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(54) SYSTEM FOR MANAGING DATA OBJECTS

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(52) **U.S. Cl.** **345/838**

(57) **ABSTRACT**

A device for managing image and audio files displays thumbnails, which are representative of the files, on a screen in different arrangements, depending on the selected layout and order. When the user enters input to indicates that he or she wishes to browse through the thumbnails, the thumbnails move across the screen in sequence, following a path through a focus outline in the center of the screen. The path followed by the thumbnails depends on the selected layout.

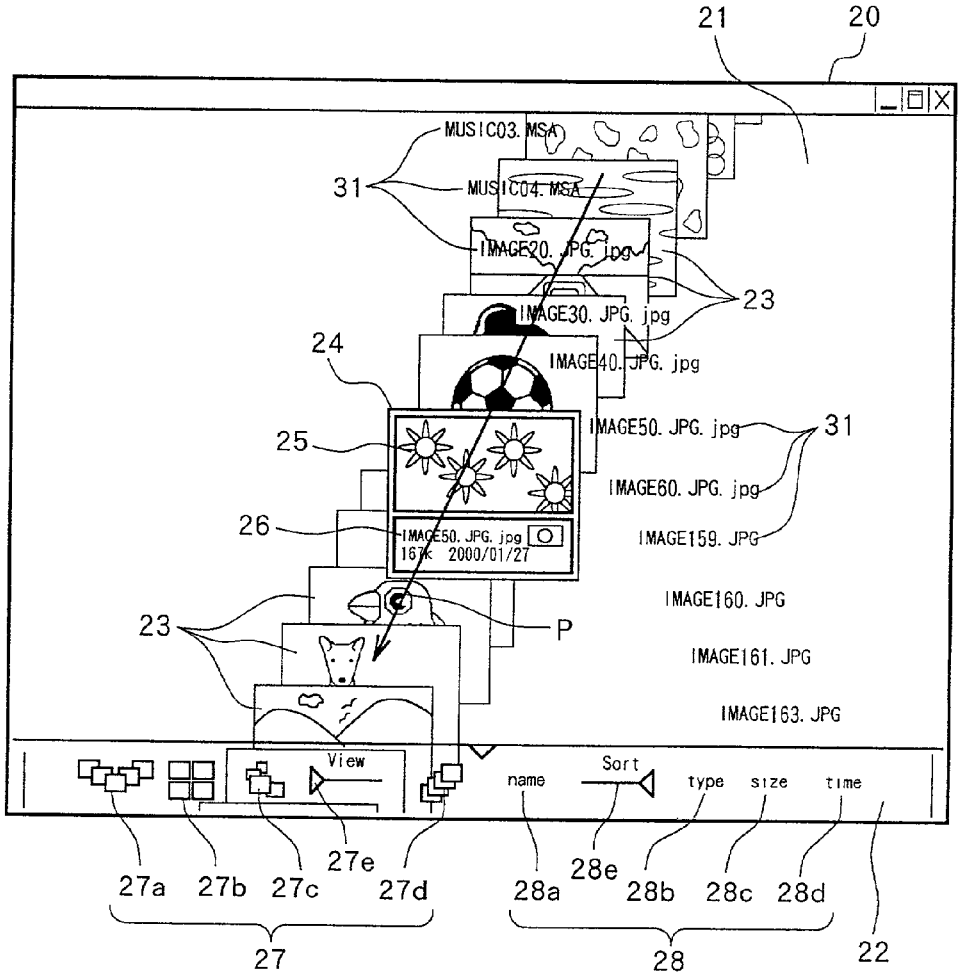


FIG. 1

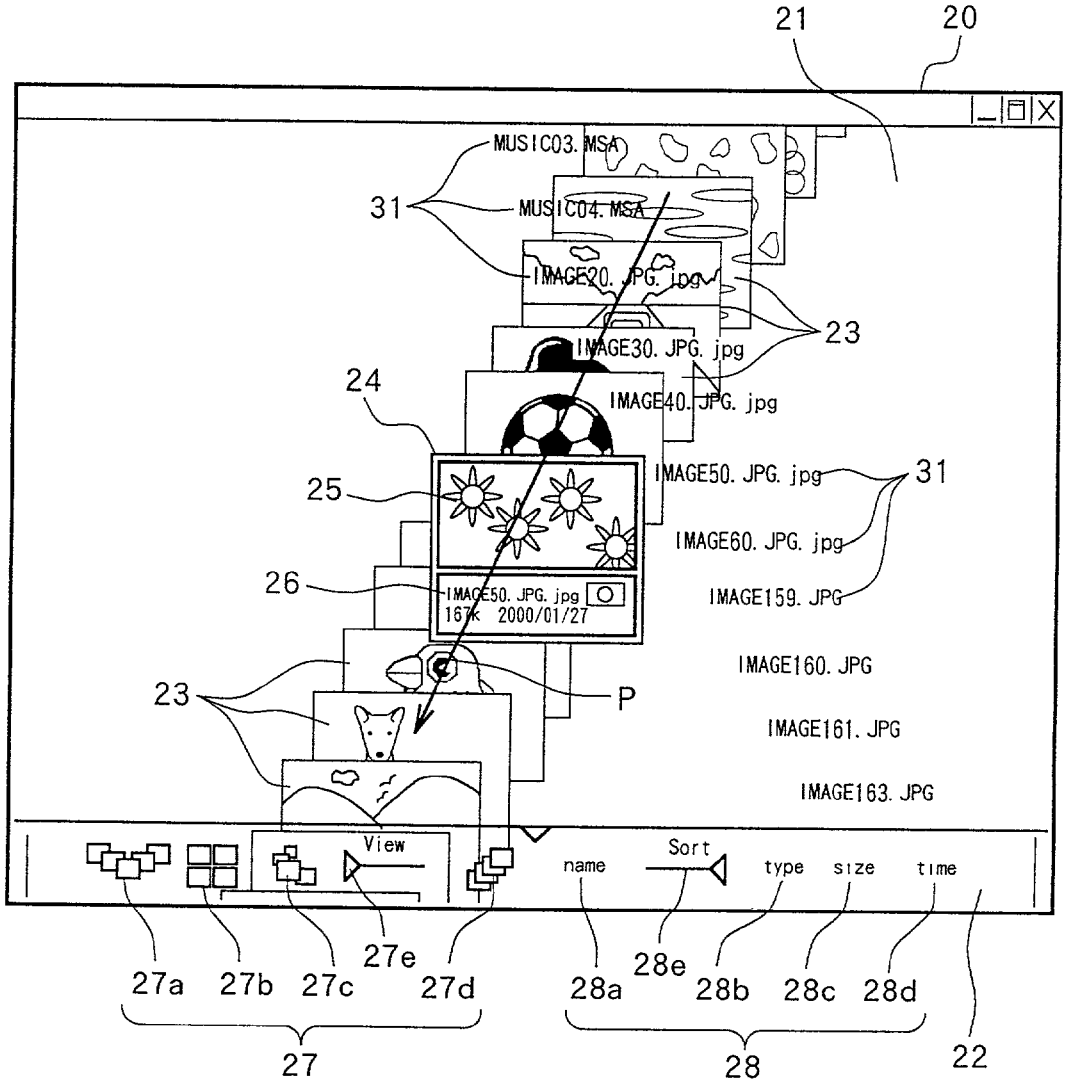

21
20
MUSIC03. MSA
31
MUSIC04. MSA
IMAGE20. JPG. jpg
23
IMAGE30. JPG. jpg
24
IMAGE40. JPG. jpg
IMAGE50. JPG. jpg
31
25
IMAGE60. JPG. jpg
26
IMAGE50. JPG. jpg
167k 2000/01/27
IMAGE159. JPG
IMAGE160. JPG
23
P
IMAGE161. JPG
IMAGE163. JPG
View
Sort
name
type
size
time
27a
27b
27c
27e
27d
28a
28e
28b
28c
28d
27
28
22

FIG. 2

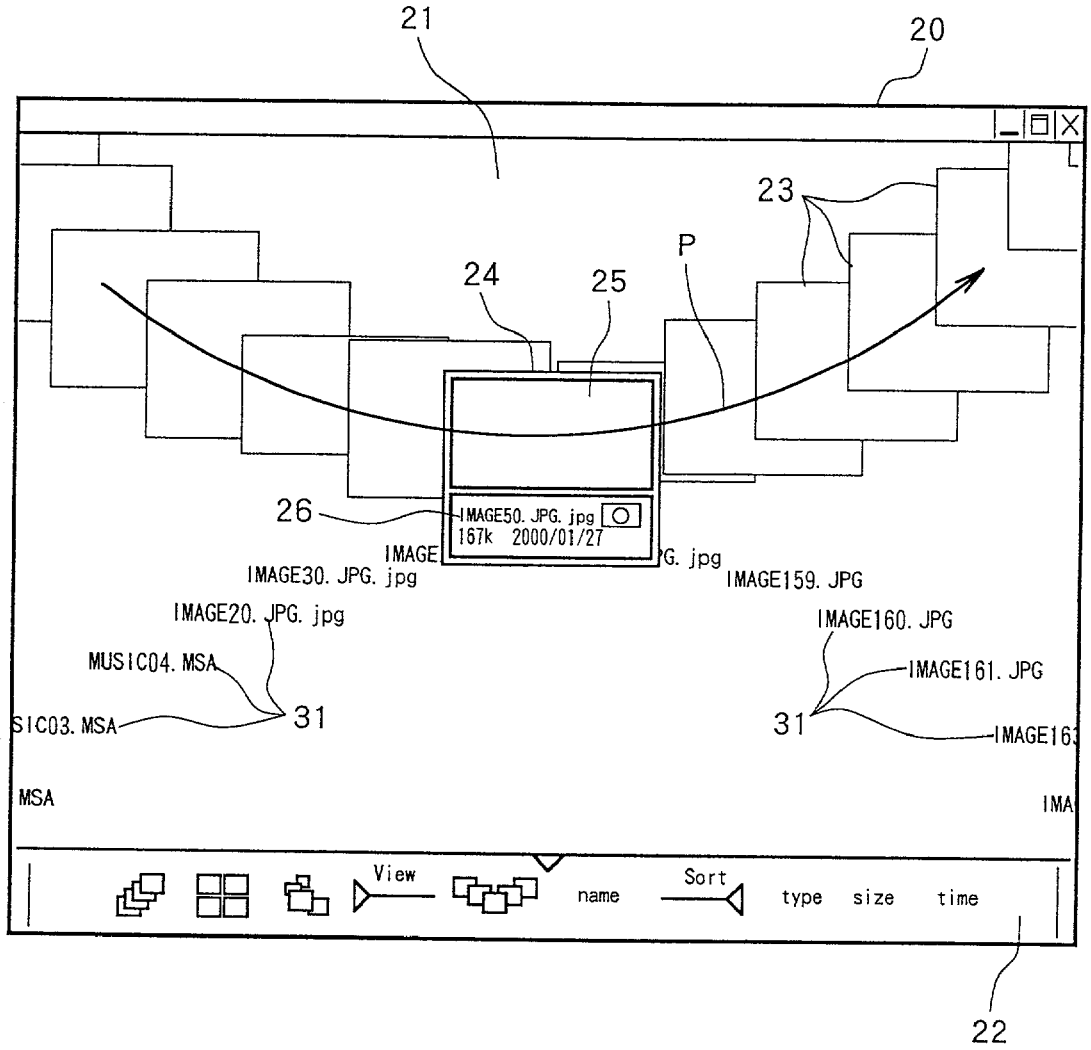

21
20
23
P
24
25
26
IMAGE50. JPG. jpg
167k 2000/01/27
IMAGE
G. jpg
IMAGE30. JPG. jpg
IMAGE159. JPG
IMAGE20. JPG. jpg
IMAGE160. JPG
MUSIC04. MSA
IMAGE161. JPG
SIC03. MSA
31
31
IMAGE16
MSA
IMA
View
name
Sort
type
size
time
22

FIG. 3

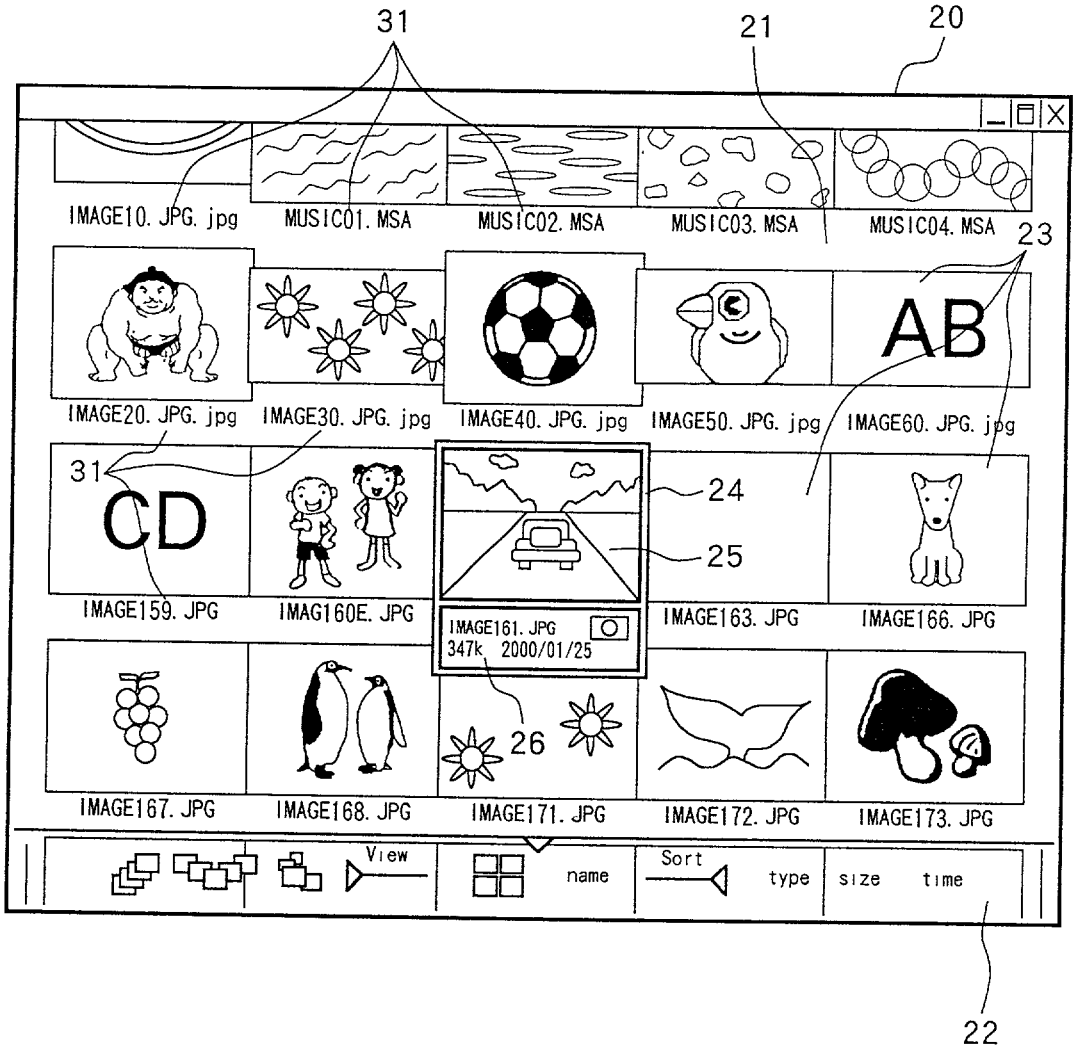

31
21
20
IMAGE10. JPG. jpg
MUSIC01. MSA
MUSIC02. MSA
MUSIC03. MSA
MUSIC04. MSA
23
AB
IMAGE20. JPG. jpg
IMAGE30. JPG. jpg
IMAGE40. JPG. jpg
IMAGE50. JPG. jpg
IMAGE60. JPG. jpg
31
CD
24
25
IMAGE159. JPG
IMAG160E. JPG
IMAGE161. JPG
347k 2000/01/25
IMAGE163. JPG
IMAGE166. JPG
26
IMAGE167. JPG
IMAGE168. JPG
IMAGE171. JPG
IMAGE172. JPG
IMAGE173. JPG
View
name
Sort
type
size
time
22

FIG. 4

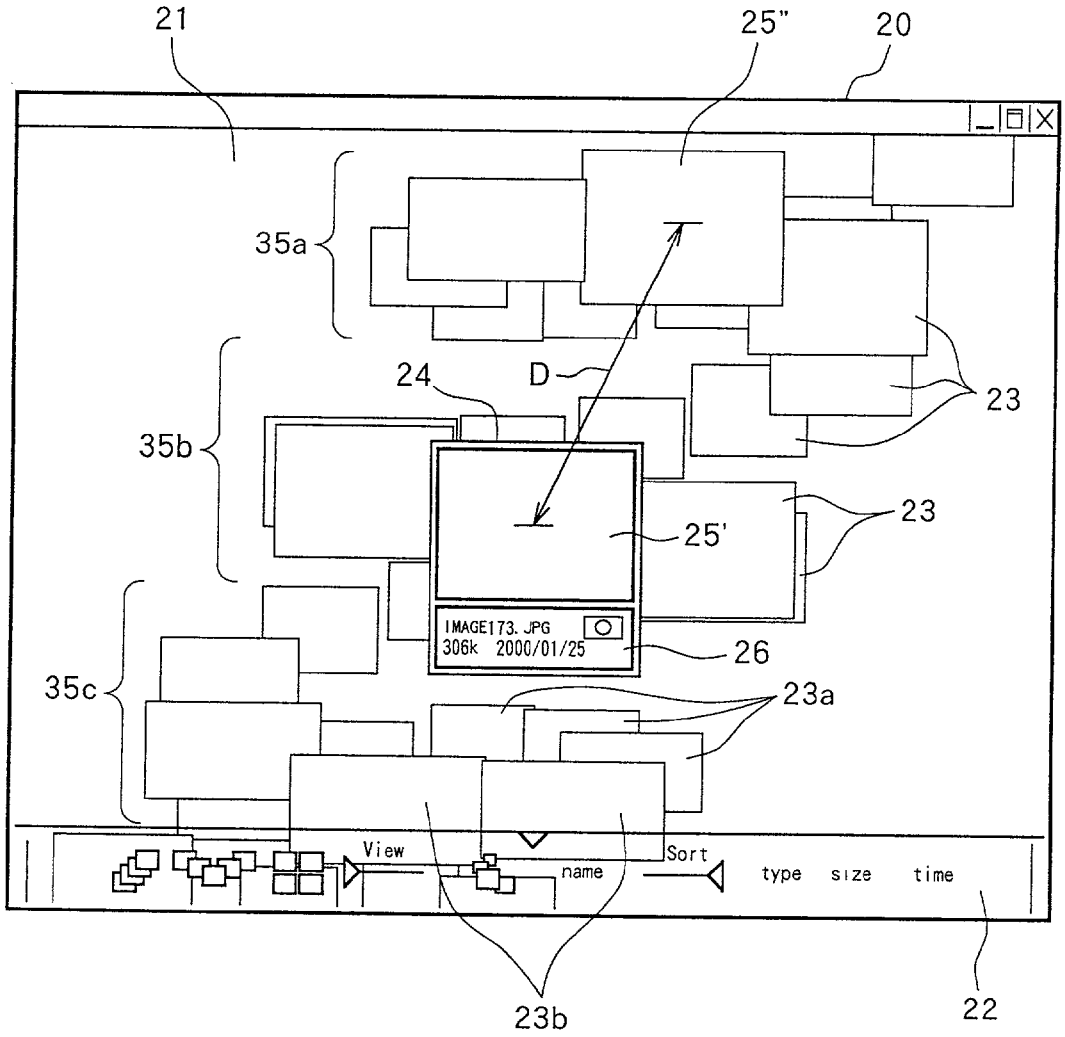

21
25"
20
35a
24
D
23
35b
25'
23
IMAGE173. JPG
306k 2000/01/25
26
35c
23a
View
Sort
name
type
size
time
23b
22

