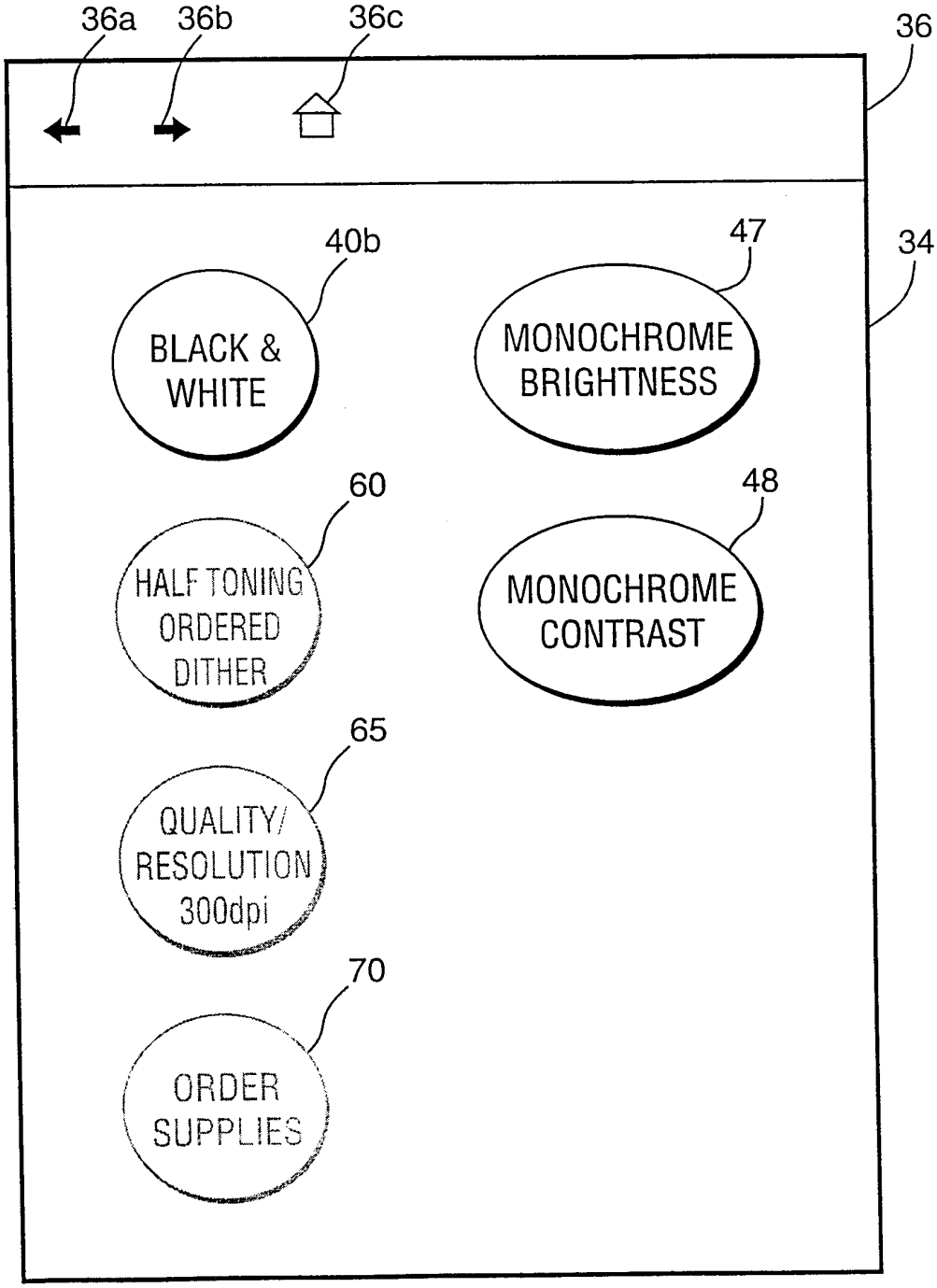

36a
36b
36c
36
34
40b
BLACK & WHITE
47
MONOCHROME BRIGHTNESS
60
HALF TONING ORDERED DITHER
48
MONOCHROME CONTRAST
65
QUALITY/ RESOLUTION 300dpi
70
ORDER SUPPLIES

