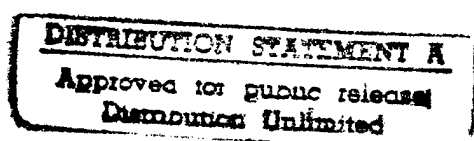


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Ray Malone

NOTICE

The above identified patent application is available for licensing. Requests for information should be addressed to:

OFFICE OF NAVAL RESEARCH  
DEPARTMENT OF THE NAVY  
CODE OCCC3  
ARLINGTON VA 22217-5660



19960823 111

1 Navy Case No. 75809

2  
3 DIGITAL DATA RETRIEVING, ORGANIZING AND DISPLAY SYSTEM

4  
5 STATEMENT OF GOVERNMENT INTEREST

6 The invention described herein may be manufactured by or for  
7 the Government of the United States of America for Governmental  
8 purposes without the payment of any royalties thereon or  
9 therefor.

10  
11 BACKGROUND OF THE INVENTION

12 (1) Field of the Invention

13 The invention relates generally to the field of digital data  
14 processing system and more particularly to systems for  
15 accumulating information from a number of disparate sources and  
16 organizing it for easy viewing.

17 (2) Description of the Prior Art

18 Digital computer systems have been used for a number of  
19 years to store and process data. A problem arises, however, when  
20 the data which is to be processed is from a number of disparate  
21 sources, particularly when the data is directed to the design,  
22 development and testing of a complex system in which a number of  
23 companies may be involved.

DTIC QUALITY INSPECTED 2

1 SUMMARY OF THE INVENTION

2 It is therefore an object of the invention to provide a new  
3 and improved system for quickly and easily accumulating status  
4 and other information concerning the design and development of a  
5 complex system from a number of disparate sources, for viewing in  
6 an organized manner.

7 Briefly, the invention provides a digital data retrieving,  
8 organizing and display system for retrieving information from a  
9 number of disparate sources relating to development of a complex  
10 system and organizing and displaying on cards the information as  
11 selected by an operator. The digital data retrieving, organizing  
12 and display system comprises a data map, a plurality of card  
13 display means, and a control means. The data map defines types  
14 of available information relating to the development of a complex  
15 system, the data map including at least one external card links.  
16 Each of the plurality of card display means facilitates the  
17 display of a card having a selected type of information relating  
18 to the development of a complex system. The control means is  
19 responsive to operator input indicia for controlling the data map  
20 display means and the card display means to enable the display of  
21 a card having a selected type of information as selected by the  
22 operator. The information to be displayed can be obtained from a  
23 number of disparate sources, and the system further includes data  
24 acquisition means and update means for obtaining information from  
25 the disparate sources to be used by the card display means.

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BRIEF DESCRIPTION OF THE DRAWINGS

This invention is pointed out with particularity in the appended claims. The above and further advantages of this invention may be better understood by referring to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 depicts an illustrative computer system, constructed in accordance with the invention, including an arrangement retrieving and organizing digital data from a large variety of disparate sources and for displaying the data to an operator;

FIG. 2 depicts a functional block diagram of a digital data retrieving, organizing and display system constructed in accordance with the invention;

FIGS. 3 and 4 depict flow diagrams useful in understanding the operations of the data acquisition element and data update element depicted in FIG. 2;

FIGS. 5 through 7 depict the organization of several HyperCard cards useful in understanding the operations of the data selection and display element depicted in FIG. 2.

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DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 depicts an illustrative computer system 10 including a data acquisition, organization and display system 20 (FIG. 2) constructed in accordance with the invention. As will be described in detail in connection with FIGS. 2 through 7, the data acquisition, organization and display system 20 retrieves

1 and organizes digital data from a large variety of disparate  
2 sources and selectively displays the data to an operator. With  
3 reference to FIG. 1, the computer system 10 in one embodiment  
4 includes a processor module 11 and operator interface elements  
5 comprising operator input components such as a keyboard 12A  
6 and/or a mouse 12B (generally identified as operator input  
7 element(s) 12) and an operator output element such as a video  
8 display device 13. The illustrative computer system 10 is of the  
9 conventional stored-program computer architecture. The processor  
10 module 11 includes, for example, a processor, memory and mass  
11 storage devices such as disk and/or tape storage elements (not  
12 separately shown) which perform processing and storage operations  
13 in connection with digital data provided thereto. The operator  
14 input element(s) 12 are provided to permit an operator to input  
15 information for processing. The video display device 13 is  
16 provided to display output information generated by the processor  
17 module 11 on a screen 14 to the operator, including data that the  
18 operator may input for processing, information that the operator  
19 may input to control processing, as well as information generated  
20 during processing. The processor module 11 generates information  
21 for display by the video display device 13 using a so-called  
22 "graphical user interface" ("GUI"), in which information for  
23 various applications programs is displayed using various  
24 "windows." Although the computer system 10 is shown as  
25 comprising particular components, such as the keyboard 12A and  
26 mouse 12B for receiving input information from an operator, and a

1 video display device 13 for displaying output information to the  
2 operator, it will be appreciated that the computer system 10 may  
3 include a variety of components in addition to or instead of  
4 those depicted in FIG. 1.

5 In addition, the processor module 11 includes one or more  
6 network interfaces , generally identified by reference numeral  
7 14, which are connected to communication links which connect the  
8 computer system 10 in a computer network. The network interface  
9 14 enables the computer system 10 to transmit information to, and  
10 receive information from, other computer systems in the network,  
11 allowing them to share information from databases and other  
12 computer files. In addition, if devices such as data acquisition  
13 devices (such as sensors), printers and facsimile transmission  
14 and receiving devices, digital audio or video storage and  
15 distribution devices, and the like, are connected in the network,  
16 they may be used by the various computer systems which are  
17 connected in the network; for such devices, the computer systems  
18 will transmit information to the various devices enabling them  
19 to, for example, print documents in hard-copy form or transmit  
20 facsimiles of the documents over the public telephony system,  
21 receive document facsimiles, transmit and receive digital audio  
22 and video information and the like. The communication links  
23 connecting the computer system to other elements of the network

1 may, as is conventional, comprise any convenient information-  
2 carrying medium, including wires, optical fibers or other media  
3 for carrying signals among the computer systems.