FIG. 5

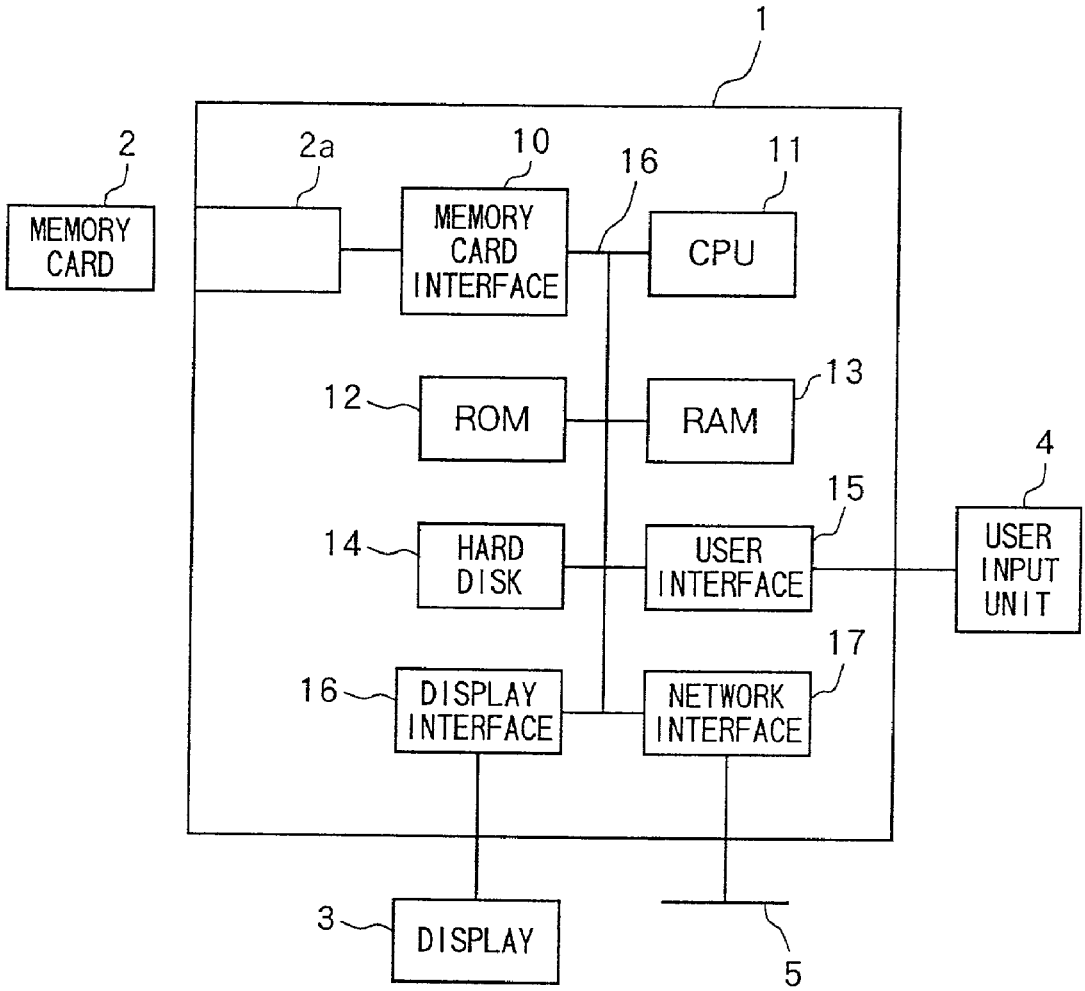

1
2
MEMORY CARD
2a
10
MEMORY CARD INTERFACE
16
11
CPU
12
ROM
RAM
13
4
15
14
HARD DISK
USER INTERFACE
USER INPUT UNIT
17
16
DISPLAY INTERFACE
NETWORK INTERFACE
3
DISPLAY
5

FIG. 6

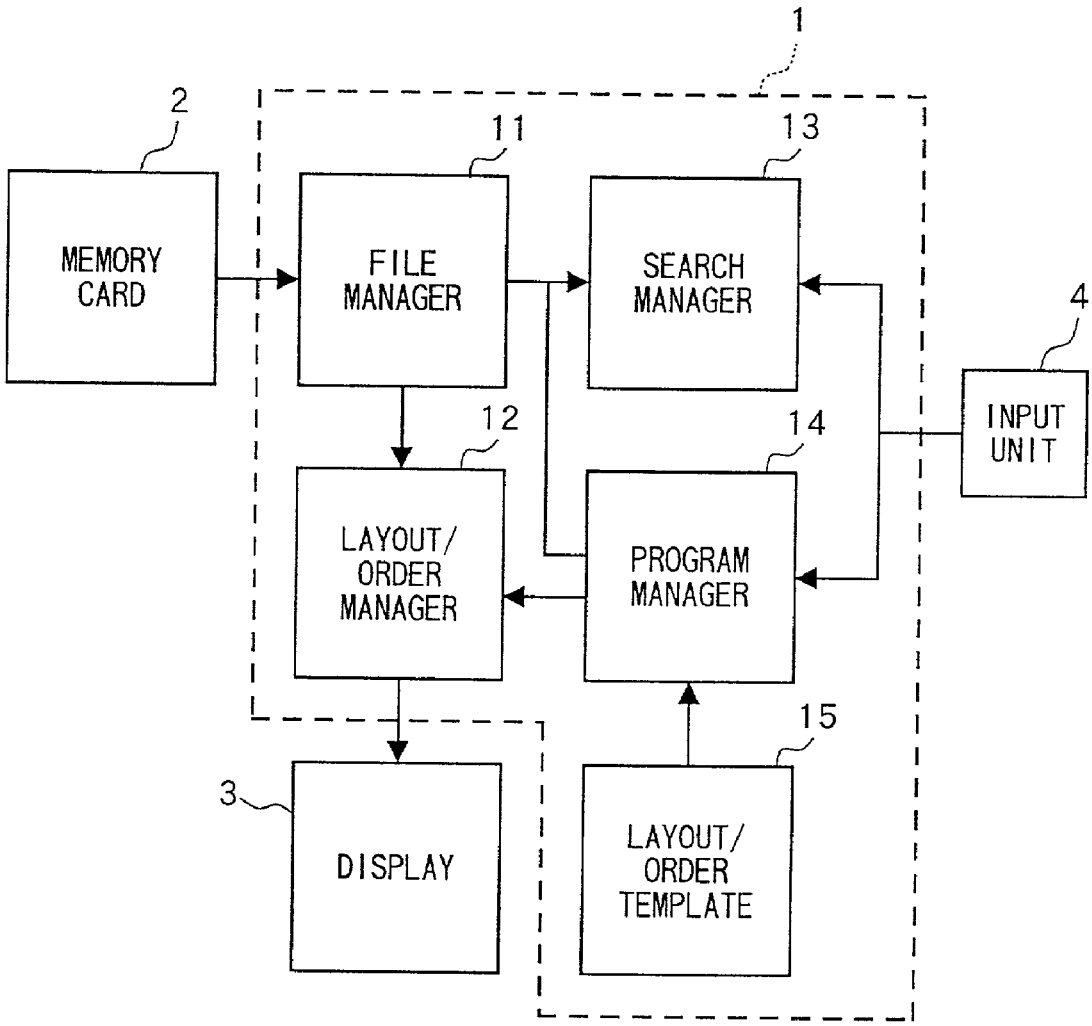

1
2
MEMORY CARD
11
FILE MANAGER
13
SEARCH MANAGER
4
INPUT UNIT
12
LAYOUT/ ORDER MANAGER
14
PROGRAM MANAGER
15
3
DISPLAY
LAYOUT/ ORDER TEMPLATE

FIG. 7

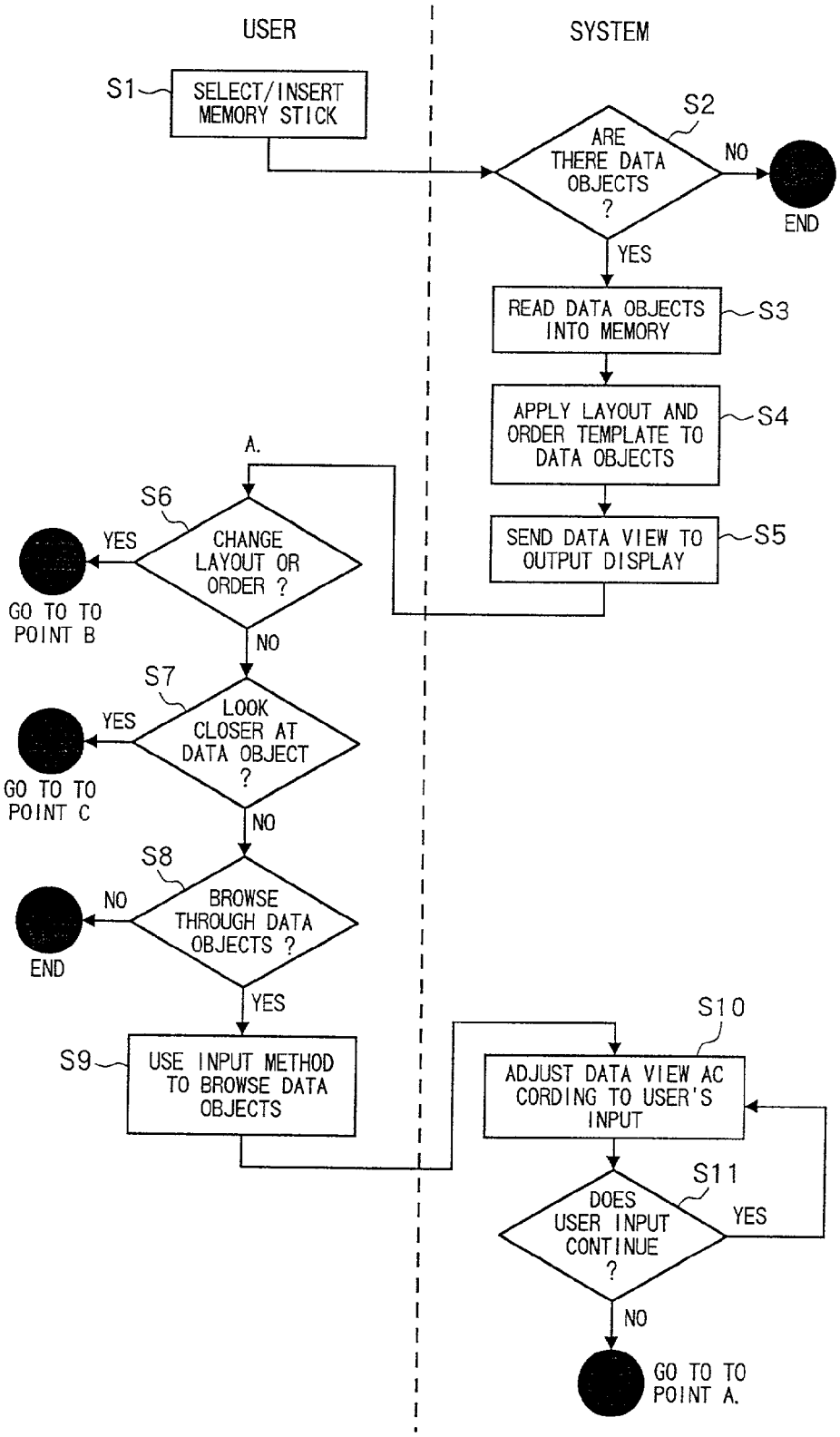

USER
SYSTEM
S1
SELECT/INSERT MEMORY STICK
S2
ARE THERE DATA OBJECTS ?
NO
END
YES
READ DATA OBJECTS INTO MEMORY
S3
APPLY LAYOUT AND ORDER TEMPLATE TO DATA OBJECTS
S4
SEND DATA VIEW TO OUTPUT DISPLAY
S5
A.
S6
CHANGE LAYOUT OR ORDER ?
YES
GO TO TO POINT B
NO
S7
LOOK CLOSER AT DATA OBJECT ?
YES
GO TO TO POINT C
NO
S8
BROWSE THROUGH DATA OBJECTS ?
NO
END
YES
S9
USE INPUT METHOD TO BROWSE DATA OBJECTS
S10
ADJUST DATA VIEW AC CORDING TO USER'S INPUT
S11
DOES USER INPUT CONTINUE ?
YES
NO
GO TO TO POINT A.

FIG. 8

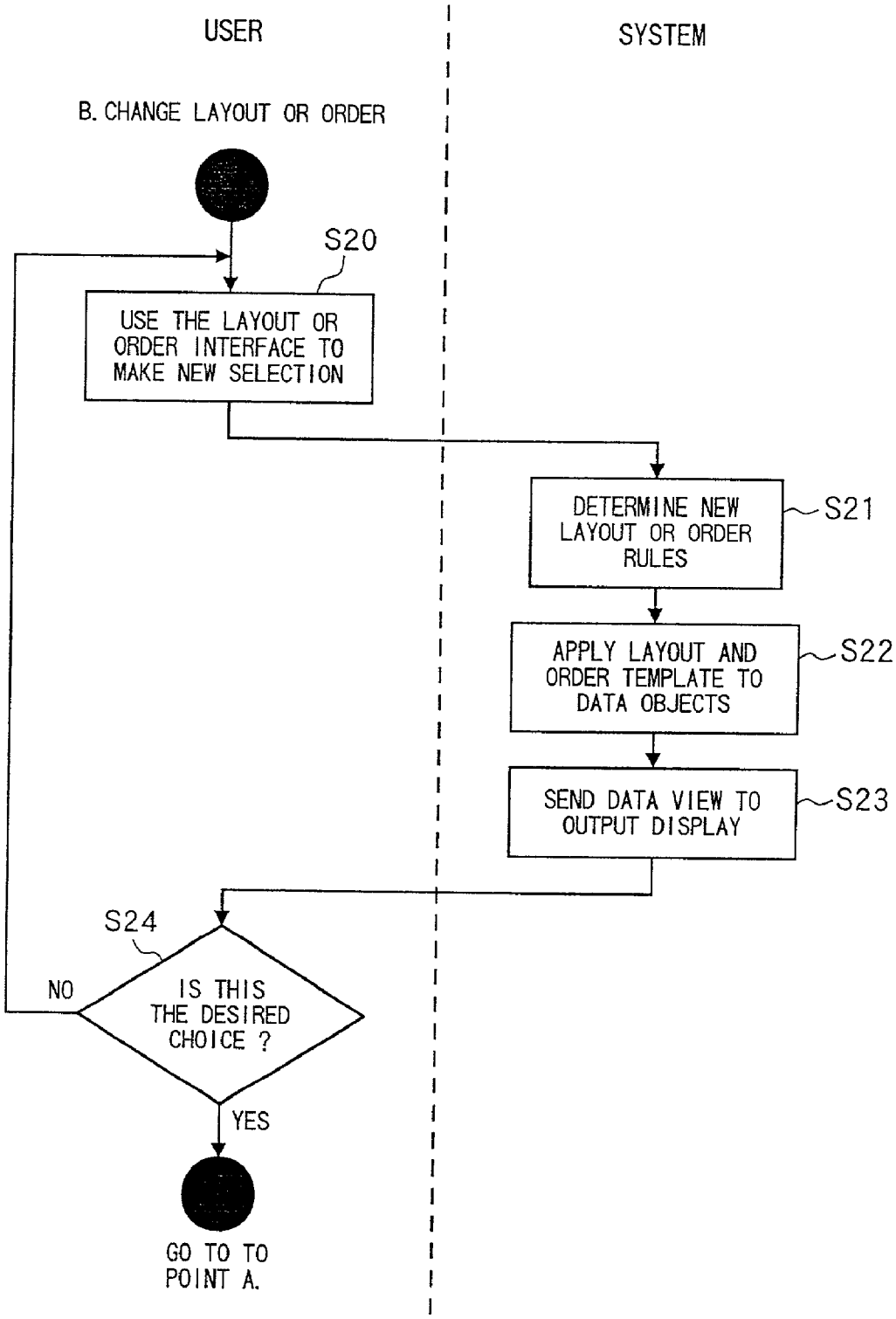

USER
SYSTEM
B. CHANGE LAYOUT OR ORDER
S20
USE THE LAYOUT OR ORDER INTERFACE TO MAKE NEW SELECTION
DETERMINE NEW LAYOUT OR ORDER RULES
S21
APPLY LAYOUT AND ORDER TEMPLATE TO DATA OBJECTS
S22
SEND DATA VIEW TO OUTPUT DISPLAY
S23
S24
IS THIS THE DESIRED CHOICE ?
NO
YES
GO TO TO POINT A.

FIG. 9

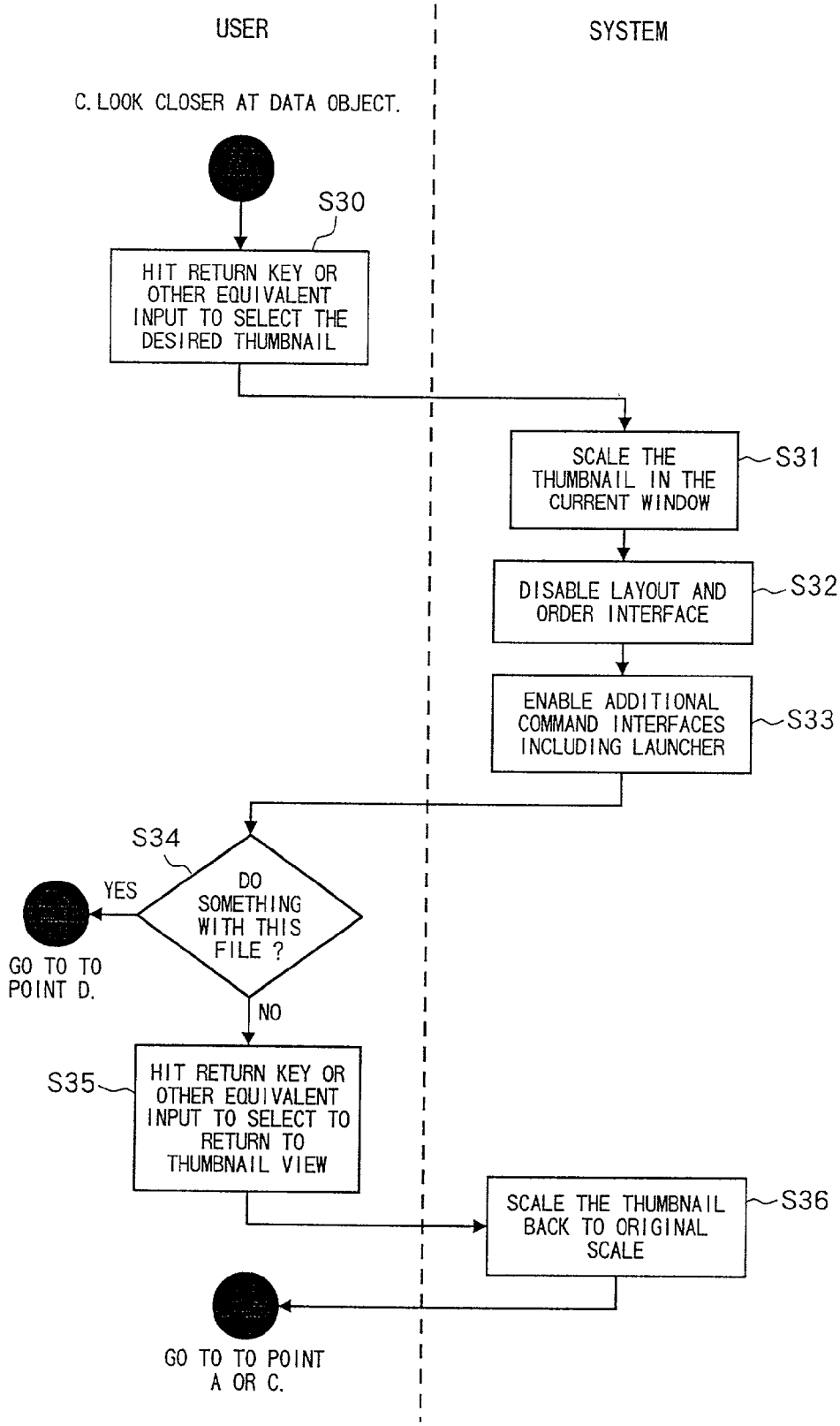

USER
SYSTEM
C. LOOK CLOSER AT DATA OBJECT.
S30
HIT RETURN KEY OR OTHER EQUIVALENT INPUT TO SELECT THE DESIRED THUMBNAIL
SCALE THE THUMBNAIL IN THE CURRENT WINDOW
S31
DISABLE LAYOUT AND ORDER INTERFACE
S32
ENABLE ADDITIONAL COMMAND INTERFACES INCLUDING LAUNCHER
S33
S34
DO SOMETHING WITH THIS FILE ?
YES
GO TO TO POINT D.
NO
S35
HIT RETURN KEY OR OTHER EQUIVALENT INPUT TO SELECT TO RETURN TO THUMBNAIL VIEW
SCALE THE THUMBNAIL BACK TO ORIGINAL SCALE
S36
GO TO TO POINT A OR C.