FIG. 14A

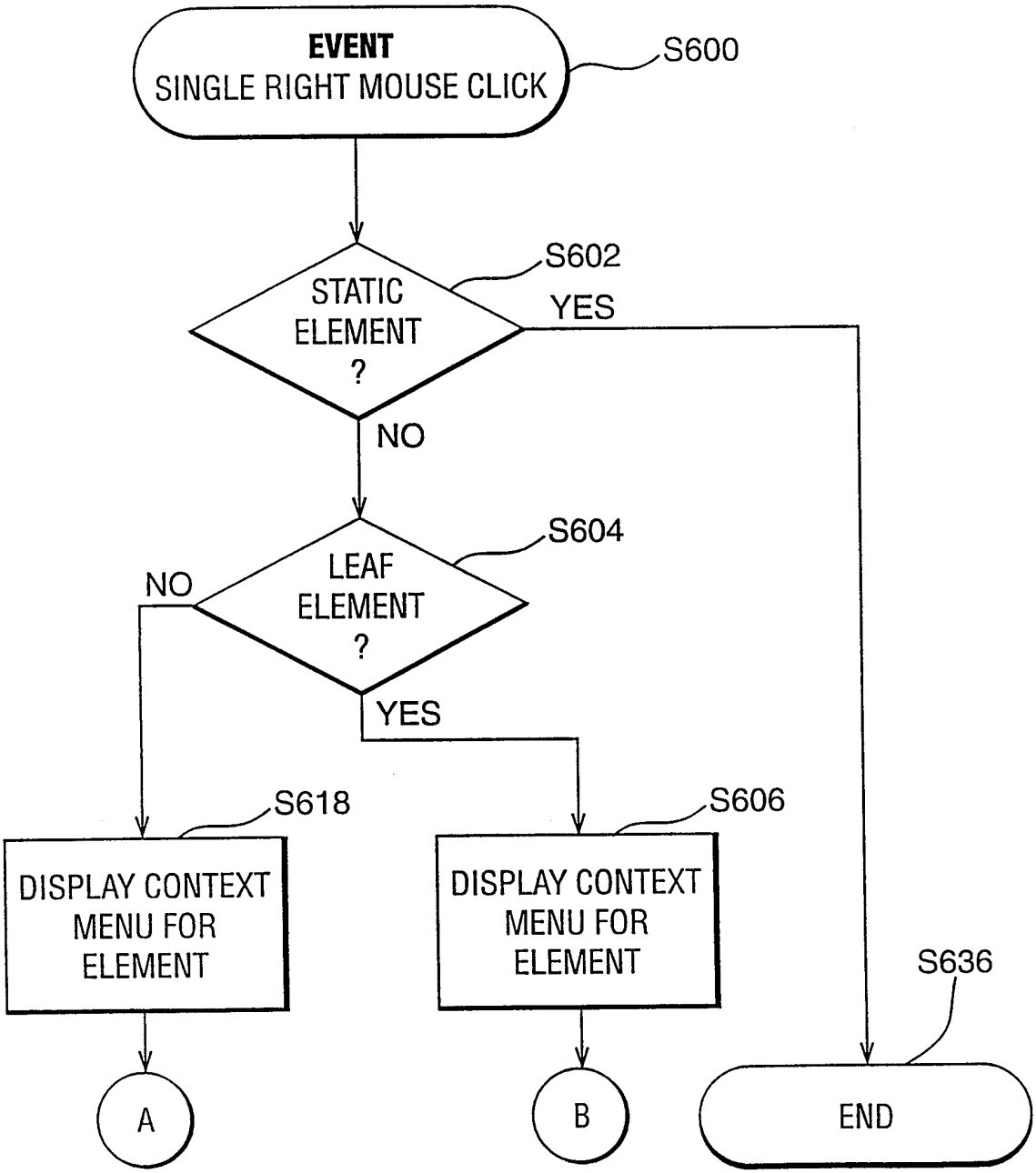
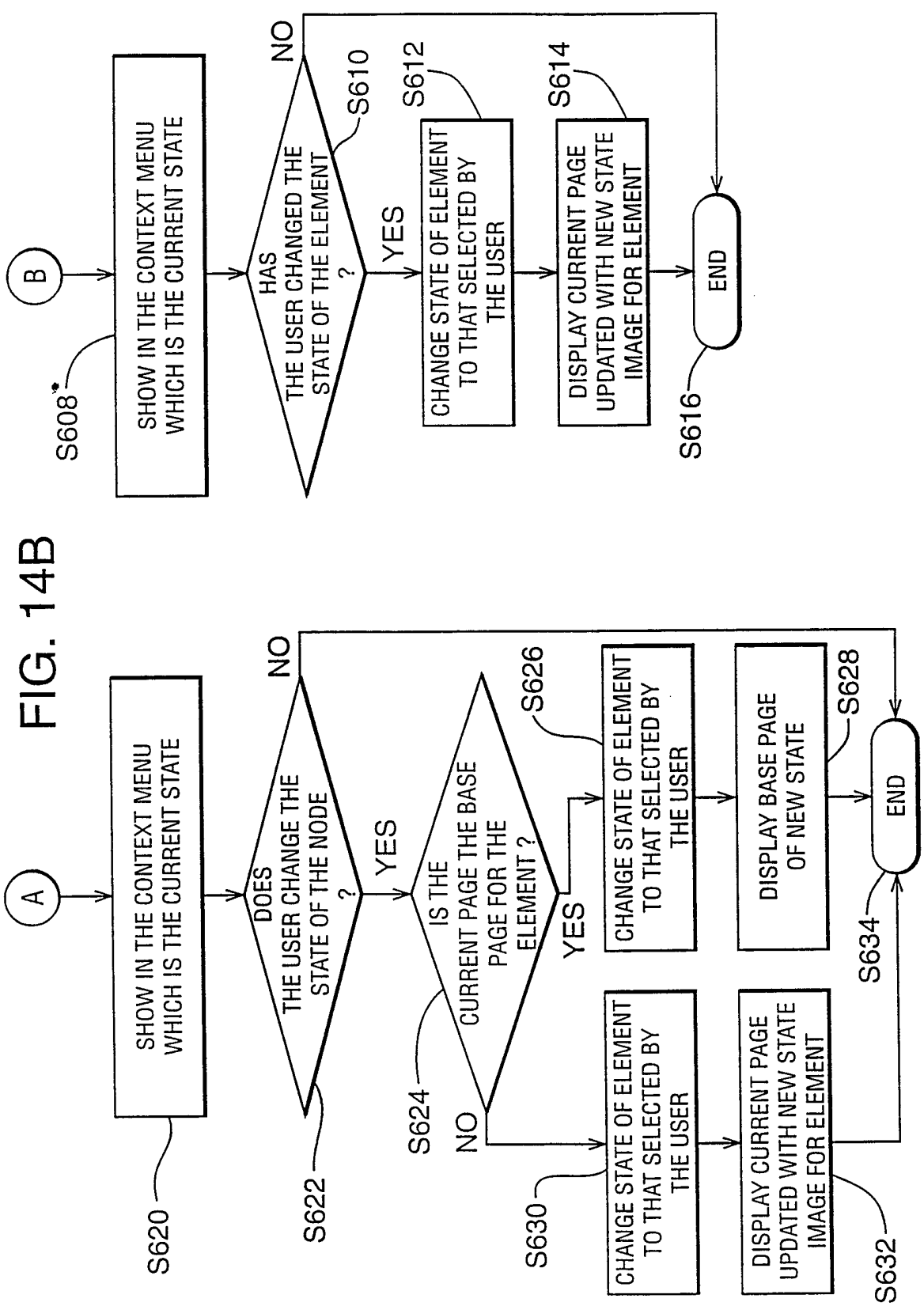