4 The invention provides a system, including the computer  
5 system 10, for retrieving and organizing digital data from a  
6 large variety of disparate sources and for displaying the data on  
7 the computer's video display device 13. The invention will be  
8 described in the context of a system for retrieving, organizing  
9 and displaying data that is related to development and  
10 construction of a complex system including a number of components  
11 which are under control of a computer; in that context, the  
12 inventive system provides information as to the status of  
13 development, construction and functional testing of the various  
14 hardware components of the complex system as well as of the  
15 status of the development of the hardware and software which will  
16 be used to control the system components. The system is aware of  
17 the particular source files for the status information, and can  
18 automatically update its information on request from an operator.  
19 In one embodiment, the system displays information in a "card"  
20 format, and is implemented using conventional HyperCard  
21 technology which is readily available. The operations of the  
22 system in retrieving and organizing information will be described  
23 in connection with FIGS. 2 through 7.

24 FIG. 2 depicts a functional block diagram of the data  
25 acquisition, organization and display system 20 constructed in  
26 accordance with the invention. With reference to FIG. 2, the

1 system 20 includes a data acquisition element 21, a data update  
2 element 22, a data selection and display element 23 and a report  
3 generator 24. The data selection and display element 23, under  
4 control of an operator, enables the display of selected data by  
5 the computer system's video display device 13. The data  
6 selection and display element 23, using HyperCard format,  
7 displays the data as selected by the operator in one or more  
8 cards.

9 The data which may be displayed under control of the data  
10 selection and display element 23 is, in turn, provided by the  
11 data acquisition element 21 and the data update element 22. The  
12 data acquisition element 21 periodically, or at particular times  
13 as selected by the operator, retrieves particular types of data  
14 from one or more input data files 25(A) through 25(F) (generally  
15 identified by reference numeral 25(F)) and provides the retrieved  
16 data to the data update element 22. The data update element 22,  
17 in turn, loads the update data in the HyperCard files used by the  
18 data selection and display element 23. The data selection and  
19 display element 23, as noted above, allows the operator to select  
20 and display selected data in card format. The report generator  
21 24 is provided to enable an operator to print hard-copy reports  
22 using the HyperCard data.

23 The operations performed by the data acquisition element 21  
24 in acquiring data for update and by the data update element 22 in  
25 performing the data update will be described with reference to  
26 FIGS. 3 and 4, respectively. With reference initially to FIG. 3,



1 the data acquisition element 21 will go through an initialization  
2 step (step 31) and will prompt an operator to provide the  
3 identification of a data input file 25(F) which is to be used to  
4 provide update data (step 32). Accordingly, when the operator  
5 enables a data input file 25(F) itself to be updated, the  
6 operator may prompt the data acquisition element to update the  
7 information used by the data acquisition, organization and  
8 display system 20. The data acquisition element 21 may prompt  
9 the operator to provide the data input identification through a  
10 conventional dialog box which it displays on the video display  
11 device 13.

12 If the data acquisition element 21 receives the  
13 identification of a data input file in step 32, it will sequence  
14 to step 33 to retrieve the required update data from the  
15 identified file and provide it in a file for the data update  
16 element 22. The data acquisition element 21 retrieves the update  
17 data element-by-data element (step 33) and, after retrieving each  
18 update data element, will determine whether it has reached the  
19 end of the selected data input file 25(F) (step 34). If the data  
20 acquisition element 21 determines in step 34 that it has not  
21 reached the end of the selected data input file 25(F), it will  
22 return to step 33 to continue sequencing through the selected  
23 data input file 25(F). The data acquisition element 21 will  
24 perform steps 33 and 34 through a number of iterations,  
25 sequencing through the selected data input file 25(F) to retrieve

1 the data therein that is used by the data selection and display  
2 element 23.

3 At some point, the data acquisition element 21 will  
4 determine in step 34 that it has reached the end of the selected  
5 data input file 22. At that point, it will sequence to step 35  
6 to provide update verification indicia, such as a date, in the  
7 file for the data update element 22, which the data update  
8 element 22 can use to verify that the file contains current  
9 update data. Thereafter, the data acquisition element 21 will  
10 terminate operations (step 36).

11 Returning to step 32, if the operator in that step fails to  
12 select a data input file 25(F) within a selected time period, or  
13 if the data input file whose identification was provided by the  
14 operator does not exist, it may sequence directly to step 36 to  
15 terminate operations.

16 The operations performed by the data update element 22 will  
17 be described in connection with FIG. 4. As noted above, the data  
18 update element 22 receives the update data as retrieved by the  
19 data acquisition element 21 from the data input files, and  
20 actually performing the data update in connection with the files  
21 used by the data selection and display element 23. With  
22 reference to FIG. 4, after receiving the update data file  
23 generated by the data acquisition element 21 as described above  
24 in connection with FIG. 3, the data update element 22 will first  
25 check the update verification data in the update data file (step  
26 41). As described above in connection with FIG. 3, the data

1 acquisition element 22 generates the update verification data in  
2 step 35 to enable the data update element 22 to verify that the  
3 update data file contains update data that needs to be inserted  
4 in the files used by the data selection and display element 23.