FIG. 10

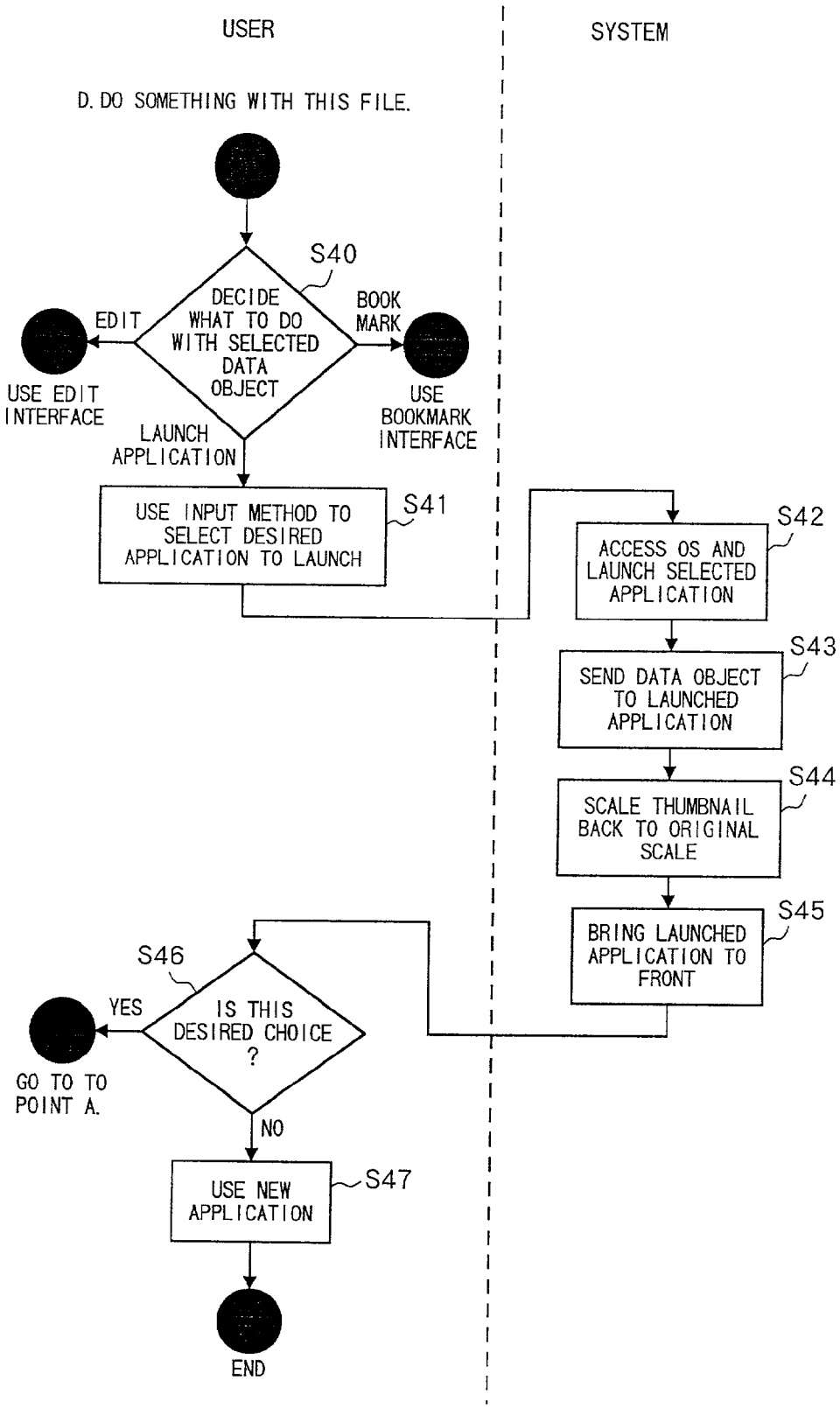

USER
SYSTEM
D. DO SOMETHING WITH THIS FILE.
S40
DECIDE WHAT TO DO WITH SELECTED DATA OBJECT
EDIT
BOOK MARK
USE EDIT INTERFACE
USE BOOKMARK INTERFACE
LAUNCH APPLICATION
USE INPUT METHOD TO SELECT DESIRED APPLICATION TO LAUNCH
S41
S42
ACCESS OS AND LAUNCH SELECTED APPLICATION
S43
SEND DATA OBJECT TO LAUNCHED APPLICATION
S44
SCALE THUMBNAIL BACK TO ORIGINAL SCALE
S45
BRING LAUNCHED APPLICATION TO FRONT
S46
IS THIS DESIRED CHOICE ?
YES
GO TO TO POINT A.
NO
USE NEW APPLICATION
S47
END

FIG. 11

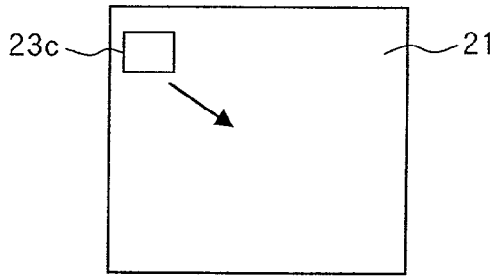


FIG. 12

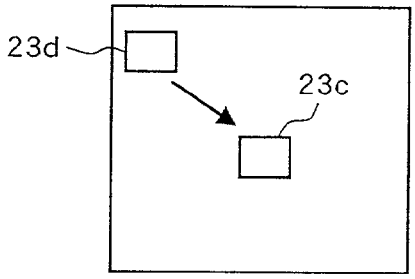


FIG. 13

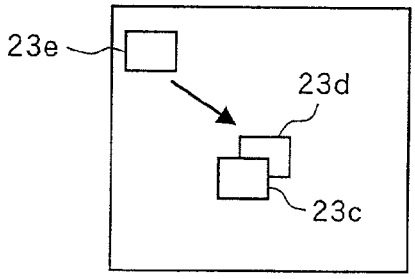


FIG. 14

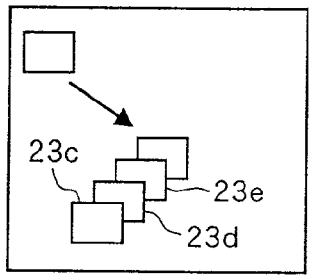


FIG. 15

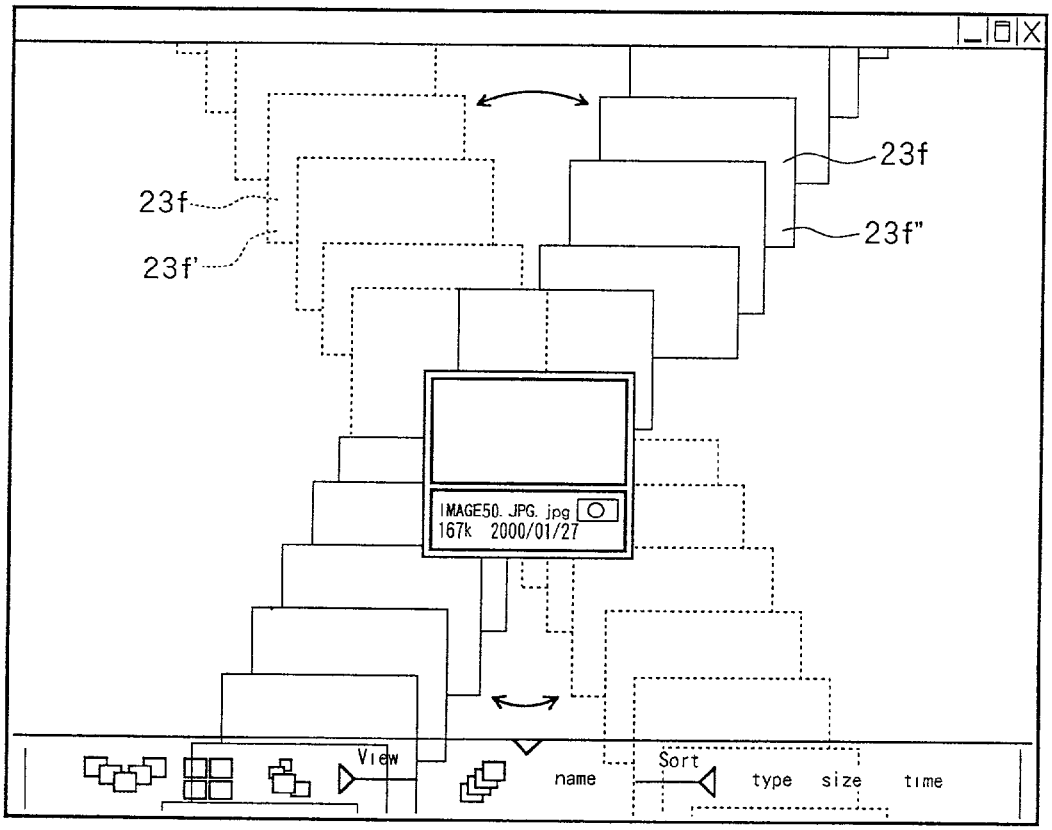

23f
23f'
23f
23f"
IMAGE50. JPG. jpg
167k 2000/01/27
View
name
Sort
type
size
time

FIG. 16

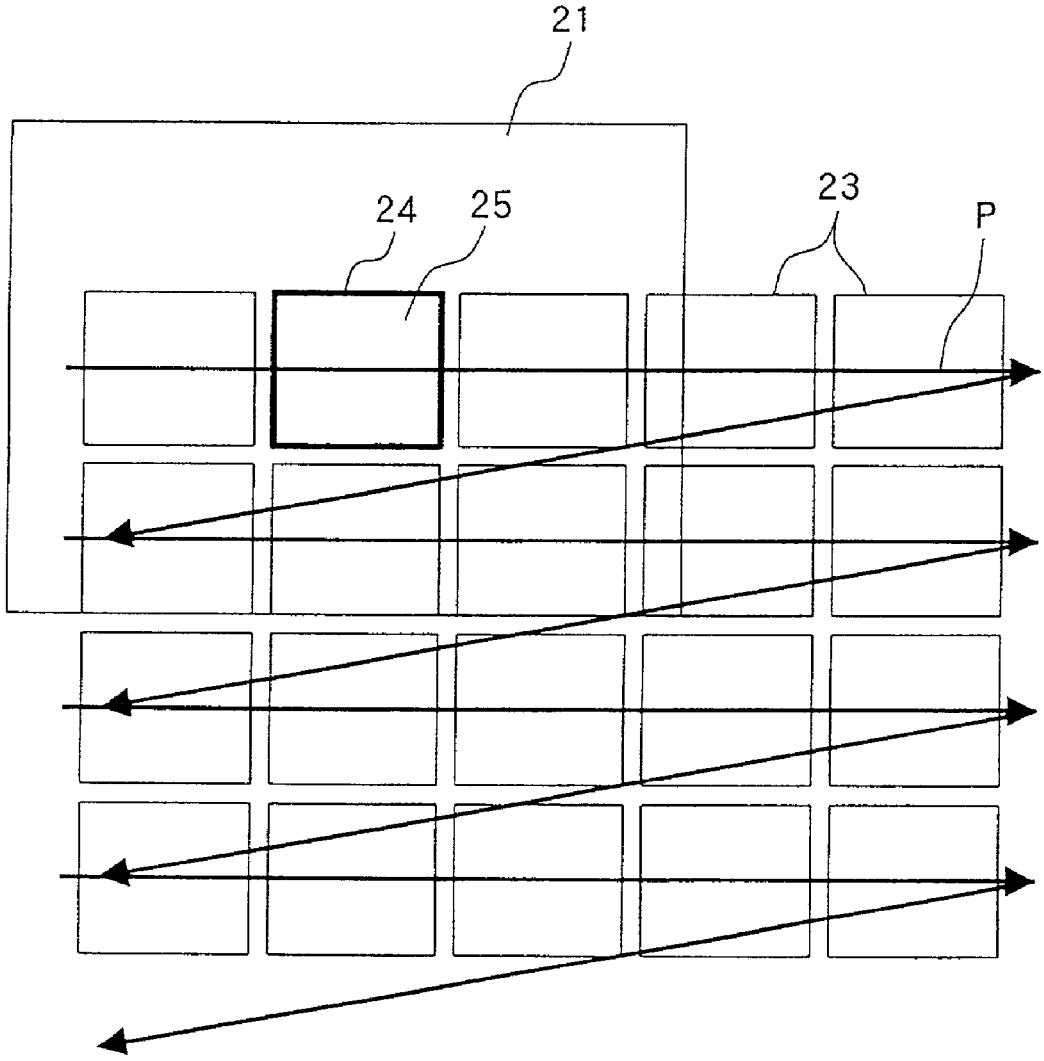


FIG. 17

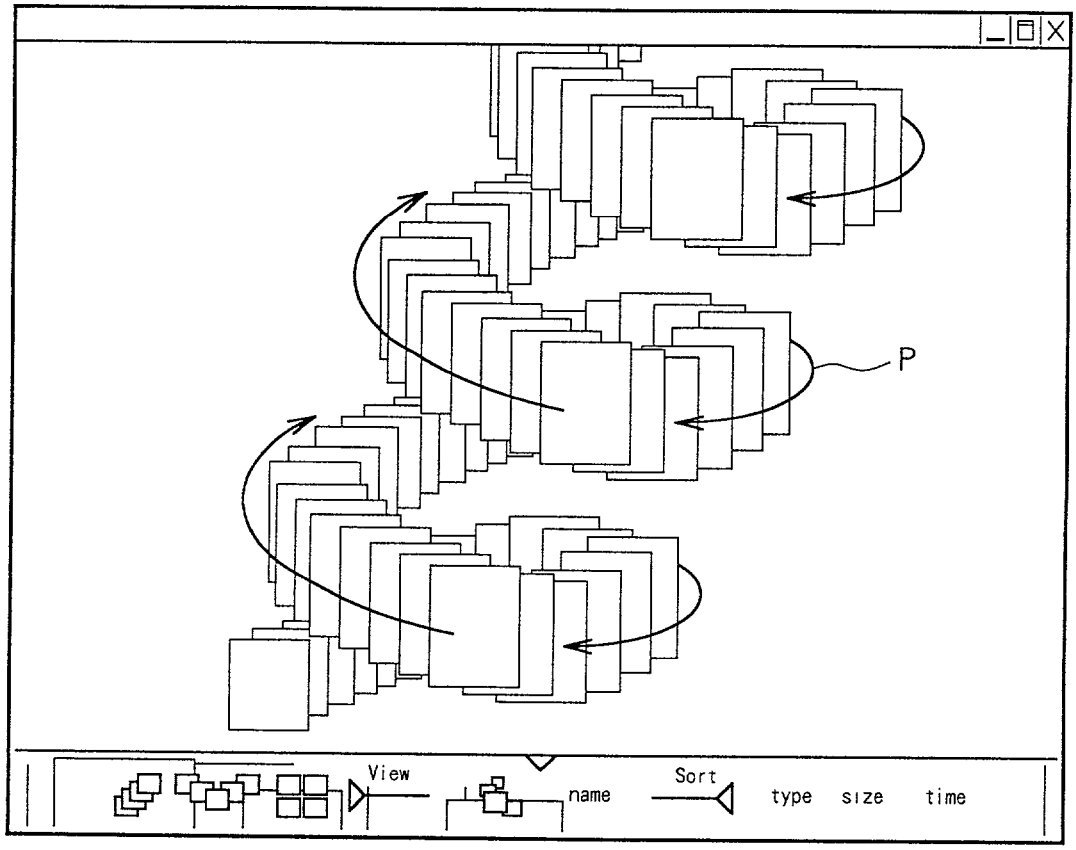


FIG. 18

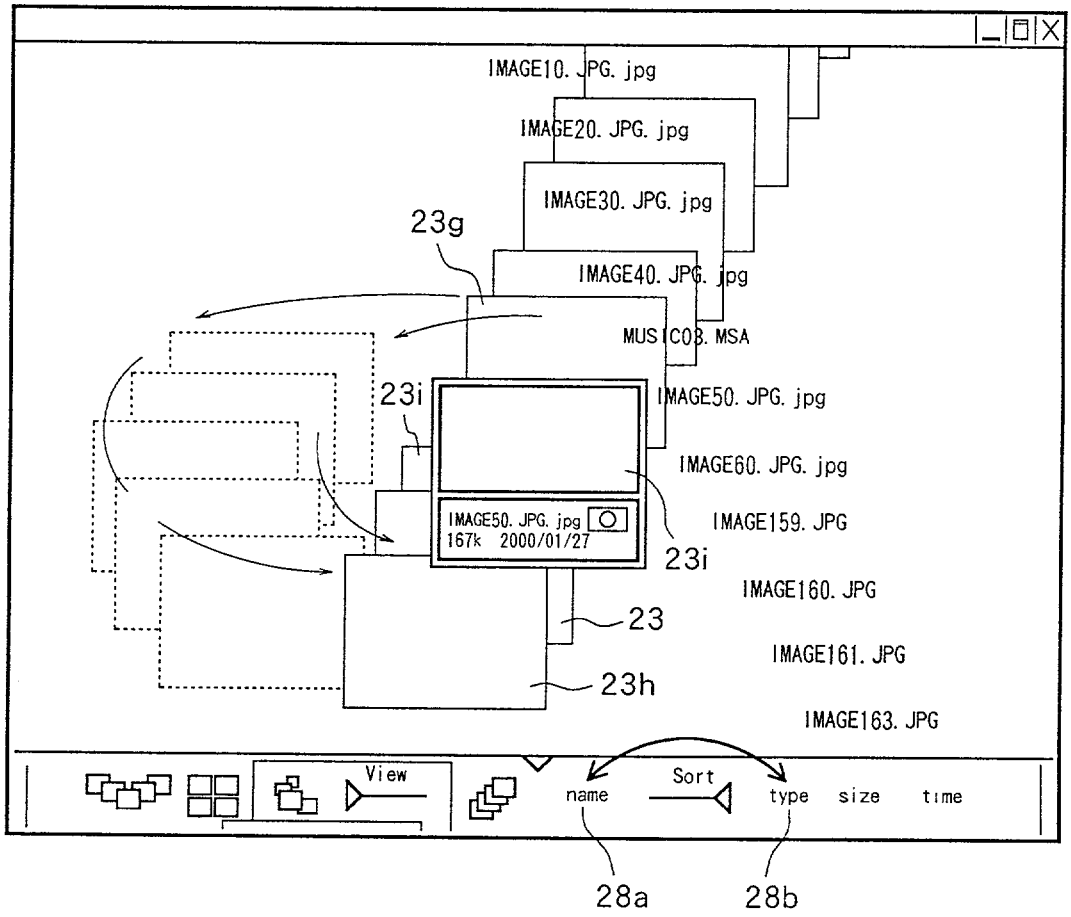


IMAGE10. JPG. jpg
IMAGE20. JPG. jpg
IMAGE30. JPG. jpg
23g
IMAGE40. JPG. jpg
MUSIC03. MSA
23i
IMAGE50. JPG. jpg
IMAGE60. JPG. jpg
IMAGE50. JPG. jpg
167k 2000/01/27
IMAGE159. JPG
23i
IMAGE160. JPG
23
IMAGE161. JPG
23h
IMAGE163. JPG
View
Sort
name
type
size
time
28a
28b