EVENT
SINGLE RIGHT MOUSE CLICK
S600
STATIC ELEMENT ?
S602
YES
NO
LEAF ELEMENT ?
S604
NO
YES
DISPLAY CONTEXT MENU FOR ELEMENT
S618
DISPLAY CONTEXT MENU FOR ELEMENT
S606
S636
A
B
END

FIG. 14B


A
B
S608
SHOW IN THE CONTEXT MENU WHICH IS THE CURRENT STATE
HAS THE USER CHANGED THE STATE OF THE ELEMENT ?
S610
NO
YES
S612
CHANGE STATE OF ELEMENT TO THAT SELECTED BY THE USER
S614
DISPLAY CURRENT PAGE UPDATED WITH NEW STATE IMAGE FOR ELEMENT
S616
END
S620
SHOW IN THE CONTEXT MENU WHICH IS THE CURRENT STATE
DOES THE USER CHANGE THE STATE OF THE NODE ?
S622
NO
YES
IS THE CURRENT PAGE THE BASE PAGE FOR THE ELEMENT ?
S624
NO
YES
S626
CHANGE STATE OF ELEMENT TO THAT SELECTED BY THE USER
S628
DISPLAY BASE PAGE OF NEW STATE
S630
CHANGE STATE OF ELEMENT TO THAT SELECTED BY THE USER
S632
DISPLAY CURRENT PAGE UPDATED WITH NEW STATE IMAGE FOR ELEMENT
S634
END

INTERNATIONAL SEARCH REPORT

Inte ɔnal Application No
PCT/GB 99/03119

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F3/12

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F G03G

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 305 199 A (LOBIONDO MARTIN F ET AL) 19 April 1994 (1994-04-19) figures 1-7 column 2, line 11 -column 5, line 27 ---	1-4, 7-26, 28-44
A	GB 2 301 980 A (RICOH KK) 18 December 1996 (1996-12-18) figures 1,6,9,10 page 7, line 5 -page 10, line 2 page 16, line 11 -page 17, line 2 page 19, line 8 -page 22, line 2 page 24, line 26 -page 27, line 34 --- -/--	1,17,26, 27,32

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 January 2000	25/01/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Weiss, P

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INTERNATIONAL SEARCH REPORT

Inte. onal Application No
PCT/GB 99/03119

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 414 494 A (CHAPURAN RONALD F ET AL) 9 May 1995 (1995-05-09) figures 2,4-9,12 column 4, line 27 - line 50 column 6, line 10 -column 10, line 18	1-17, 19-26, 28-31, 33-36, 38-44

1

INTERNATIONAL SEARCH REPORT

information on patent family members

Inter onal Application No
PCT/GB 99/03119

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		GB 2305818 A,B	16-04-1997
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		GB 2305820 A,B	16-04-1997
		JP 8331267 A	13-12-1996
US 5414494 A	09-05-1995	JP 7195805 A	01-08-1995