5 After checking the update verification data, the data update  
6 element 22 will determine whether the update verification data  
7 indicates that the update data file contains valid update data,  
8 that is, that it contains update data that needs to be inserted  
9 in the files used by the data selection and display element 23  
10 (step 42). In response to a positive determination in step 42,  
11 the data update element will store the data from the data update  
12 file in the data files used by the data selection and display  
13 element 23 (step 43), and thereafter will terminate.

14 Returning to step 42, if the data update element 22 makes a  
15 negative determination in that step, it will sequence to an error  
16 trap (step 45). In processing the error trap, the data update  
17 element 22 may, for example, enable an appropriate notice to be  
18 displayed to the operator, who may perform predetermined error  
19 recovery operations. After processing the error trap (step 45),  
20 the data update element 22 will terminate.

21 It will be appreciated that the detailed operations  
22 performed by the data acquisition element 21 and the data update  
23 element 22 in retrieving data from the data input files 25(F) and  
24 in updating the files used by the data selection and display  
25 element 23, will depend on the particular formats of the data  
26 input files 25(F) and data selection and display element's files.

1 In one embodiment, the data input files 25(F) are in textual  
2 form, in which various types of data are delimited by selected  
3 delimiting characters, and the data acquisition element 21 may  
4 use conventional text searching techniques in step 33 to search  
5 through the data input files 25(F) to obtain the necessary  
6 information. As noted above, the data selection and display  
7 element 23 in one embodiment uses HyperCard technology to select  
8 and display data. Accordingly, the data selection and display  
9 element's files will be in a conventional HyperCard format, and  
10 the data update element 22 can update the files (in step 43) in a  
11 conventional manner.

12 The data selection and display element 23, as noted above,  
13 allows the operator to select selected data and display it as a  
14 HyperCard cards on the video display device 13. The structure  
15 and operation of the data selection and display element 23 will  
16 be described in connection with FIGS. 5 through 7. FIG. 5  
17 depicts a "selection" card 50 which the data selection and  
18 display element 23 enables the video display device to display  
19 when the data selection and display element 23 is initialized.  
20 The selection card 50 essentially provides a data map of the  
21 types of data that are available to the operator through the data  
22 selection and display element 23, and links to other HyperCard  
23 cards available in the data acquisition, organization and display  
24 system 20. By way of background, the data acquisition,  
25 organization and display system 20 in one embodiment, organizes  
26 the data in two hierarchies, identified as "views," namely a

1 functional view and a physical view, and the screen 50 depicted  
2 in FIG. 5 allows the operator to select one of the views for  
3 further use during a session by means of pushbuttons 51 and 52.

4 The data map depicted in the FIG. 5 includes a title 53 and  
5 the identification of the various types of data which are  
6 available in the functional view and the physical view. In  
7 particular, in one embodiment, if the functional view is  
8 selected, status and other information regarding such items as  
9 "Detailed Subsystem Integration Plan" (DSIP), "Prime Item  
10 Development Specification" (PIDS) and information relating  
11 thereto are available, as indicated in blocks 60-62 and 63-65.  
12 On the other hand, if the physical view is selected, status and  
13 other information concerning hardware and software configuration  
14 items are available, as indicated in blocks 70, 71-73 and 74-76,  
15 including a block diagram (represented by block 70).

16 Each of the pushbuttons 51 and 52 essentially provide  
17 HyperCard links to a DSIP Subsystem card stack (represented by  
18 blocks 60-62) and a PIDS Function card stack (represented by  
19 blocks 63-65), in the case of pushbutton 51, or the block diagram  
20 70 and the hardware configuration item cardstack (represented by  
21 blocks 71-73) and computer software configuration cardstack  
22 (represented by blocks 74-76) in the case of pushbutton 52. As is  
23 conventional, the operator may actuate a pushbutton by moving a  
24 pointer, controlled by the mouse 12B (FIG. 1) and clicking  
25 thereon with a mouse button (not separately shown).

1           With initial reference to the physical view, which is  
2 enabled by pushbutton 52, when the operator actuates the physical  
3 view pushbutton 52, the data selection and display element 23  
4 will initially display the block diagram card 70. The block  
5 diagram card 70 is a HyperCard card that provides the operator  
6 with a block diagram of the various functional blocks of the  
7 complex system whose status is being indicated by the data  
8 acquisition, organization and display system 20. An illustrative  
9 block diagram card 70 is depicted in FIG. 6. FIG. 6 shows the  
10 block diagram card as having a title 80, which identifies the  
11 particular complex system whose functional block diagram card is  
12 represented by the card, various blocks representing the various  
13 hardware configuration items ("HWCI") 73 and computer software  
14 configuration items ("CSCI") 74 comprising the complex system.  
15 For the illustrative complex system, as shown in FIG. 6 there are  
16 five blocks 81(A) through 81(E) (generally identified by  
17 reference numeral 81(h) representing five hardware configuration  
18 items in the complex system). One of the hardware configuration  
19 item blocks 81(E) is, for example, provided for a video display,  
20 as shown in FIG. 6. Other blocks 81(h) are provided for other  
21 elements in the complex system.

22           In addition, there are four blocks 82(A) through 82(D)  
23 (generally identified by reference numeral 82(s)) representing  
24 four software configuration items in the complex system. Each  
25 hardware configuration item which has associated computer  
26 software (including "firmware") will have associated therewith a

1 computer software configuration item block 82(s), as shown in  
2 FIG. 6. The various hardware configuration item blocks 81(h) may  
3 also have other indicia, represented by blocks 83(h), which may  
4 be helpful in understanding the operation of the hardware  
5 configuration item associated with the respective block 81(h).  
6 The functional block diagram card 70 may also include blocks,  
7 such as represented by array blocks 84 and an outboard  
8 electronics block 85, which represent elements external to the  
9 complex system represented by the data acquisition, organization  
10 and display system 20. The functional block diagram card 70  
11 further depicts lines interconnecting the hardware configuration  
12 item blocks 81(h), as well as any external elements, as required  
13 in the complex system.