FIG. 19

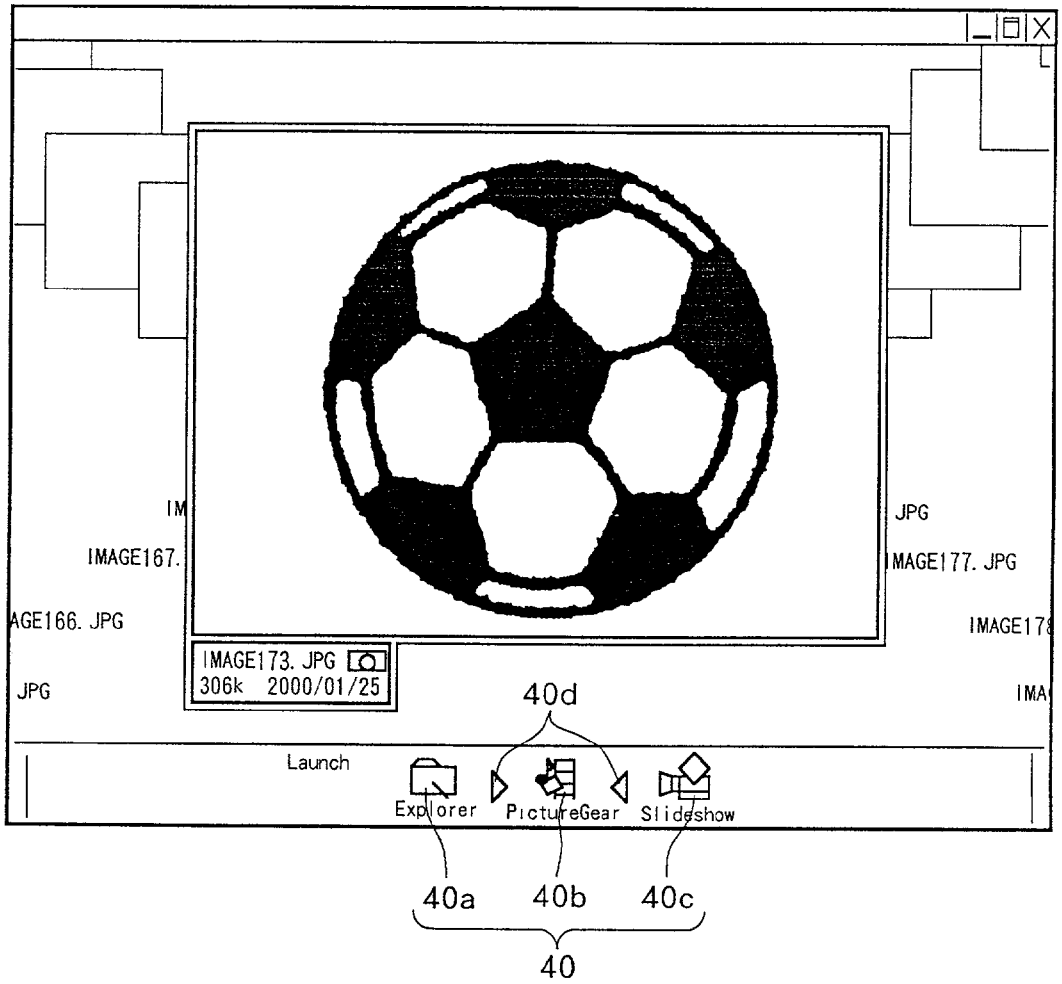


IMAGE167.
AGE166. JPG
JPG
IMAGE173. JPG
306k 2000/01/25
JPG
IMAGE177. JPG
IMAGE17
IMA
40d
Launch
Explorer
PictureGear
Slideshow
40a
40b
40c
40

FIG. 20

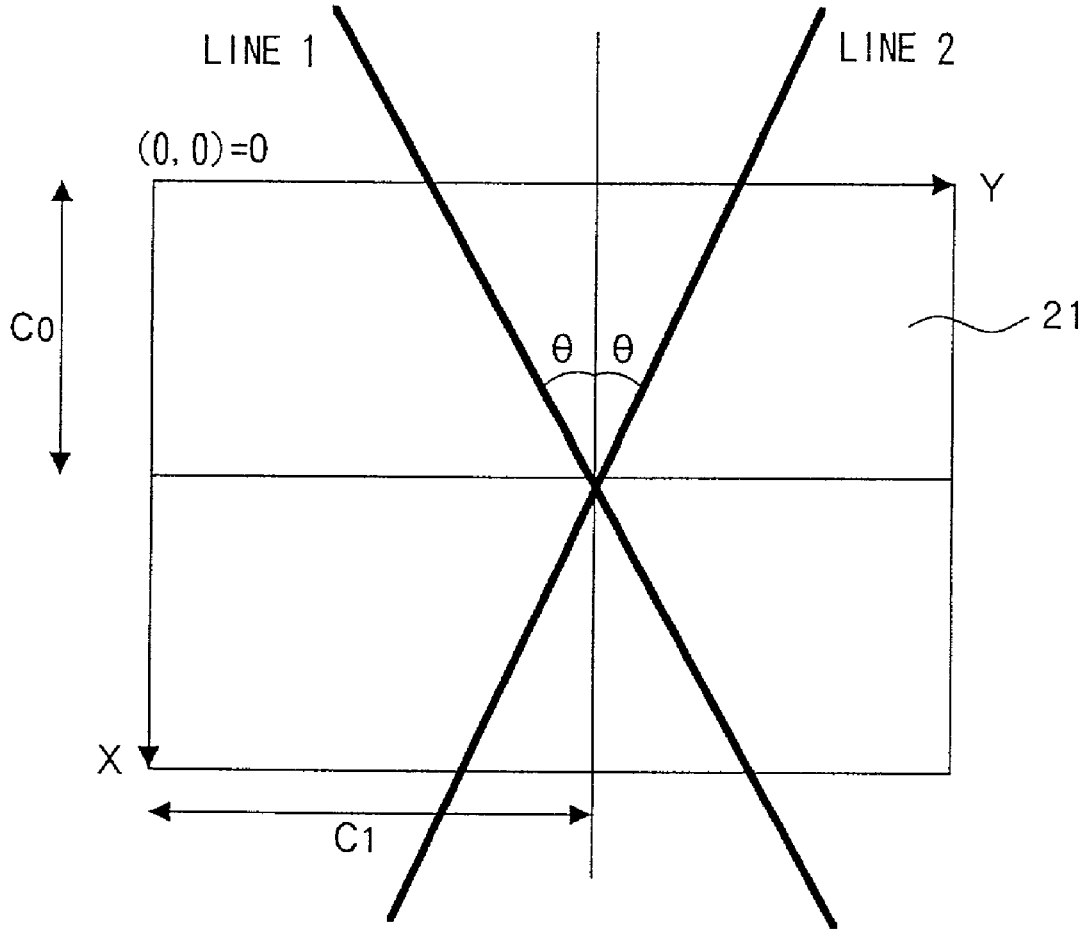


FIG. 21

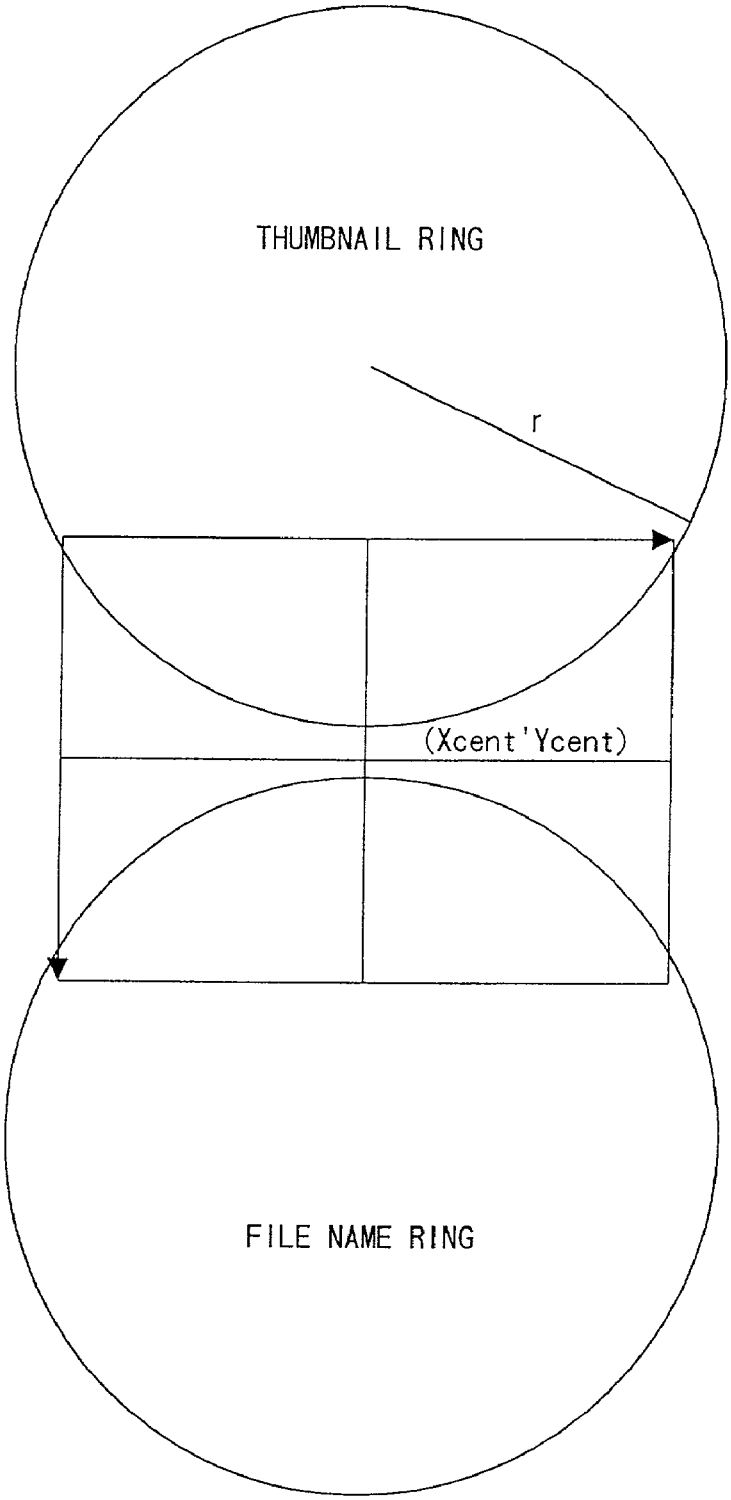


FIG. 22

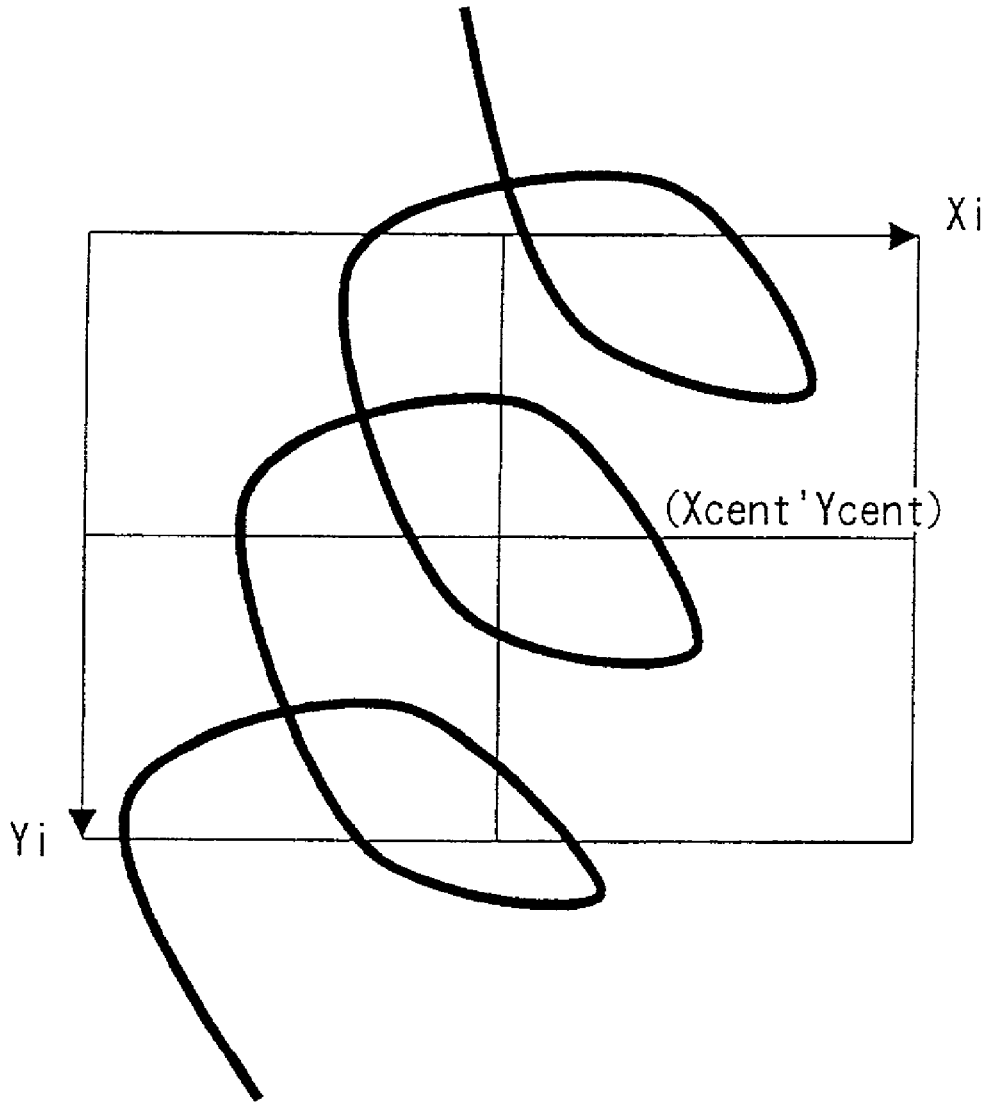


FIG. 23 (a)

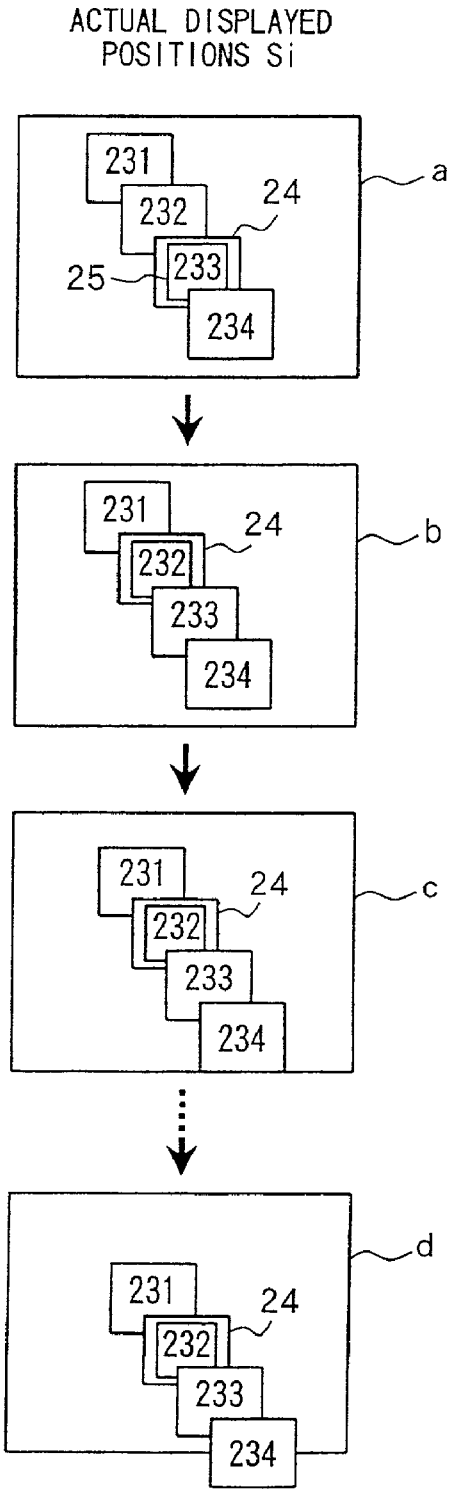


FIG. 23 (b)

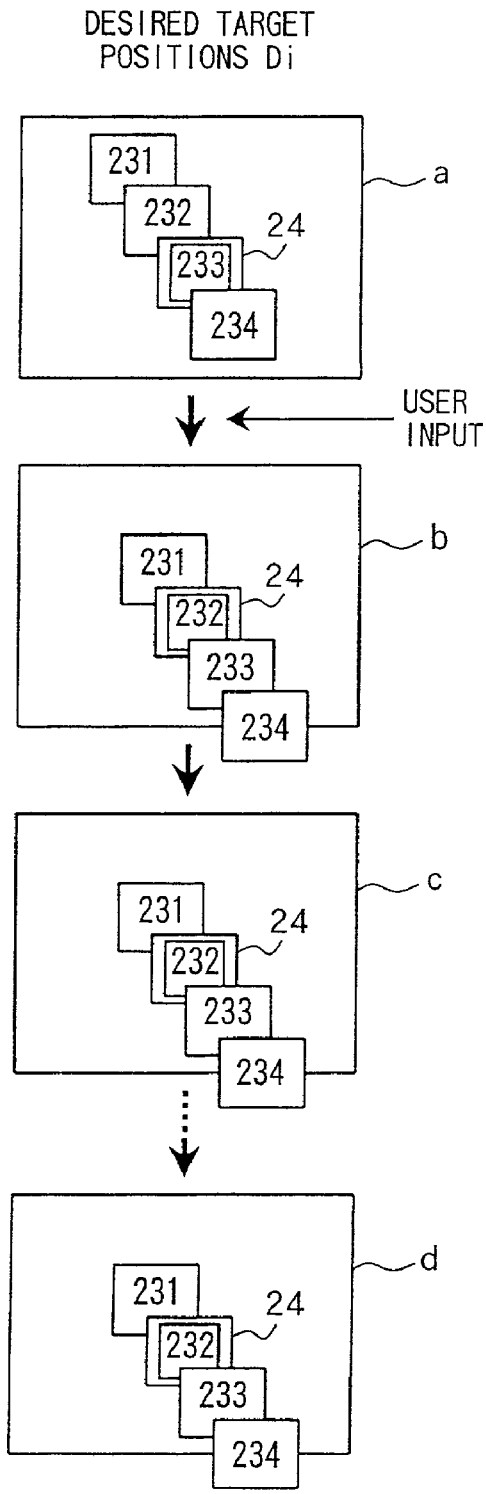


FIG. 24

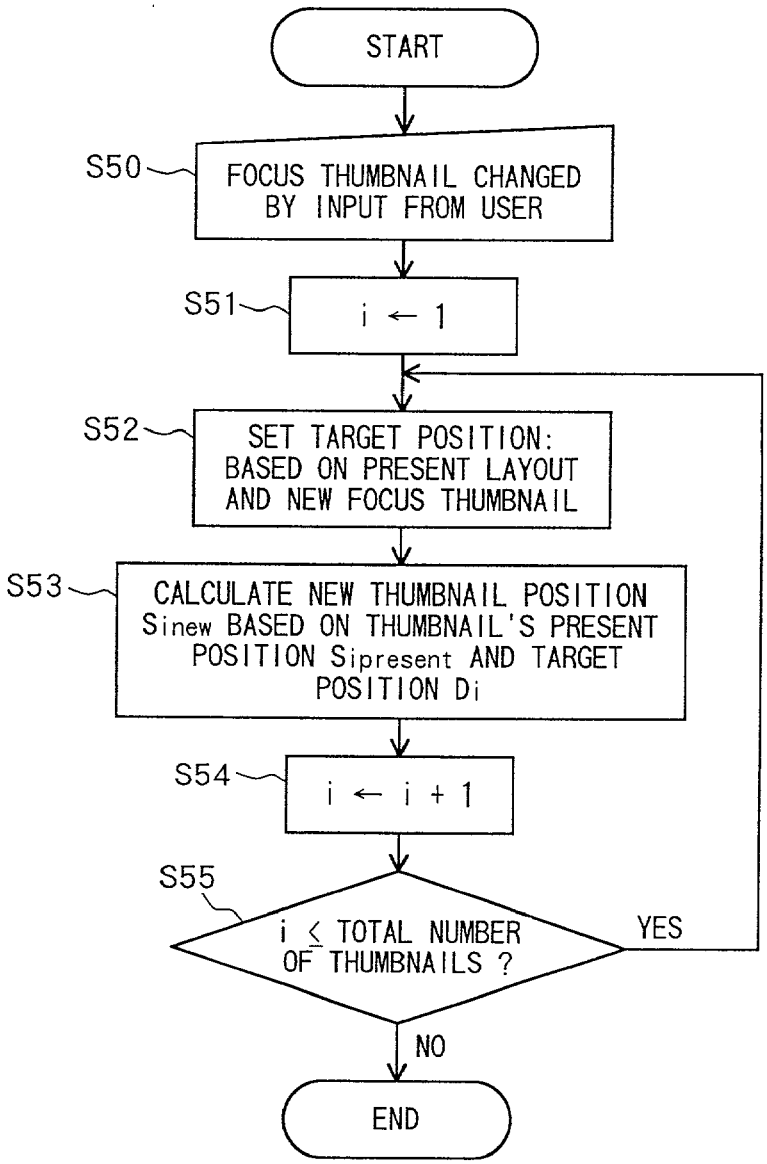

START
S50
FOCUS THUMBNAIL CHANGED BY INPUT FROM USER
S51
i ← 1
S52
SET TARGET POSITION: BASED ON PRESENT LAYOUT AND NEW FOCUS THUMBNAIL
S53
CALCULATE NEW THUMBNAIL POSITION Sinew BASED ON THUMBNAIL'S PRESENT POSITION Sipresent AND TARGET POSITION Di
S54
i ← i + 1
S55
i ≦ TOTAL NUMBER OF THUMBNAILS ?
YES
NO
END

FIG. 25

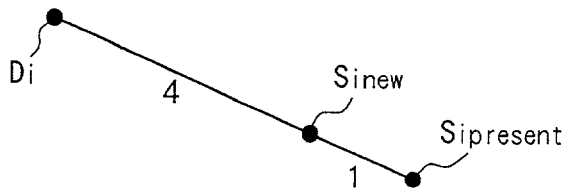

Di
4
Sinew
Sipresent
1

FIG. 26

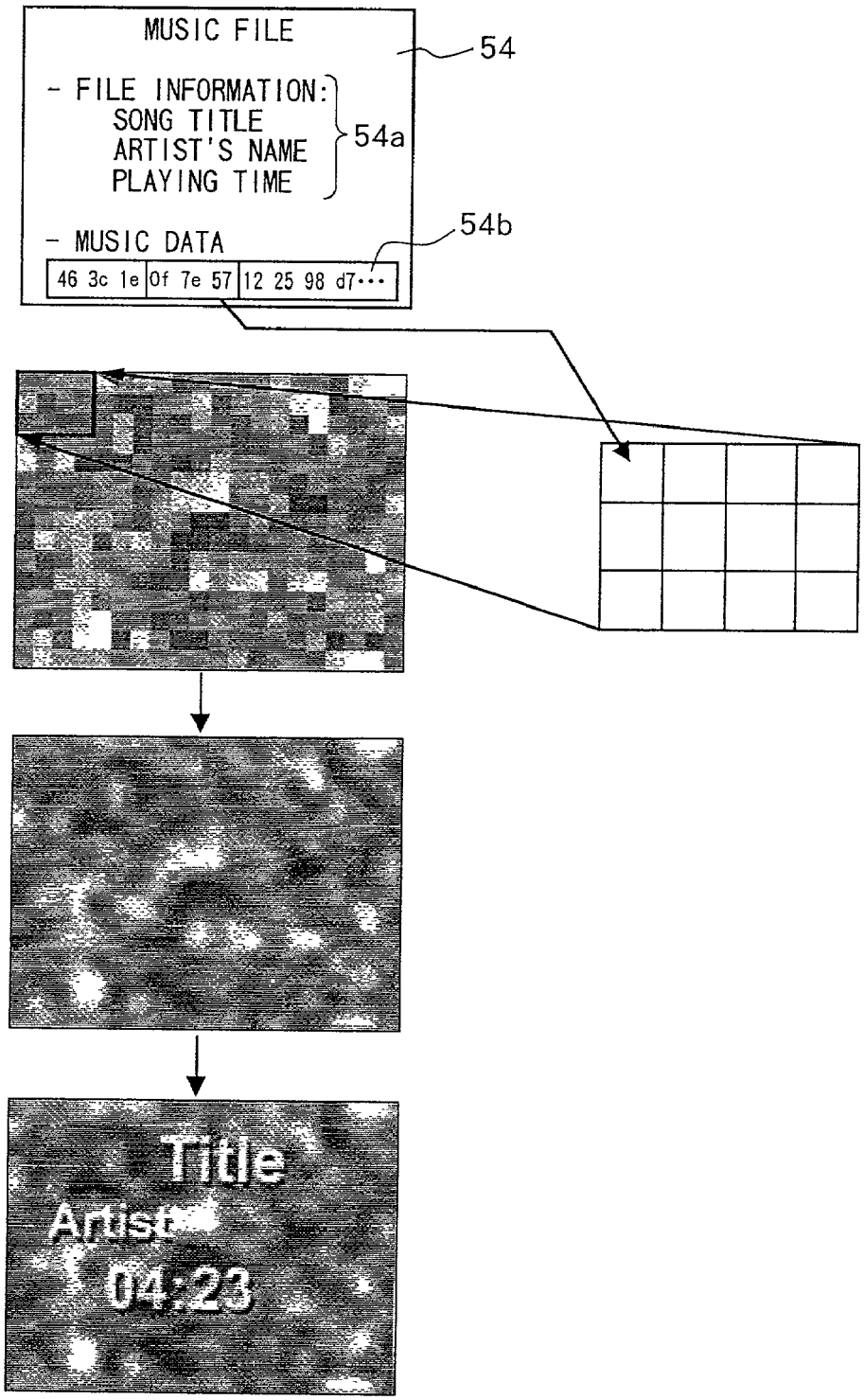

MUSIC FILE
54
- FILE INFORMATION:
SONG TITLE
ARTIST'S NAME
PLAYING TIME
54a
- MUSIC DATA
54b
46 3c 1e
0f 7e 57
12 25 98 d7···
Title
Artist
04:23

FIG. 27

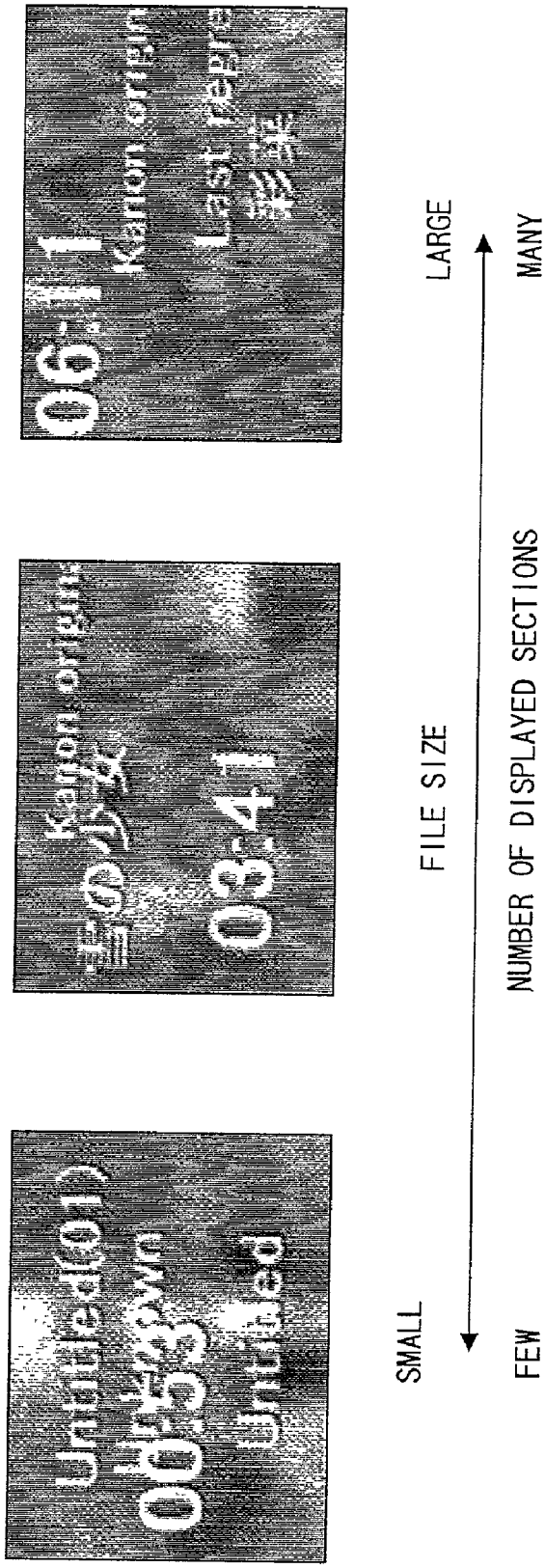

Untitled(01)
06:53
Untitled
Kanon origin
03:41
06:11
Kanon origin
Last regre
SMALL
FILE SIZE
LARGE
FEW
NUMBER OF DISPLAYED SECTIONS
MANY

FIG. 28

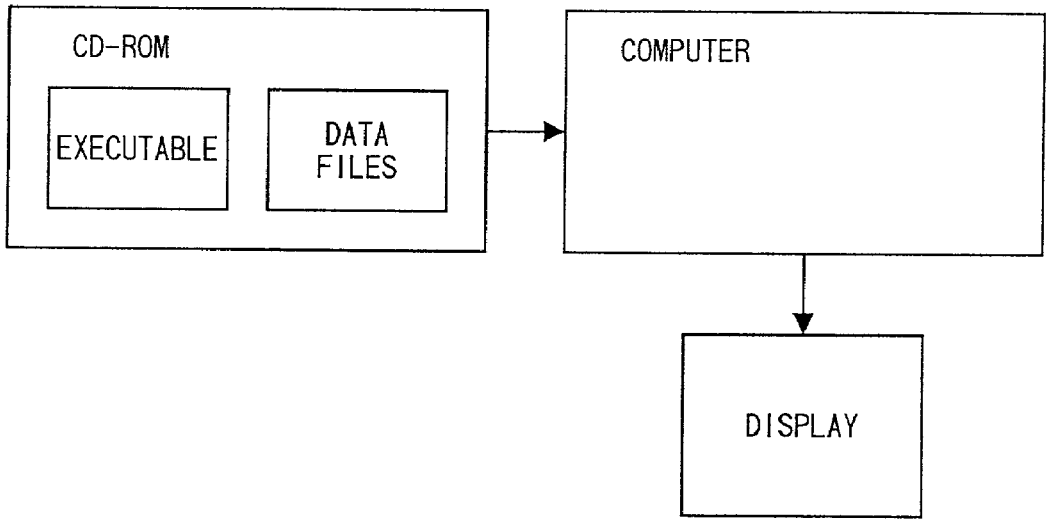

CD-ROM
EXECUTABLE
DATA FILES
COMPUTER
DISPLAY

FIG. 29

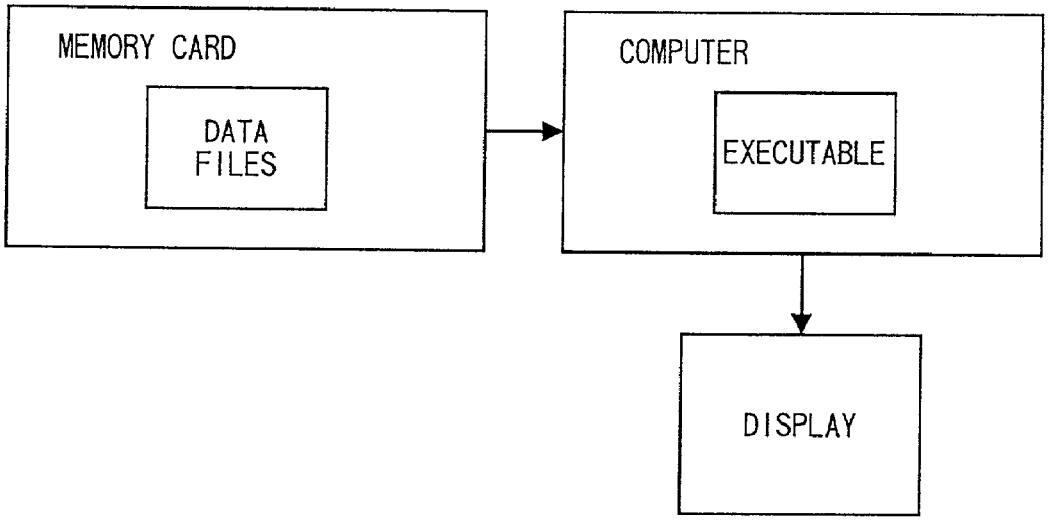

MEMORY CARD
DATA FILES
COMPUTER
EXECUTABLE
DISPLAY

FIG. 30

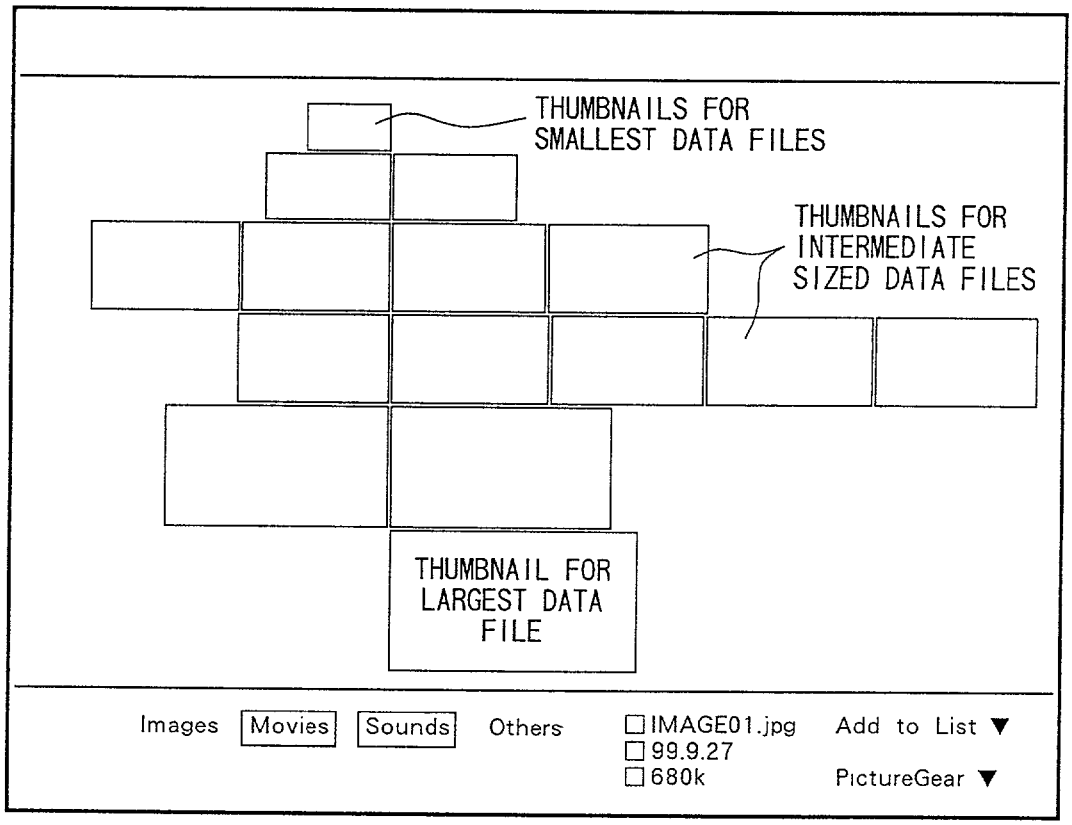

THUMBNAILS FOR SMALLEST DATA FILES
THUMBNAILS FOR INTERMEDIATE SIZED DATA FILES
THUMBNAIL FOR LARGEST DATA FILE
Images
Movies
Sounds
Others
IMAGE01.jpg
99.9.27
680k
Add to List ▼
PictureGear ▼