14 The block diagram card 70 further includes a menu bar 86,  
15 which, inter alia, enables the operator to navigate among  
16 HyperCard cards in other portions of the physical view stack,  
17 represented by blocks 71-76 (FIG. 5). In particular, the menu  
18 bar 86 includes entries (not shown) that allow an operator to  
19 select a hardware configuration item or a computer software  
20 configuration item whose status information is to be displayed,  
21 which the operator can actuate in a conventional manner. In  
22 addition, since the block diagram card 70 is a HyperCard card,  
23 the operator can select a hardware configuration item or computer  
24 software configuration item whose status information is to be  
25 displayed by clicking on a hardware configuration item block  
26 81(h) or a computer software configuration item block 82(h).

1 When the operator selects an appropriate "computer software  
2 configuration item" entry in the menu bar 86, or clicks on a  
3 computer software configuration item block 82(h), the data  
4 selection and display element 23 displays a list of computer  
5 software configuration items, one of which the operator may  
6 select with the mouse 12B in a conventional manner. On the other  
7 hand, when the operator selects an appropriate "hardware  
8 configuration item" entry in the menu bar 86, or clicks on a  
9 hardware configuration item block 81(h) in the block diagram card  
10 70, the data selection and display element 23 will display a  
11 HyperCard card representing a HyperCard "cabinet" for hardware  
12 configuration item cards, which will be described in connection  
13 with FIG. 7.

14 The specific organization and contents of a computer  
15 software configuration item card will depend on the particular  
16 information to be displayed, and will not be specifically  
17 described herein. In one embodiment, a computer software  
18 configuration item card for a particular item will include such  
19 information as the PIDS and DISP which applies to the computer  
20 software configuration item, the size of the computer software  
21 configuration item, scheduling status (planned and actual) and so  
22 forth.

23 As noted above, when the operator selects an appropriate  
24 "hardware configuration item" entry in the menu bar 86, or clicks  
25 on a hardware configuration item block 81(h) in the block diagram  
26 card 70, the data selection and display element 23 will display a



1 HyperCard card representing a HyperCard "cabinet" for hardware  
2 configuration item cards. An illustrative HyperCard cabinet  
3 card, identified by reference numeral 90 is depicted in FIG. 7.  
4 (The cabinet card 90 corresponds to the cabinet block in the data  
5 map 50 depicted in FIG. 5.) With reference to FIG. 7, the  
6 cabinet card 90 includes a menu bar 91, which is similar to menu  
7 bar 86 (FIG. 6) used with the block diagram card 50. The cabinet  
8 card 90 also includes a cabinet graphic 92 that includes a number  
9 of drawer graphics generally identified by reference numeral 93,  
10 each of which is associated with a hardware configuration item in  
11 the complex system. Adjacent the cabinet graphic 92 is a  
12 plurality of blocks, which has the same organization as the  
13 drawer graphics 93 in the cabinet graphic 92, listing the  
14 particular elements of one of the hardware configuration items.  
15 The operator may select a block 94 associated with a desired  
16 hardware configuration item with the mouse 12B in a conventional  
17 manner. After selection, the data selection and display element  
18 23 will display a hardware configuration item card which, like  
19 the computer software configuration item card, will have a  
20 specific organization and contents which will depend on the  
21 particular information to be displayed. Accordingly, the  
22 specific organization and contents of a hardware configuration  
23 item card will not be specifically described herein. In one  
24 embodiment, a hardware configuration item card for a particular  
25 item will include such information as the computer software  
26 configuration items associated with the hardware configuration

1 item, certain hardware design information, scheduling information  
2 and so forth.

3         Returning to FIG. 5, as described above the operator can  
4 also select the "functional" view during a session by actuating  
5 the pushbutton 51. If the operator actuates the pushbutton 51,  
6 the data selection and display element 23 will display a series  
7 of cards through which the operator may select a DSIP (Detailed  
8 Subsystem Integration Plan) card or a PIDS (Prime Item  
9 Development Specification) card. After selection, the data  
10 selection and display element 23 will display a DSIP card or a  
11 PIDS card which, like the computer software configuration item  
12 card and hardware configuration item card as described above,  
13 will have a specific organization and contents which will depend  
14 on the particular information to be displayed. Accordingly, the  
15 specific organization and contents of these cards will not be  
16 specifically described herein. In one embodiment, both the DSIP  
17 and the PIDS cards will include such information as test  
18 summaries and specification revisions which may result from  
19 testing or changed requirements. The PIDS card also identifies  
20 various computer software configuration items which relate to a  
21 particular function, mode and sub-mode (represented by blocks 64  
22 and 65 in the data map 50 depicted in FIG. 5) to which the PIDS  
23 card is directed.

24         The invention provides a number of advantages. In  
25 particular, it provides an arrangement whereby an operator may,  
26 quickly and easily accumulate status and other information

1 concerning the design and development of a complex system from a  
2 number of disparate sources, and view the information in an  
3 organized manner.

4 While the invention has been described as using HyperCard  
5 technology, it will be appreciated by those skilled in the art  
6 that it may be implemented in connection with a number of diverse  
7 types of technologies.