FIG. 31

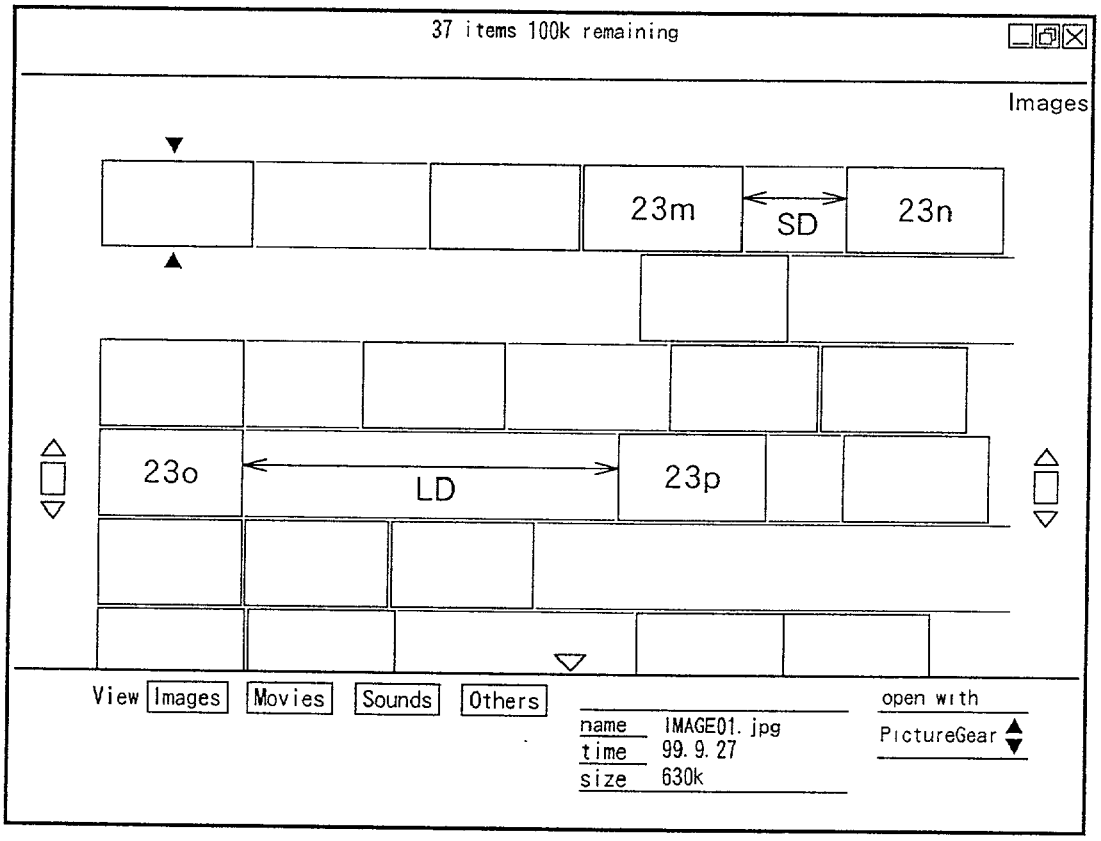
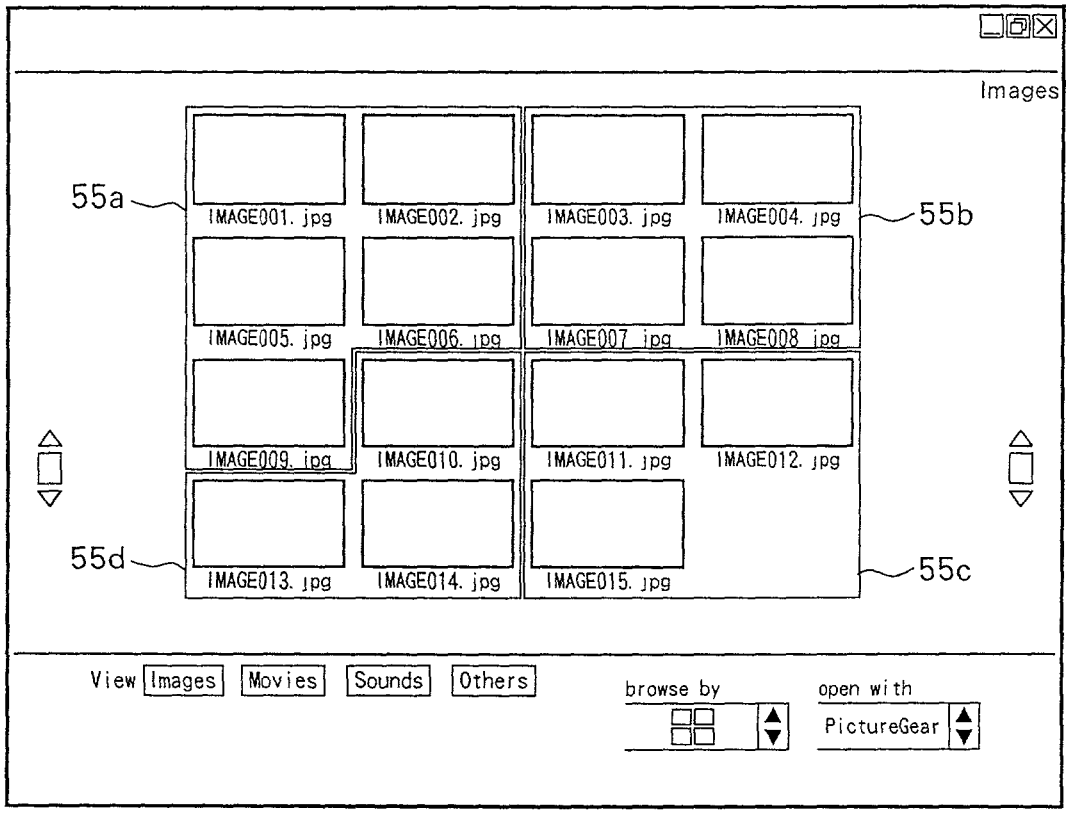

37 items 100k remaining
Images
23m
SD
23n
23o
LD
23p
View
Images
Movies
Sounds
Others
name IMAGE01. jpg
time 99. 9. 27
size 630k
open with
PictureGear

FIG. 32


Images
55a
55b
55c
55d
IMAGE001. jpg
IMAGE002. jpg
IMAGE003. jpg
IMAGE004. jpg
IMAGE005. jpg
IMAGE006. jpg
IMAGE007. jpg
IMAGE008. jpg
IMAGE009. jpg
IMAGE010. jpg
IMAGE011. jpg
IMAGE012. jpg
IMAGE013. jpg
IMAGE014. jpg
IMAGE015. jpg
View
Images
Movies
Sounds
Others
browse by
open with
PictureGear

SYSTEM FOR MANAGING DATA OBJECTS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to an on-screen graphical user interface, and database management.

[0003] 2. Related Art

[0004] Digital cameras, mini disks, and other devices for recording and playing digital media are becoming quite popular. These devices store digital media as data objects in memories such as flash memories, hard disks, and on-line storage.

[0005] There are many methods available for managing large numbers of data objects. For example, data objects are frequently managed using windows and folders. U.S. Pat. No. 5,917,488 describes a system for displaying and manipulating image data sets. First, a window including programmed groups is displayed. When a user selects one of the programmed groups, then a second window is displayed with thumbnails that represent data objects of the selected programmed group.

[0006] Data objects are also handled in hierarchical lists, using static light-box metaphors. A light-box metaphor displays images in the manner of "slides" all the same size on a white background. The "slides" are arranged in a grid.

[0007] There are methods known for selecting a format for displaying data objects. For example, U.S. Pat. No. 5,673,429 describes a system that displays a list of different display formats. When the user selects a desired display format from the list, then items that match the selected format are pulled from a database and displayed in a list that depends on the selected display format.

[0008] Memory is becoming available in increasingly large capacities, which enable storage of increasingly large numbers of data objects. For example, memory cards are available that are capable of storing data for several hundred different digital photographs. However, conventional techniques, such as windows, folders, and lists, have a problem in that they are insufficient for presenting such large numbers of data objects in a manner that a user can easily and quickly understand.

SUMMARY OF THE INVENTION

[0009] It is an objective of the present invention to solve the above-described problems, and to provide a method and device that allows a user to easily browse, view, manage, select, and command a large number of data objects.

[0010] In order to achieve this objective, a device according to the present invention for managing data objects, includes displaying means, defining means, moving means, and enable/disable means.

[0011] The displaying means is for displaying thumbnails representative of data objects. The defining means is for defining a focus region that indicates a focus thumbnail subject to processes. The moving means is for moving the displayed thumbnails along a predetermined path through the focus region.

[0012] The enable/disable means is for selectively enabling and disabling the moving means. When the enable/disable means disables the moving means, then the displaying means statically displays a single thumbnail in the focus region. When the enable/disable means enables the moving means, then the displaying means displays the thumbnails to move along the predetermined path through the focus region.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The above and other objects, features and advantages of the invention will become more apparent from reading the following description of the embodiment taken in connection with the accompanying drawings in which:

[0014] **FIG. 1** is a schematic view showing a window display with thumbnails arranged in a line layout;

[0015] **FIG. 2** is a schematic view showing the window display with thumbnails arranged in a circle layout;

[0016] **FIG. 3** is a schematic view showing the window display with thumbnails arranged in a grid layout;

[0017] **FIG. 4** is a schematic view showing the window display with thumbnails arranged in a helix layout;

[0018] **FIG. 5** is a block diagram showing components of a computer and peripheral equipment for displaying the window display of FIGS. **1** to **4**;

[0019] **FIG. 6** is a block diagram showing functional modules the computer of **FIG. 5**;

[0020] **FIG. 7** is a flowchart representing overall processes for implementing the functional modules of **FIG. 6**;

[0021] **FIG. 8** is a flowchart representing processes for changing layout or order of thumbnails in the window display;

[0022] **FIG. 9** is a flowchart representing processes for taking a closer look at a focus thumbnail;

[0023] **FIG. 10** is a flowchart representing processes for performing further process on the focus thumbnail;

[0024] **FIG. 11** is a schematic view showing movement of a thumbnail representing a first-loaded data object;

[0025] **FIG. 12** is a schematic view showing movement of thumbnails as further data objects are loaded;

[0026] **FIG. 13** is a schematic view showing movement of thumbnails as further data objects are loaded;

[0027] **FIG. 14** is a schematic view showing movement of thumbnails as further data objects are loaded;

[0028] **FIG. 15** is a schematic view graphically representing pivoting movement of a thumbnail line in the line layout;

[0029] **FIG. 16** is a schematic view showing browsing motion of a thumbnail grid in the grid layout;

[0030] **FIG. 17** is a schematic view showing browsing motion of a thumbnail helix in the helix layout;

[0031] **FIG. 18** is a schematic view showing motion of a thumbnail when a new order is selected;

[0032] **FIG. 19** is a schematic view showing the display window when a closer look is taken at the focus thumbnail;

[0033] **FIG. 20** is a graphical view for explaining the pivoting movement of the thumbnail line;

[0034] **FIG. 21** is a graphical view for explaining the form of the circle layout;

[0035] **FIG. 22** is a graphical view for explaining the form of the helix layout;

[0036] **FIG. 23**(*a*) is a schematic view showing displayed position of thumbnails before, during, and after the focus thumbnail is changed;

[0037] **FIG. 23**(*b*) is a schematic view showing timing of change of the focus thumbnail;

[0038] **FIG. 24** is a flowchart showing operations for implementing movement of the thumbnails shown in **FIG. 23**(*b*);

[0039] **FIG. 25** is a view schematically showing determination of a new position for the newly selected thumbnail;

[0040] **FIG. 26** is a schematic view representing processes for displaying audio files visually as thumbnails;

[0041] **FIG. 27** is a schematic view showing thumbnails divided into sections depending on the amount of data in corresponding audio files;

[0042] **FIG. 28** is a schematic view showing configuration of a CD-ROM;

[0043] **FIG. 29** is a schematic view showing configuration of a memory card;

[0044] **FIG. 30** is a schematic view showing thumbnails displayed according to the size of the corresponding data files;

[0045] **FIG. 31** is a schematic view showing thumbnails displayed separated from each other depending on timing of the corresponding data files; and

[0046] **FIG. 32** is a schematic view showing thumbnails displayed in groups depending on the relationship of the corresponding data files.

DETAILED DESCRIPTION OF THE EMBODIMENT

[0047] Next, a system according to an embodiment of the present invention will be described while referring to the accompanying drawings. The system is for managing data objects such as digital image files, digital audio files, text files, executable programs, program files, and movie files.

[0048] As shown in FIGS. **1** to **4**, the system displays a window **20** including a thumbnail screen **21** and a layout/order interface **22**. Thumbnails **23**, that represent a variety of data objects, are displayed in the screen **21**. As shown in **FIGS. 1 and 3**, each of the thumbnails **23** includes an image that is the essence of the corresponding data object. The thumbnails shown in all other drawings include similar images, but the images have been omitted from the drawings to facilitate explanation.

[0049] The thumbnails **23** can be displayed in any of four different graphical display layouts: a line layout as shown in **FIG. 1, a** circle layout as shown in **FIG. 2, a** grid layout as shown in **FIG. 3**, and a helix layout as shown in **FIG. 4**. As will be described in detail below, the layouts use the X and Y dimensions and scale to layout thumbnails that represent various data objects.

[0050] As shown in **FIG. 1, a** focus outline **24** surrounds the center-most, or focus, thumbnail **25** in the thumbnail screen **21**. The focus outline **24** indicates that the focus thumbnail **25** is currently the focus of any operations initiated by input from the user. For example, when input is received for browsing through the thumbnails **23**, the thumbnails **23** are dynamically scrolled across the screen through the focus outline **24**, following a path P according to the presently implemented layout as indicated by arrows P in **FIGS. 1, 2, 16**, and **17**. In this way, the user's attention can be selectively drawn to particular ones of the thumbnails **23** by dynamically moving the thumbnails **23** through the single screen **21**, rather than by using multiple windows in the conventional manner. The single screen **21** is advantageous over multiple windows, because the single screen **21** gives the user a primary focus and a single unified context as he or she manipulates the thumbnails **23**, which represent data objects. As will be described in detail below, the thumbnails **23** are moved by panning, scrolling, and zooming in the screen **21** to change the degrees of focus placed on the thumbnails **23**.

[0051] An information tab **26** is displayed within the focus outline **24** at a position below the focus thumbnail **25**. The information tab **26** includes further information about the focus thumbnail **25** such as a file name, date, size, and file type of the data object that corresponds to the focus thumbnail **25**.

[0052] The layout/order interface **22** is displayed at the bottom of the screen **21** below the display of the thumbnails **23**, and includes a layout interface **27** and an order interface **28**. The layout interface **27** includes icons **27***a* to **27***b* representing each of the four different layouts. The user can select a desired display layout by selecting the corresponding icon **27***a* to **27***d*, using a mouse and cursor for example. The icon **27***a* to **27***d* that represents the presently selected layout is displayed near the center of the layout/order interface **22** to indicate the presently selected layout. The selected icon can also be changed by clicking on the center icon, or by clicking on an icon **27***e*. With each click, the icons **27***a* to **27***d* switch places with the selected icon one after another in order. The graphical icons **27***a* to **27***d* allows a user to select a display layout with more confidence that when selecting by using a list.

[0053] The order interface **28** is for selecting one of four different sequence orders that determined arrangement of the thumbnails **23** in the selected layout. The four orders include: name of data object, type of data object, size of the data file, and time the file was stored. The order interface **28** is displayed at the right bottom of the screen, and includes words **28***a* to **28***d* that represent each of the four different order types. The word, name **28***a* in this example, that represents the selected order is displayed near the center of the layout/order interface **22**. The selected icon can be changed by either clicking on a desired word, or by clicking on an icon **28***e*.

[0054] Here, a more detailed description of the four layouts will be provided. As shown in **FIG. 1**, in the line layout, the thumbnails **23** are aligned in a slightly overlapping manner in a single continuous angled line. File names **31** for

the data objects are displayed in a separate angled line that intersects the angled thumbnail line. The line layout has a clear beginning and end, so the user can easily grasp the number of data objects.

[0055] As shown in **FIGS. 2 and 16**, the circle layout consists of slightly overlapping thumbnails **23** in an arc of a circular ring. Filenames **31** corresponding to the thumbnails **23** appear in an arc of a second ring that is symmetric to, but inverse from the thumbnail arc. Although not shown in the drawings, when there are only a few thumbnails in the circle layout, the entire circular ring of thumbnails is displayed in the screen **21**. At this time, filenames are displayed in a circle below the thumbnail circle. However, the ring enlarges as the number of thumbnails increases, until a portion of the thumbnail ring can not be displayed. When the ring contains thumbnails up to a certain number, then the radius of the arc increases as the size of the ring increases. However, once a certain number of thumbnails **23** is exceeded, so that the ring reaches a certain size, then only an arc having a predetermined radius is displayed as shown in **FIG. 2**. The radius of the arc is fixed regardless of how many thumbnails **23** are in the ring, because if the radius were varied according to the number of thumbnails **23** in the ring, then the displayed arc would appear linear when the ring contains a large number of thumbnails **23**.

[0056] As shown in **FIG. 4**, in the grid layout, the thumbnails **23** are aligned vertically and horizontally, that is, with fixed mutual position in horizontally-extending rows and vertically-extending columns. The number of thumbnails in the rows of the grid layout is determined by how many thumbnails **23** if aligned side by side, can be displayed completely on the screen. In the example shown in **FIG. 4**, five thumbnails **23** are disposed side by side in each horizontal row, because in this example complete rows of five thumbnails **23** can be displayed in the screen **21** without the thumbnails in the rows overlapping. Any further thumbnails are added by increasing the number of rows, that is, by adding the thumbnails to elongate the columns. It should be noted that rows with more or less than five thumbnails might be desirable, depending on the displaying conditions. The thumbnails **23** contact each other on lateral sides, but have a space between top and bottom sides. The file names **31** appear below each corresponding thumbnail **23**. The grid layout displays more complete rows of thumbnails **23**, without the thumbnails overlapping, than any of the other layouts.

[0057] As shown in **FIG. 4**, the thumbnails **23** in the helix layout are displayed in the screen **21** in different scales to give the illusion of viewing a three-dimensional helix from the side. That is, thumbnails **23***a* at the far side of the helix are displayed in a smaller scale than thumbnails **23***b* at the near side of the helix. The helix shape includes rings **35***a* to **35***c* of thumbnails **23**. Each ring **35***a*, **35***b*, **35***c* includes about ten thumbnails **23**. The helix layout shows a large number of thumbnails at the same time, while maintaining the benefits of a line configuration.

[0058] Next, configuration of the file management system for displaying the window **20** will be explained, along with further explanation of various features of the file management system. As shown in **FIG. 1**, the file management system includes a computer **1**, a memory card **2**, a display **3**, and a user input unit **4**.

[0059] The memory card **2** can be any memory card, such as a Memory Stick™, a SmartMedia™ memory card, or a Compact Flash™ memory card. The memory card **2** stores data files for a large number of photographs, songs, or any other type of data objects. The other modules of the system can write data objects into, or read data objects from, the memory card **2**. The user input unit **4** can be any user interface for inputting commands and the like, such as a keyboard, a jog-dial, a game controller, or an on-screen unit such as a mouse or a pen.

[0060] The computer **1** includes a slot **2***a* for insertion of the memory card **2**, a memory card interface **10**, a CPU **11**, a ROM **12**, a RAM **13**, a hard disk **14**, a user interface **15**, a display interface **16**, and a network interface **17**, all connected together by a bus **16**. The user interface **15** is connected to the user input unit **4**. The display interface **16** is connected to the display **3**. The network interface **17** is connected to a network **5**.

[0061] **FIG. 2** shows functional modules of the computer **1**. As shown the computer **1** includes a file manager **11**, a layout/order manager **12**, a search manager **13**, a program manager **14**, and a layout/order template stock **15**. The functional modules are realized by application software stored in the hard disk **14**, or retrieved over the network **5**.

[0062] The file manager **11** reads data objects from the memory card **2** and stores them in memory, such as the RAM **13**.

[0063] The layout/order template stock **15** is memory, such as the hard disk **14**, that holds a layout/out template for each combination of the four layouts and the four orders. Each layout/order template contains two primary rule sets for the corresponding layout, one set of rules for setting relative positions of thumbnails **23** and another set of rules for movement of thumbnails **23**.

[0064] Although rules in the layout/order templates will be described later, with respect to relative position of thumbnails, a layout/order template for the grid layout includes layout rules that indicate that each thumbnail should be positioned immediately to the right of the preceding thumbnail, unless the thumbnail is sixth in a thumbnail sequence. If the thumbnail is sixth in the sequence, then the thumbnail should be positioned underneath the first image in the sequence in order to begin a new sequence, that is, to start a new row in the grid. The templates for the line, circle, and helix layouts indicate that the thumbnails should be aligned in line, circle, and helix patterns, respectively.

[0065] With respect to rule for movement of the thumbnails, the grid template also includes rules defining that the thumbnails in the grid layout move as shown in **FIG. 16** when the user browses through the thumbnails in a manner to be described below. The templates for the line, circle, and helix layouts indicate that the thumbnails should be move following linear, circular, and spiraling paths, respectively.

[0066] The program manager **14** reads a layout/order template from the layout/order template stock **15** for the presently selected layout and order. The program manager **14** writes the template into the file manager **11** to apply the template to the data objects stored by the file manager **11**. The program manager **14** reads templates from the layout/order template stock **15** and writes them in the file manager

11 each time the layout or order is changed, because only one set of display rules needs to be in active memory at any one time.

[**0067**] The layout/order manager **12** reads information about the data objects in the file manager **11**, and draws the corresponding thumbnails **23** accordingly in the presently selected layout. The file layout/order manager **12** controls the display **2** to display the thumbnails accordingly.

[**0068**] The search engine **13** enables a user to search for data objects based on inputted search criteria. The search engine **13** incrementally writes the criteria in the file manager **11**. The display **3** changes the screen **21** to display only thumbnails of data objects that satisfy the search criteria. The search engine **13** supports key words and file attributes, such as date, size, color.

[**0069**] Here, operations of the computer **1** will be described while referring to the flowcharts in FIGS. **7** to **10**. In S**1**, the operating system of the computer **1** recognizes the memory card **2** when the memory card **2** is inserted into the slot **2***a*. As a result, the operating system launches an executable application for performing the functions of the file manager **11**, the layout/order manager **12**, and the other function modules in **FIG. 6**. The executable application can be either retrieved for this purpose from where it is stored in the hard disk **14**, or downloaded from over the network **5**, for example. In S**2**, the file manager **11** judges whether the memory card **2** stores any data objects. If not (S**2**:NO), then the application is ended here.

[**0070**] On the other hand, if the memory card **2** stores data objects (S**2**:YES), then in S**3** the file manager **11** loads the data objects from the memory card **2** one at a time into the RAM **13**. In S**4**, the program manager **14** determines the presently selected layout and order for display of thumbnails to represent the data objects. In the present example, the line layout is set as the default layout, and file name is set as the default order. The program manager **14** then pulls the appropriate layout/order template from the layout/order template stock **15** and stores the layout/order template in the RAM **12**. The program manager **14** writes the template on the file manager **11**, thereby applying the template to each data object in the file manager **11**.

[**0071**] In S**5**, the file layout/order manager **12** draws a data view for the thumbnails **23** according to the presently selected layout and order, and controls the display **2** to display the thumbnails accordingly.

[**0072**] Each thumbnail **23** is displayed as soon as retrieved by the file manager **11**, and during the loading process the thumbnails are dynamically arranged on the screen according to the presently selected layout. That is, as shown in **FIG. 11, a** thumbnail **23***c* of the first-loaded data object is displayed at the upper left corner of the screen **21** and then moved to the center of the screen **21**. The focus outline **24** is displayed surrounding the thumbnail **23***c* in a size that matches the dimensions of the thumbnail **23***c*.

[**0073**] As shown in **FIG. 12, a** thumbnail **23***d* of the second-loaded data object is similarly displayed at the upper left corner and then moved to the center of the screen **21**. At this time, the first thumbnail **23***c* moves slightly to the lower left of center. Once the thumbnail **23***d* is centered in the screen **21**, it is displayed surrounded by the focus outline **24** to indicate that the thumbnail **23***d* is the currently selected thumbnail. In this way, the center thumbnail is always designated as the focus of user input. As shown in **FIGS. 13 and 14**, this process continues until all the data objects have been loaded from the memory card **2** into the file manager **11**. The user need not wait for all data objects to be loaded, but can begin browsing through the thumbnails while the remaining data objects are being loaded.

[**0074**] During and after the loading process, the layout/order manager **12** controls the display **3** to move the thumbnails in the line layout dynamically with a reciprocal pivoting motion, based on the oscillation of a pendulum. The center of the focus thumbnail **25** serves as the unmoving axis of the pivoting movement. In **FIG. 15**, the positions of thumbnails while at one extreme of the pivoting motion are indicated in solid line and the positions of thumbnails while at the other extreme are indicated in dotted line. The reciprocal pivoting motion exposes most or all of each thumbnail over a short period of time, so that the viewer can gain a better grasp of each displayed thumbnail. For example, as the thumbnail line swings back and forth, lower right and left sections **23***f*', **23***f*'' of a thumbnail **23***f* are alternately exposed. It should be noted that all the other layouts except the grid layout also move dynamically to reveal most or all of each thumbnail in time.

[**0075**] This movement of the thumbnail layout also informs the user that the thumbnail can be interacted with in a dynamic manner. For example, the user can choose to change the layout or order of the thumbnails (S**6**), to look closer at the data object that is presently selected (S**7**), or to browse through the thumbnails (S**8**).

[**0076**] If the user wishes to browse through the thumbnails (S**8**:YES), then in S**9** the program manager **14** receives browsing input from the user. In S**10**, the layout/order manager **12** controls the display **3** to adjust how the thumbnails **23** are displayed, according to the browsing input from the user. In S**11**, the layout/order manager **12** continuously adjusts display screen of the display **3** as long as input is received from the user. Once the user stops providing browsing input (S**11**:NO), then the routine returns to S**6**.

[**0077**] When the browsing input is singular in nature, such as from pressing an arrow key on a keyboard once, then this indicates that the user wishes to change the selected thumbnail **25** to the thumbnail adjacent to the current selected thumbnail, that is, the thumbnail either prior or subsequent to the center thumbnail in the displayed thumbnail train. As a result, the layout/order manager **12** controls the display **3** to smoothly shift the thumbnail in the thumbnail train one position in the direction that moves the indicated adjacent thumbnail to the center of the screen. Although the focus outline **24** remains generally at the center of the screen **21**, it can also be moved slightly toward the adjacent thumbnail as the adjacent thumbnail is shifted toward center, to further increase the smooth flowing movement of the displayed layout.

[**0078**] When the browsing input is continuous in nature, such as when the user continuously holds down an arrow key, then the layout/order manager **12** controls the display **3** to continuously stream the thumbnails train through the focus outline **24** on the screen **21**. This enables the user to browse through the thumbnails of all the loaded data objects, even when the memory card **2** stores a great number of data objects, so that not all thumbnails can be displayed on the display **3** at the same time.

[0079] In the case of the circle layout, the displayed circle of thumbnails rotates so that the thumbnails **23** in the loop move through the focus outline **24**. This allows the user to browse in a circular manner. The user does not have to be conscious of the beginning or end because they are linked. As mentioned above, when the ring can include a large number of thumbnail, then only a portion of the thumbnails are displayed at one time in an arc as shown in **FIG. 2**. In this case, the displayed thumbnails **23** are sequentially moved on and off the display during the browsing operation, thereby constantly changing the thumbnails presently being displayed.

[0080] In the case of the grid layout, all the thumbnails **23** remain in the same position with respect to each other during the browsing operation. When the user input indicates horizontal scroll, then as shown in **FIG. 16** the entire grid is moved in a zigzag pattern across the screen **21** as indicated by arrow P. Although the grid is actually configured with the same or smaller width than the screen **21**, the width of the grid is shown larger than the width of the screen **21** in **FIG. 21** to facilitate understanding. This moves the thumbnails **23** of separate rows through the focus outline **24** in a flowing motion. Rows are followed one after the other in succession starting from the same end of each successive row. As with the line layout, the focus outline **24** moves slightly to meet the next thumbnail in the train. When the user input indicates horizontal scroll, the thumbnails **23** in the column that includes the focus thumbnail **25** are moved through the focus outline **24** one at a time. Because the horizontal dimension of the grid is set to a number thumbnails that can be displayed all at one time, that is, to five thumbnails in the present embodiment, browsing is simpler for the user, because he needs to think basically in a single dimension, rather than in two dimensions as would be the case if the grid were made larger in the horizontal direction. As a result, the user browses mainly in the vertical direction during the grid layout.

[0081] In the case of the helix layout, when the user input indicates horizontal scroll, the helix spirals vertically in order to move the thumbnails **23** through the focus outline **24**. The amount that the helix screwingly rotates depends on the number of thumbnails **23** scrolled. When more than a few thumbnails are scrolled in succession, then as shown in **FIG. 17** the rotating helix is displayed in a contracted shape by reducing the radius of the helix and the inter-thumbnail distance, while the thumbnails **23** flow through the focus outline **24**. When the continuous browsing input continues for longer than a certain duration of time, then the speed at which the thumbnails **23** move is accelerated. At this time, the display of the thumbnails **23** is adjusted to match the browsing speed. For example, the helix of the helix layout is displayed to contract with increase in browsing speed and expand with decrease in browsing speed. This visual change increases the user's awareness that the browsing speed has changed. The display of the circle layout is similarly contracted and expanded based on the duration and speed of browsing.

[0082] Returning to **FIG. 4**, when the user input indicates vertical scroll through the helix, the entire helix is shifted vertically by one pitch D, that is, by one inter-ring distance, without rotating. As a result, the present focus thumbnail **25** is shifted out of the focus outline **24**, and the largest-scale thumbnail of the upper or lower adjacent ring, depending on the direction of scroll, is shifted into the focus outline **24**. In the example shown in **FIG. 4**, when the user input is for moving the vertically by a single thumbnail, the helix is shifted downward by one pitch D so that the thumbnail **25'** of the ring **35*b*** shifts out of the focus outline **24** and the thumbnail **25"** of ring **35*a*** shifts into the focus outline **24**. Because jumping to an adjacent ring in this way skips over the interposing ten thumbnails, the user can browse through more thumbnails much more rapidly than in the other layouts. Furthermore, with each jump, the ten thumbnails of another ring are brought into the range of the screen **21**.

[0083] When the user wishes to change the layout or order of the thumbnails (S6:YES), then the routine proceeds to S**20** of the flowchart of **FIG. 8**. In S**20**, the layout or order selected by the user is determined. In S**21**, the program manager **14** determines the rules for the newly selected layout or order, and pulls out the appropriate template from the layout/order template stock **15**. In S**22**, the program manager **14** applies the template to the data objects in the file manager **11**. In S**23**, the layout/order manager **12** creates a new display view, and controls the display **3** accordingly.

[0084] When the processes in S**21** to S**22** are performed to implement a new layout, the icon that represents the selected layout is shifted rightward to near the center bottom of the screen to indicate its selected condition. The icon of the preceding selected layout shifts leftward to the side to join the icons of the other non-selected layouts. This enables a user to easily know when he properly selected a layout icon. At the same time, the thumbnails **23** are repositioned from the preceding layout into the newly selected one.

[0085] For example, while the thumbnails **23** are being displayed in the line layout as shown in **FIG. 1**, when the user input indicates selection of the circle layout, the line layout icon **27*d*** and the circle layout icon **27*a*** move leftward and rightward respectively to switch positions, and the thumbnails **23** move into the circle layout, resulting in the display shown in **FIG. 2**. The actual movement of the icons is displayed. Also, actual movement is shown of the thumbnails from positions of the line layout into positions of the newly selected circle layout. This enables the user to know that the newly selected layout was properly implemented.

[0086] When the processes in S**21** to S**22** are performed to implement a new order, then in a manner similar to implementation of a new layout, the word that represents the newly selected order is shifted leftward to near the center bottom of the screen to indicate its selected condition. The word of the preceding selected order shifts rightward to the side to join the words of the other non-selected orders. At the same time, the thumbnails **23** are repositioned from the sequence of the preceding order into the sequence of the newly selected order.

[0087] In the example shown in **FIG. 18**, the user selects the type word **28*b*** while the thumbnails **23** are being displayed in name order. In the shown example, all of the thumbnails **23** are the same type except for a thumbnail **23*g***, which represents a music file instead of an image file like the rest of the thumbnails **23**. When type is selected for the order, then the thumbnail **23*g*** falls out of line and shifts to the lead position of the line. The previous lead thumbnail **23*h*** and other intervening thumbnails **23*i*** all shift back one inter-thumbnail distance to restore order to the line. Actual movement of the thumbnails is shown from positions of the

preceding order into positions of the newly selected order to enable the user to know for certain that the change in order was successful.

[0088] A user can get a closer look at a desired thumbnail by increasing the scale of the thumbnail in the focus outline **24** to a larger scale. When the user wishes to look closer at the data object that is presently selected (S7:YES), then the routine proceeds to S**30** of the flowchart of **FIG. 9**. In S**30**, input is received from the return key of the keyboard or equivalent input unit to indicate that the focus thumbnail **25** is selected. Then, as a result of S**31** to **33**, the screen appears as shown in **FIG. 19**. That is, in S**31** the layout manager **12** increases the scale of the focus thumbnail **25** in the focus outline **24** to a larger scale. In S**32**, the program manager **14** disables the layout and order interfaces **27**, **28** at the bottom of the screen **21**, and in S**33** enables a command interface **40** including icons **40***a* to **40***c*, which represent various application launchers. Arrows **40***d* are also displayed for indicating the icon of the application that will be launched when a command is received from the user. The user can change location of the arrows **40***d* by performing horizontal scroll operations. If the focus thumbnail **25** represents an audio file, then the program manager **14** plays the audio file when the focus thumbnail **25** is selected. If the focus thumbnail **25** represents a movie file, then the program manager **14** plays the movie when the focus thumbnail **25** is selected.

[0089] Next in S**34**, the user has the opportunity to use the command interface **40** to perform a variety of different processes on the selected data object. If the user does not wish to process the selected data object (S**34**:NO), then in S**35** user input to this effect is received, such as from the user again pressing the return key while the arrows **40***d* surround all of the icons **40***a* to **40***c*, which indicates that no particular application has been selected. In S**36**, the layout/order manager **12** reduces the thumbnail **25** back to the original small scale. Then the flow returns to S**6** or S**30**.

[0090] On the other hand, if the user wishes to process the selected data object (S**34**:YES), then the flow proceeds to S**40** shown in the flowchart of **FIG. 10**. In S**40**, the user selects what process he wishes to perform on the selected data object. For example, the user can select to launch an application relating to the selected data object, to edit the data object using an edit interface, or to bookmark the data object using a bookmark interface. When the user chooses to launch an application, then in S**41** the user selects the desired application. In S**42**, the program manager **14** accesses the operating system and launches the selected application. In S**43**, the file manager **11** transfers the selected data object to the launched application. In S**44**, the layout/order manager **12** reduces size of the focus thumbnail **25** to the original scale. In S**45**, the program manager **14** moves the launched application to the front. If the launched application is the one the user desired (S**46**:YES), the in S**47** the user uses the new application and this flow is ended. If not (S**46**:NO), then the flow returns to point S**6**.

[0091] When the application is closed, before completely stopping display of the thumbnails, the thumbnails are shown scattering off the screen, to stress that the application has been terminated.

[0092] Here, the layout/order templates for determining mutual position and movement of thumbnails in each layout will be described in more detail. The layout manager **14** also includes information for defining the focus outline **24** at a position at or near the center of the screen **21**. In templates for all layouts, the inter-thumbnail distance is set to a constant value of 64 pixels on the screen **21**.

[0093] With respect to the line layout, the thumbnails are aligned on a line separated by 64 pixels. The line extends to a length L, which equals the number n of thumbnails times the constant 64 pixels (L=64n).

[0094] The content of the layout/order template for producing the reciprocal pivoting motion of the thumbnail line will be described with reference to **FIG. 20**. It should be noted than the pivoting movement of the line layout continues even during browsing. The center of thumbnails and the center of filenames are aligned on different ones of lines **1** and **2**, separated from each other by the distance 64 pixels. The lines **1** and **2** are shown in **FIG. 20** at the extremes of the reciprocal pivoting movement. Movement of the lines **1** and **2** are defined using the following formulas:

$$\text{Line 1 } y = \sin\left(\frac{\pi}{2}t\right)(y - c_0) + c_1$$

$$\text{Line 2 } y = -\sin\left(\frac{\pi}{2}t\right)(y - c_0) + c_1$$

[0095] wherein x and y are coordinates on the display screen **21**;

[0096] t is time in seconds; and

[0097] c_0 and c_1 are the coordinates at the center of the screen **21**.

[0098] In the example of **FIG. 20**, c_0 represents the distance from the top of screen **21** to the center of the screen, and c_1 represents the distance from the right side of the screen **21** to the center of the screen. Angle θ shown in **FIG. 20** is determined using the following formula:

$$\theta = \frac{\pi}{2}t$$

[0099] The template for the circle layout will be explained with reference to **FIG. 21**. The radius r of the thumbnail and file name circles is determined based on the following formula:

$$r = \frac{64n}{2\pi}$$

[0100] The center of the thumbnail circle is determined based on the following formula:

$$(x_{\text{circle1}}, Y_{\text{circle 1}}) = (x_{\text{cent}}, Y_{\text{cent}} - r - 64)$$

[0101] The center of filename circle is determined based on the following formula:

$$(X_{\text{circle2}}, Y_{\text{circle 2}}) = (x_{\text{cent}}, Y_{\text{cent}} + r + 64)$$

[0102] The position of each thumbnail in the thumbnail circle is determined based on the following formula:

[0103]

$$(x_{1i}, y_{1i}) = \left(x_{circle1} + r\sin\left(\frac{2\pi}{n}i\right), y_{circle1} + r\cos\left(\frac{2\pi}{n}i\right)\right)$$

[0104] The position of each file name in the file name circle is determined based on the following formula:

[0105]

$$(x_{2i}, y_{2i}) = \left(x_{circle2} + r\sin\left(\frac{2\pi}{n}i\right), y_{circle2} - r\cos\left(\frac{2\pi}{n}i\right)\right)$$

[0106] Here, the template for displaying the helix layout will be explained with reference to **FIG. 22**. The x, y, and z coordinates of each thumbnail in the helix are determined based on the following formulas:

[0107]

$$x_1 = x_{cent} + r\sin\left(\frac{2\pi}{9}j\right) - \frac{r}{20}j$$

$$y_1 = y_{cent} + \frac{r}{10}j$$

$$z_1 = r - r\cos\left(\frac{2\pi}{9}j\right)$$

[0108] wherein i is a thumbnail number representing a target thumbnail of all the thumbnails. For example, to determine the position of a second thumbnail in the thumbnail train, the value of i is set to two. The value of j is determined by subtracting n from i (j=i−n), wherein n is the thumbnail number of the focus thumbnail. For example, if the target thumbnail is the focus thumbnail, then j would equal zero. The scale of each thumbnail **23** is determined based on its Z-axis coordinate.