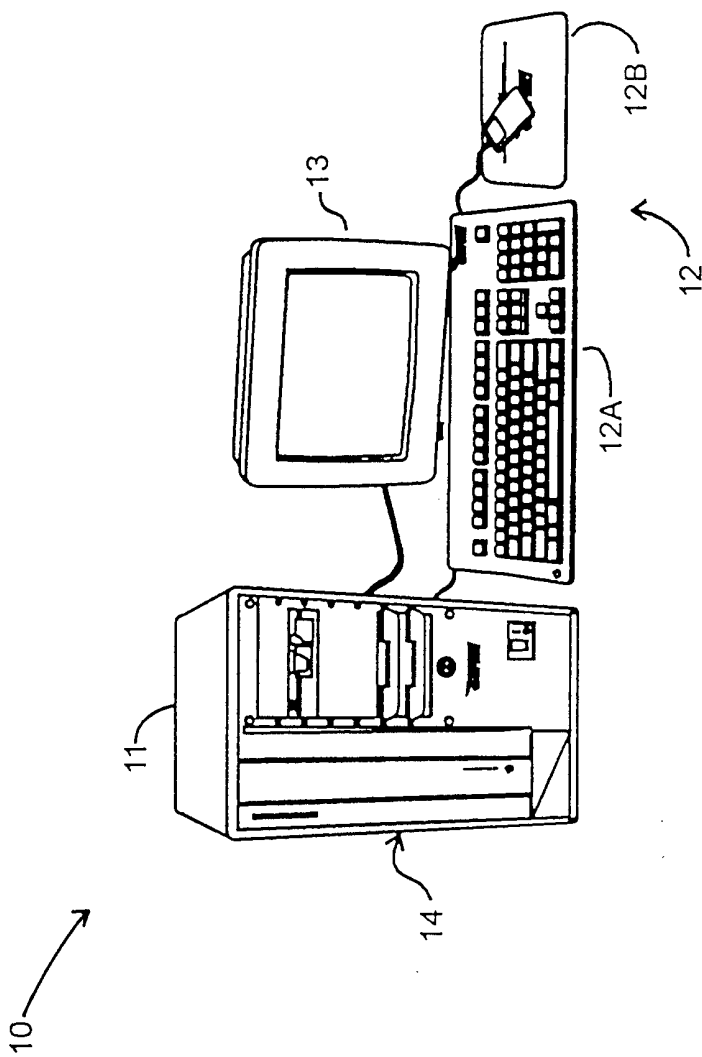
8 The preceding description has been limited to a specific  
9 embodiment of this invention. It will be apparent, however, that  
10 variations and modifications may be made to the invention, with  
11 the attainment of some or all of the advantages of the invention.

1 Navy Case No. 75809

2  
3 DIGITAL DATA RETRIEVING, ORGANIZING AND DISPLAY SYSTEM

4  
5 ABSTRACT OF THE DISCLOSURE

6 A digital data retrieving, organizing and display device for  
7 retrieving information from a number of disparate sources  
8 relating to development of a complex system and organizing and  
9 displaying on cards the information as selected by an operator.  
10 The device comprises a data map, a plurality of card display  
11 means, and a control means. The data map defines types of  
12 available information relating to the development of a complex  
13 system, and includes at least one external card link. Each card  
14 display element facilitates the display of a card having a  
15 selected type of information relating to the development of a  
16 complex system. The control means is responsive to operator  
17 input for controlling the data map display means and the card  
18 display element to enable the display of a card having a type of  
19 information as selected by the operator. The information that  
20 can be displayed can be obtained from a number of disparate  
21 sources, and the system further includes a data acquisition  
22 element and an update element for obtaining information from the  
23 disparate sources to be used by the card display element.