[0109] Next, content of the templates for determining slide movement during browsing will be explained while referring to FIGS. **23**(*a*) to **25**. The example will be given for the situation shown in **FIG. 23**(*b*), wherein four thumbnails **231** to **234** are arranged in the line layout. The thumbnail **233** is the present focus thumbnail **25** as indicated in box a.

[0110] When the user input indicates to change the focus thumbnail to the next higher in the thumbnail line, that is, to the thumbnail **232**, then the layout/order manager **12** sets target positions D_i for the thumbnails **231** to **234** based on the thumbnail **232** being centered in the screen as the focus thumbnail **25** as shown in box b of **FIG. 23**(*b*). By comparing boxes b in FIGS. **23**(*a*) and **23**(*b*), it can be seen that the newly set target positions D_i of the thumbnails **231** to **234** are different from the present positions S_i. Therefore, the layout/order manager **12** gradually changes display of the thumbnails **23** as can be seen by comparing boxes c in FIGS. **23** (*a*) and **23**(*b*), until the target positions D_i match the actual positions S_i of the thumbnails **231** to **234** as shown in boxes d of FIGS. **23**(*a*) and **23**(*b*).

[0111] Next, a routine performed by the program manager **14** for changing the display of thumbnails in this manner will be described while referring to the flowchart in **FIG. 24**. This routine is performed each time the screen is updated. The screen is updated at a fixed interval of 30 times per second. First in S**50**, the focus thumbnail **25** is changed by input from the user. It should be noted that if no input is received from the user to change the focus thumbnail **25**, then this routine is ended here. Then in S**51**, a thumbnail number i in a counter is set to one. The thumbnail number i indicates a present thumbnail under consideration.

[0112] In S**52**, the target position D_i of the ith thumbnail is set based on the new focus thumbnail selected in S**50**. It should be noted that the target position D_i is also set based on the present layout. For example, if the present layout is the helix layout, then the target position D_i will be a position somewhere on the helix shape defined by the helix layout template. This is true for all the layouts.

[0113] In S**53**, a new position S_{inew} for the ith thumbnail is calculated based on the ith thumbnail's present position $S_{ipresent}$ and the target position D_i. The new position S_{inew} is determined based on the following formula:

$$S_{inew}=S_{ipresent}+((D_i-S_{ipresent})/5)$$

[0114] That is, as shown in **FIG. 25**, the distance between the ith thumbnail's present position $S_{ipresent}$ and the target position D_i is divided into five segments. The new position S_{inew} is set to a position one fifth the distance from the present position $S_{ipresent}$.

[0115] Then, in S**54** the thumbnail number i is incremented by one to change focus of the routine to the next thumbnail in the thumbnail train. Once the routine has been performed for all the thumbnails in the thumbnail train (S**55**:YES). then this routine is ended.

[0116] As a result of repeated runs of this routine, the thumbnails will eventually reach their target positions. Because of the process in S**53**, the thumbnails will move quickly at first, and then reduce speed as they approach their new target positions in a type of movement commonly referred to as "easing in." This gives the effect that the thumbnails settle into their new target positions.

[0117] As mentioned above, the focus outline **24** moves slightly to greet the next thumbnail in the thumbnail train during browsing operations. The templates include information for displaying this motion.

[0118] **FIGS. 26 and 27** show an example of how thumbnails that represent audio files are visually displayed based on size and content of the audio files. As shown in **FIG. 26, a** music file **54** includes file information **54***a* and music data **54***b*. The file information **54***a* includes title of the song, the artist's name, and the playing time. To produce a thumbnail for the music file **54**, first a portion of the music data is retrieved. The amount of data retrieved at this time depends on the size of the music file, that is, if the music file is large, then a great deal of data is retrieved. The retrieved data is divided into sections. In the present example, it will be assumed that the retrieved data is divided into 300 sections. Each section has three 16-bit sets. In the example of **FIG. 26** one representative section has the three 16-bit sets of 0f 7e

57 in hexadecimal notation. The 16-bit sets in each section are used to define one of 256 possible color gradations for each of red, green, and blue colors. In the example of **FIG. 26**, the 16-bit sets of 0f, 7e, and 57 are used to determined gradations of red, green, and blue respectively.

[0119] The thumbnail for the audio file is divided into the same number of sections as the retrieved music data, that is, into 300 sections in this example, by dividing a thumbnail into 300 sections (15×20). The color gradations determined by the three 16-bit sets of each section are used to display color in the corresponding section of the thumbnail as shown in the second square from the top in **FIG. 26**. Once RGB values for all sections of the display have been determined, then borders between display sections are blurred as shown in the third square from the top in **FIG. 26**. Then various file information is superimposed in capital letters over the blurred image as shown in the bottom square in **FIG. 26**.

[0120] As shown in **FIG. 27**, the number of display sections is increased or decreased depending on the size of the corresponding data file. That is, thumbnails for large data files are displayed with many sections, and thumbnails for small data files are displayed with few sections.

[0121] While the invention has been described in detail with reference to specific embodiments thereof, it would be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention, the scope of which is defined by the attached claims.

[0122] For example, the embodiment described data objects being loaded from a memory card into a computer. However, the memory card can be replaced by any local storage device, such as flash memory, recordable media, hard disk, or CD-ROM. Alternatively, data objects can be provided over a networked server, or from any combination of local memories and networks.

[0123] Further, data objects could be transferred via a network protocol by using a standalone application or browser applet. Such a configuration could be used as an on-line multimedia photo album, wherein a user uploads data-objects to a server, and others browse the data-objects from remote terminals. Alternately, the user's computer itself could be used as a server.

[0124] When the data objects are provided from a CD-ROM, then in this case also the data objects can be loaded from the CD-ROM into the file manager automatically upon insertion of the CD-ROM into the computer. However, as shown in **FIG. 28**, all executable applications, such as for performing the loading operation, for displaying the thumbnail according to the selected layout, and changing display of the thumbnail and graphical icons when a different layout is selected, must be provided on the CD-ROM.

[0125] This contrast to the case of a memory card. As shown in **FIG. 29**, executables are provided in the computer's hard disk or over a network. Use of a memory card is preferable because the executables can be used with many different data files, not just those on the memory card. Also, the executables can be upgraded independently of the data files. Further, although an application run from either a CD-ROM or a memory card becomes the front-most application, other applications are inaccessible in the case of CD-ROM, but are accessible in the case of memory card.

[0126] Although the embodiment describes launching an application in **S41** for a single data object, an application could be launched for more than one data object. For example, the user can bookmark several thumbnails using the bookmark interface, and then launch the application for all of the book marked thumbnails.

[0127] The layout interface **27** uses icons to represent layouts, and the order interface **28** uses words to represent orders. However, any indicia can be used to represent layouts and orders.

[0128] Although the embodiment described layouts and orders as being predetermined, the computer could be modified to enable a user to define new layouts and orders. New layouts can be defined using a visual programming function that a user uses to position and size a series of thumbnails or other data object representatives in a repeatable pattern. Such new layouts can be shared and distributed through a plug-in architecture. New orders can be defined by the user simply adding a new file attribute to the list of order parameters. Search criteria could also be stored and used as order parameters.

[0129] In the embodiment, thumbnails and the overall layout are displayed in the same manner regardless of the selected order. However, the thumbnails and layout could be displayed in a manner dependent on the selected order. For example, when file size is chosen as the order, then as shown in **FIG. 30** each thumbnail can be displayed in a size relative to the overall range of sizes for the data objects. In two-dimensional layouts, such as the grid, line, and circle layout, the thumbnail need only be scaled in X and Y directions. However, since scaling is used as a part of three dimensional layouts, that is, the helix layout, a thumbnail's relative size can be represented by adding isometric dimensionality or "thickness" to the thumbnail.

[0130] When time is chosen as the order, the sequence or pattern of how thumbnails are displayed can be varied based on how close together the data objects are in time. For example, the time between two data objects can be represented by varying the space between two thumbnail. In the example shown in **FIG. 31**, data objects represented by thumbnails **23*m*** and **23*n*** are separated by a relatively short time, so the thumbnails **23*m*** and **23*n*** are displayed separated by a relatively short distance SD. Data objects represented by thumbnails **23*o*** and **23*p*** are separated by a relatively long time, so the thumbnails **23*o*** and **23*p*** are displayed separated by a relatively long distance LD.

[0131] Alternately, thumbnails can be grouped together, and the groups separated from each other, as shown in **FIG. 31** depending on how close in time the thumbnails are. For example, if a collection of images were taken, or a set of files were created, all within a certain time span, then the images or files from that time span can be grouped together, and separated from other groups when there is a significant time gap between the images or files of other groups. In the example shown in **FIG. 32**, digital photos that are taken less than 15 minutes apart are placed in the same group, and different groups are displayed encompassed by lines **55*a*** to **55*d***. That is, photos taken more than 15 minutes apart are put into a separate groups. Such groups could alternately be indicated using different colors or text labels.

[0132] A more sophisticated algorithm can take into account overall image taking frequency, total elapsed time,

and image criteria to adjust the groupings dynamically. Examples of how image taking frequency, total elapsed time, and image criteria can be used to adjust grouping will be given for the situation of taking images with a digital camera.

[0133] Image taking frequency can be measured by determining the time intervals between all images taken, finding the average interval, and comparing each time interval with the average interval. Whether images have a time interval greater or less than average can be used as a weighting factor for determining whether or not thumbnails should be displayed in different groups.

[0134] Total elapsed time refers to the entire duration of time from when the first image was taken to when the last image was taken. The standard time difference used to determine what thumbnails are grouped together can be varied depending on the elapsed time. For example, if only an hour has elapsed since the first image was taken, then the standard time difference might be set to ten minutes. However, if 10 hours has elapsed, then the standard time difference might be set to one hour.

[0135] Image criteria refers to using certain criteria, such as brightness level, color, and pattern recognition of images, to determine whether images should be grouped together or not. Each image is analyzed for certain criteria, and thumbnails for images sharing the same characteristics are grouped together.

[0136] Any dynamic element, such as icons, can be used instead of thumbnails to represent the data objects. However, thumbnails are preferable to icons, because the thumbnail is the essence of the data object itself. For example, when the thumbnail is a depiction of an image, the thumbnail is the essence of the image itself in a smaller size. An icon is a generic representation of a file type, in which case all of the same type of image would have the same icon.

[0137] The outline **24** need not be provided for indicating the focus thumbnail **25**, which is the focus of operations induced by input from the user. The focus thumbnail **25** can be designated merely by placement in a focus region, without displaying the focus outline **24** itself.

[0138] In the embodiment, the application is launched when the memory card **2** is inserted into the slot **2***a*. However, the application can be launched when the memory card **2** is selected based on input from the user input unit **4**.

[0139] In the embodiment, the same application is launched when any memory card is selected or inserted. However, different applications can be launched depending on the data in the memory card or the type of memory card, or to launch an application only for certain memory cards.

[0140] Although the embodiment described the system as being user controlled, the system could also be autonomous. For example, a slide show mode can be provided for randomly presenting thumbnails, automatically without user control. This is similar to a slide show program that randomly displays images in a certain folder. The slide show mode can be initiated automatically in the manner of a screen saver mode after a period of in-action by the user. The user can easily interrupt the screen saver mode by taking any action. It would also be possible for the user to directly initiate this slide show function.

What is claimed is:

1. A device for managing data objects, comprising:

displaying means for displaying thumbnails representative of data objects;

defining means for defining a focus region that indicates a focus thumbnail subject to processes;

moving means for moving the displayed thumbnails along a predetermined path through the focus region; and

enable/disable means for selectively enabling and disabling the moving means, the displaying means statically displaying a single thumbnail in the focus region when the enable/disable means disables the moving means, the displaying means displaying the thumbnails to move along the predetermined path through the focus region when the enable/disable means enables the moving means.

2. A device as claimed in claim 1, wherein the displaying means displays the thumbnails in partial overlap with sections of each thumbnail exposed, and changes relative position of thumbnails to change exposed sections of thumbnails while the enable/disable means enables the moving means.

3. A device as claimed in claim 1, wherein the displaying means displays the thumbnails in partial overlap, and changes overlapping sections of thumbnails while the enable/disable means disables the moving means.

4. A device as claimed in claim 1, wherein the displaying means further displays an interface portion with a plurality of indicia, and further comprising selection means for selecting one of the indicia of the interface portion.

5. A device as claimed in claim 4, wherein the indicia include a plurality of layout indicia each representing one of a plurality of layouts, the displaying means displaying the thumbnails in relative positions, and the moving means moving the thumbnails along a predetermined path, in accordance with the layout indicium selected by the selection means.

6. A device as claimed in claim 5, wherein the displaying means further displays file names of files containing the data objects of the thumbnails, the displaying means displaying the file names in a pattern that is inverse a pattern formed by the thumbnails.

7. A device as claimed in claim 5, wherein:

the displaying means displays the selected layout indicium at a present layout position to indicate presently displayed layout of the thumbnails; and

when the selection means newly selects a layout indicium, the displaying means displays movement of the newly selected layout indicium to the present layout position and movement of a preceding selected layout indicium out of the present layout position.

8. A device as claimed in claim 5, wherein:

the layout indicia include a line indicium; and

when the selection means selects the line indicium, the displaying means displays the thumbnails in a line layout with the thumbnails aligned in partial overlap in a line.

9. A device as claimed in claim 8, wherein the displaying means displays the thumbnails in the line layout with a

reciprocal pivoting motion, the focus thumbnail serving as an unmoving axis of the pivoting movement.

10. A device as claimed in claim 5, wherein:

the layout indicia include a circle indicium; and

when the selection means selects the circle indicium, the displaying means displays the thumbnails in a circle layout with the thumbnails disposed in partial overlap in a circular ring.

11. A device as claimed in claim 10, wherein, when number of thumbnails exceeds a predetermined number, the displaying means displays a portion of the thumbnails in an arc with a predetermined radius and the moving means sequentially changes displayed thumbnails while enabled.

12. A device as claimed in claim 5, wherein:

the layout indicia include a grid indicium; and

when the selection means selects the grid indicium, the displaying means displays the thumbnails in a grid layout with thumbnails aligned with fixed mutual positions in rows and columns.

13. A device as claimed in claim 12, wherein:

the displaying means displays the thumbnails in the grid layout in rows having a length that can be completely displayed at once; and

when the enable/disable means enables the moving means, the moving means moves the thumbnails of a single column through the focus region.

14. A device as claimed in claim 12, wherein the moving means when enabled moves the thumbnails in the grid layout through the focus region one row at a time in succession, starting from the same end of each successive row.

15. A device as claimed in claim 5, wherein:

the layout indicia include a helix indicium; and

when the selection means selects the helix indicium, the displaying means displays the thumbnails in a helix layout that mimics a side view of a helix by displaying thumbnails at a far side of the helix in a smaller scale than thumbnails at a near side of the helix.

16. A device as claimed in claim 15, wherein the displaying means displays the thumbnails in the helix layout to mimic a helix with a shorter radius when the enable/disable means enables the moving means than when the enable/disable means disables the moving means.

17. A device as claimed in claim 15, wherein the displaying means displays movement of the thumbnails in the helix layout through the focus region by displaying spiral movement of the helix.

18. A device as claimed in claim 15, wherein the displaying means displays movement of the thumbnails in the helix layout through the focus region by shifting the helix one pitch distance to move the present focus thumbnail out of the focus region and to move a thumbnail of an adjacent ring of the helix into the focus region.

19. A device as claimed in claim 5, wherein, when the selection means selects a new layout indicium that is different from a preceding selected layout indicium, the displaying means repositions the thumbnails into a new layout that corresponds to the new layout indicium while displaying the thumbnails moving toward and into positions of the new layout.

20. A device as claimed in claim 4, wherein the indicia include a plurality of order indicia each representing one of a plurality of predetermined sequence orders, the displaying means displaying the thumbnails in an order represented by an order indicium selected by the selection means.

21. A device as claimed in claim 20, wherein:

the displaying means displays the selected order indicium at a present order position to indicate present order of the thumbnails; and

when the selection means newly selects an order indicium, the displaying means displays movement of the newly selected order indicium to the present order position and movement of a preceding selected order indicium out of the present order position.

22. A device as claimed in claim 20, wherein, when the selection means selects a new order indicium that is different from a preceding selected order indicium, the displaying means repositions the thumbnails according a new order that corresponds to the new order indicium, while displaying movement of the thumbnails into positions appropriate for the new order.

23. A device as claimed in claim 20, wherein:

the order indicia include a time indicium; and

when the selection means selects the time indicium, the displaying means displays the thumbnails in groups according to when the corresponding data objects were produced.

24. A device as claimed in claim 20, wherein:

the order indicia include a time indicium; and

when the selection means selects the time indicium, the displaying means displays the thumbnails separated by distance corresponding to time between when the corresponding data objects were produced.

25. A device as claimed in claim 4, wherein the indicia include a plurality of application indicia each representing one of a plurality of applications, and further comprising an application launcher that launches an application that corresponds to the application indicium selected by the selection means.

26. A device as claimed in claim 1, further comprising further request means for indicating desire for further information on data object that corresponds to the focus thumbnail, the displaying means enlarging display of the focus thumbnail when the further request means indicates a desire for further information.

27. A device as claimed in claim 26, wherein the displaying means displays application indicia representing software applications when the further information request means indicates a desire for further information on the data object of the focus thumbnail.

28. A device as claimed in claim 1, wherein the displaying means displays thumbnails of audio data objects for audio contents based on data of the audio data object.

29. A device as claimed in claim 28, wherein the displaying means displays thumbnails of audio data objects according to amount of data in the audio data object.

30. A device as claimed in claim 28, wherein the displaying means displays thumbnails of audio data objects according to content of data in the audio data object.

31. A device as claimed in claim 1, further comprising:

retrieval means for retrieving data objects from a memory card; and

recognition means for recognizing presence of a memory card and activating the retrieval means when a memory card is present.

32. A device as claimed in claim 31, wherein the displaying means displays thumbnails one at a time in a sequence that the retrieval means retrieves the data objects from the memory card.

33. A device as claimed in claim 1, further comprising search means for searching to find thumbnails that meet certain criteria, the displaying means displaying only thumbnails found by the search means.

34. A device as claimed in claim 1, wherein when the enable/disable means enables the moving means, the moving means determines a target position for each thumbnail, and moves the thumbnails to their respective target positions in an easing-in movement.

35. A device as claimed in claim 1, wherein the displaying means displays the thumbnails in a line layout with the thumbnails aligned in partial overlap in a line.

36. A device as claimed in claim 1, wherein the displaying means displays the thumbnails in a circle layout with the thumbnails disposed in partial overlap in a circular ring.

37. A device as claimed in claim 1, wherein the displaying means displays the thumbnails in a grid layout with thumbnails aligned with fixed mutual positions in rows and columns.

38. A device as claimed in claim 1, wherein the displaying means displays the thumbnails in a helix layout that mimics a side view of a helix by displaying thumbnails at a far side of the helix in a smaller scale than thumbnails at a near side of the helix.

39. A method for managing data objects, comprising the steps of:

displaying thumbnails representative of data objects;

defining a focus region that indicates a focus thumbnail subject to processes; and

selectively displaying a single thumbnail in the focus region, and displaying the thumbnails moving along a predetermined path through the focus region.

40. A program storage medium for storing data of a program indicative of a process for managing data objects, the program comprising:

a program for displaying thumbnails representative of data objects;

a program for defining a focus region that indicates a focus thumbnail subject to processes; and

a program for selectively displaying a single thumbnail in the focus region, and displaying the thumbnails moving along a predetermined path through the focus region.

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