**FIG. 1**

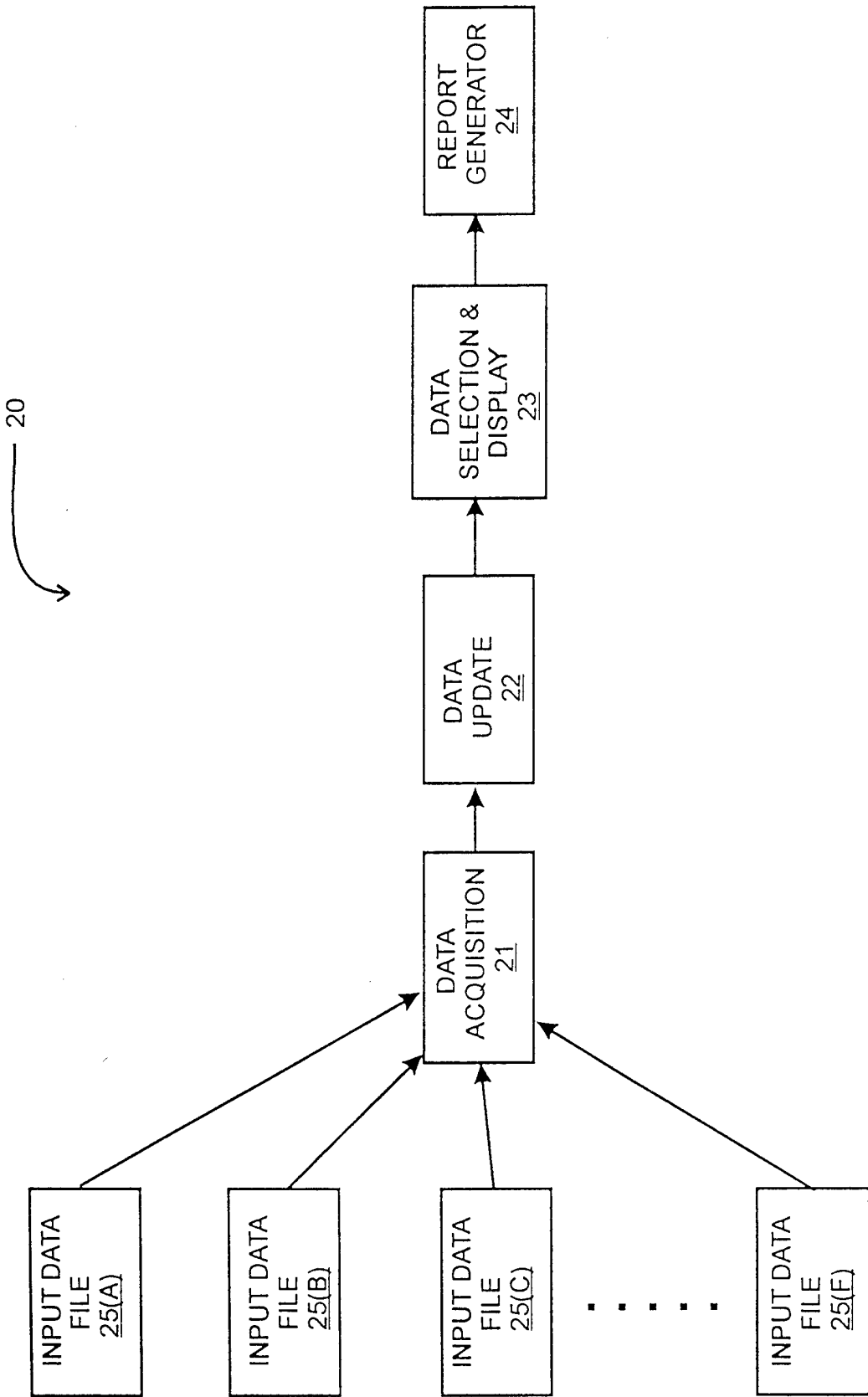


FIG. 2

FIG. 3

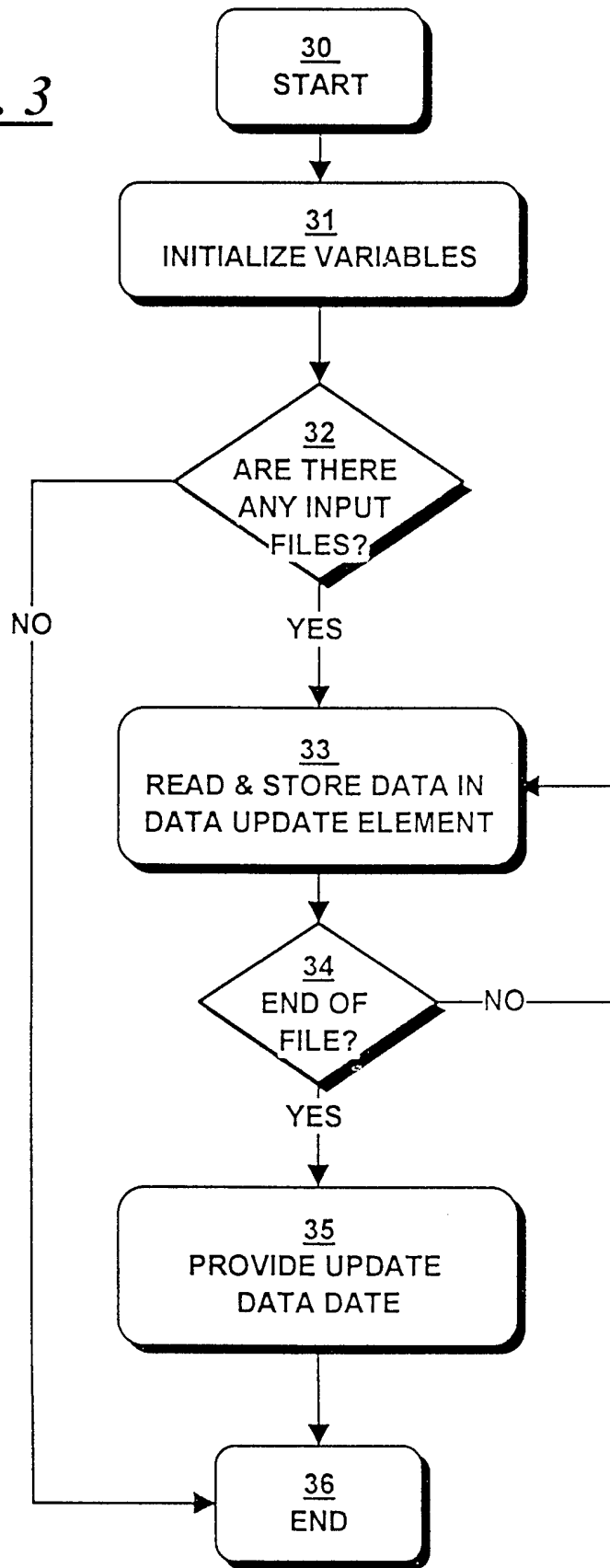
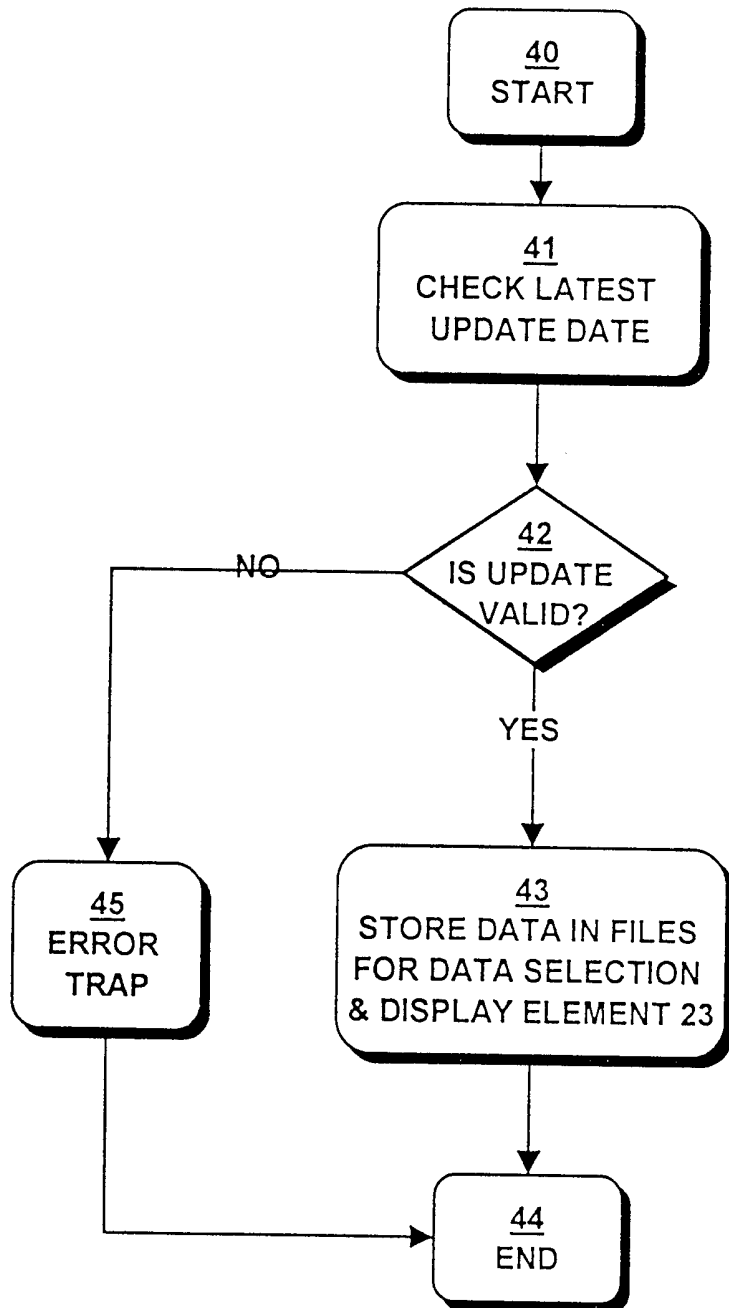
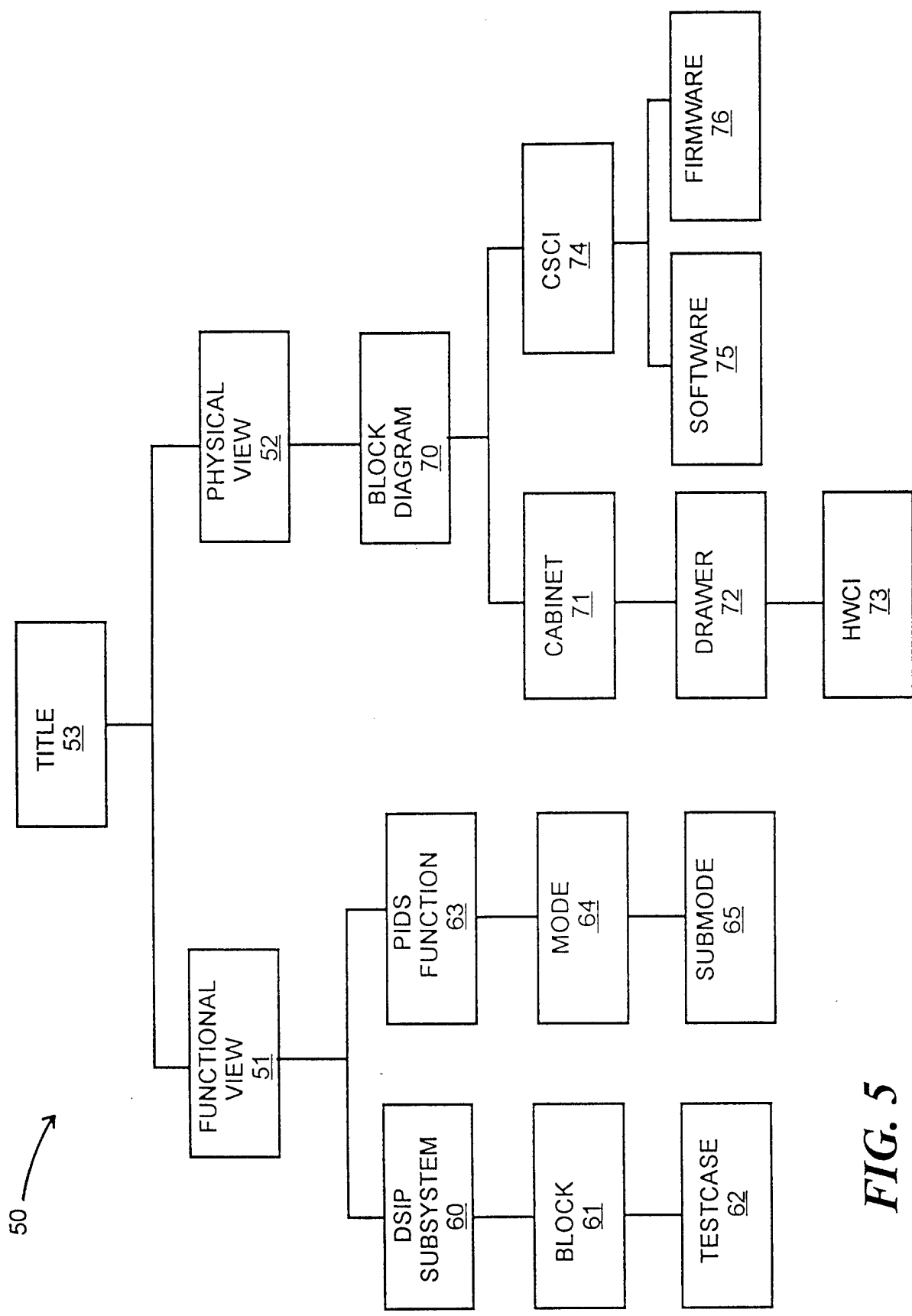


FIG. 4

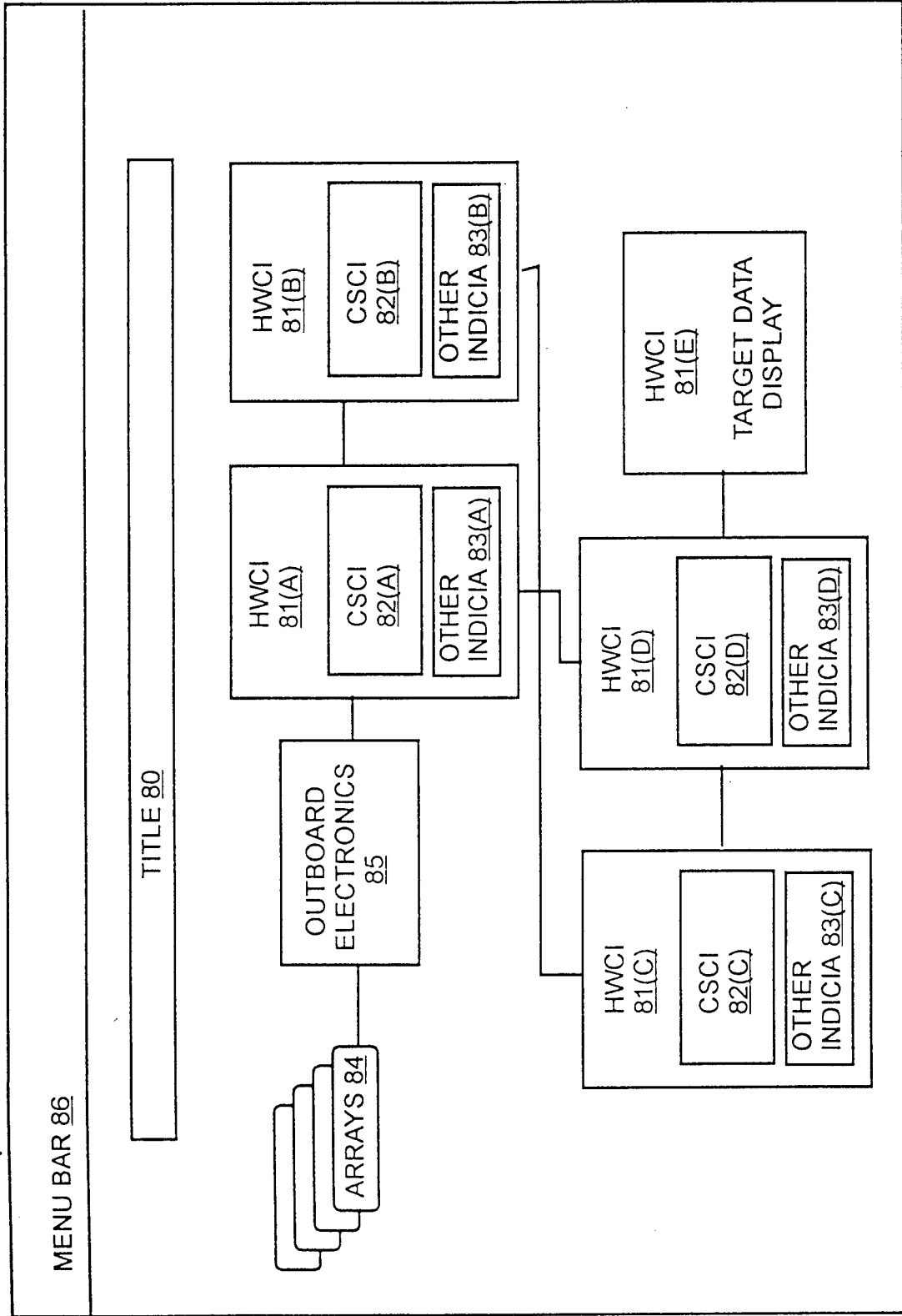






50 →

**FIG. 5**

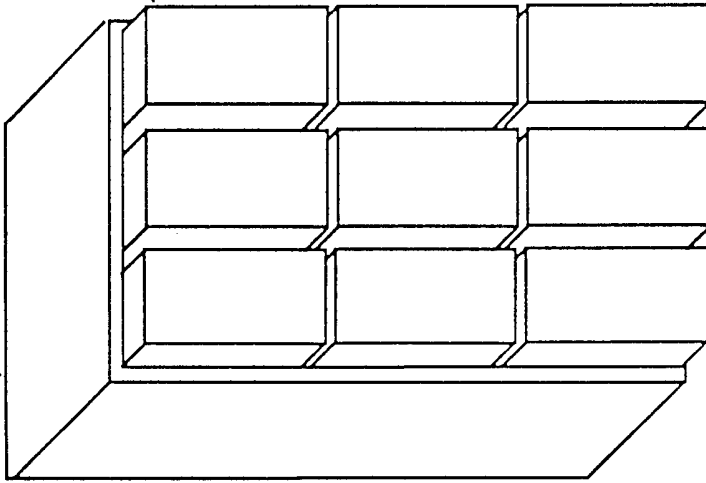


**FIG. 6**

90

MENU BAR 91

92



DRAWER  
CONTENTS  
IDENT  
94

DRAWER  
CONTENTS  
IDENT  
94

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**FIG. 7**