(12) PATENT **(11)** Application No. **AU 199721297 B2**
(19) AUSTRALIAN PATENT OFFICE **(10)** Patent No. **723085**

(54) Title
Video viewing experiences using still images

(51)[7] International Patent Classification(s)
H04N 007/15 **H04N 005/30**

(21) Application No: **199721297** (22) Application Date: **1997.02.20**

(87) WIPO No: **WO97/31482**

(30) Priority Data

(31) Number	(32) Date	(33) Country
012033	**1996.02.21**	**US**
742684	**1996.10.31**	**US**

(43) Publication Date : **1997.09.10**
(43) Publication Journal Date : **1997.11.06**
(44) Accepted Journal Date : **2000.08.17**

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(56) Related Art
US 5444476
US 5432871
US 5682511

OPI DATE 10/09/97 APPLN. ID 21297/97
AOJP DATE 06/11/97 PCT NUMBER PCT/US97/02530
AU9721297

INTER

(51) International Patent Classification 6 : H04N 7/15, 5/30

A1

(11) International Publication Number: WO 97/31482

(43) International Publication Date: 28 August 1997 (28.08.97)

(21) International Application Number: PCT/US97/02530

(22) International Filing Date: 20 February 1997 (20.02.97)

(30) Priority Data:

012,033	21 February 1996 (21.02.96)	US
742,684	31 October 1996 (31.10.96)	US

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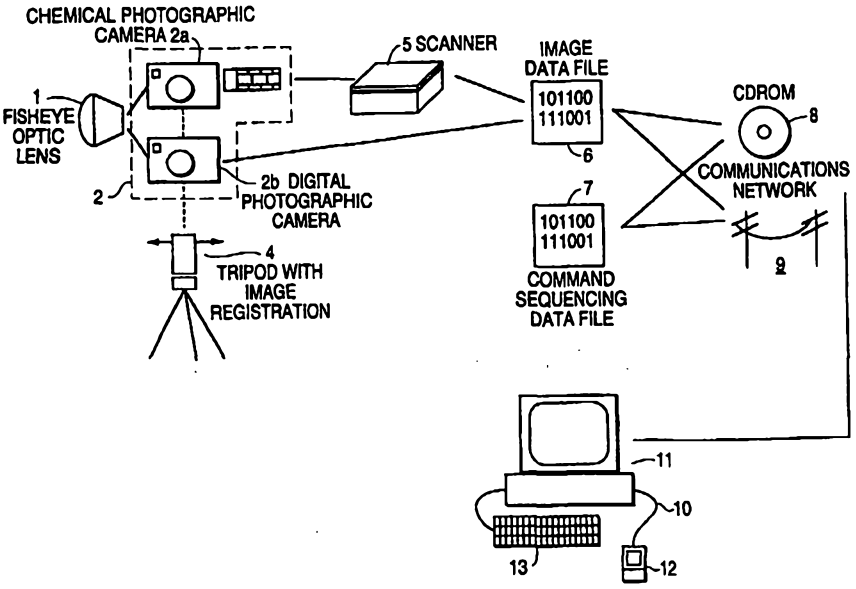
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published

With international search report.

AUSTRALIAN PATENT OFFICE 92 BIS 6/11/97

(54) Title: VIDEO VIEWING EXPERIENCES USING STILL IMAGES



(57) Abstract

A method and apparatus for sequencing views retrieved from a spherical still image file (6) provide the viewer the perception of video performance with low bandwidth transmission. The method incorporates digital transmission (9) and automatic sequencing (7) of the playback of the view. The apparatus provides video-motion rate images via low bandwidth digital transmissions or small data files from a still image taken of an inanimate environment. The resulting method and apparatus allows the viewer to experience a video display of any environment (for example, real estate locations, malls, museums, and hotels) and view a "video" tour of the location through a low bandwidth transmission.

VIDEO VIEWING EXPERIENCES USING STILL IMAGES

Field of the Invention

The invention relates to an apparatus and method which allows still spherical or high resolution flat images to be used to provide a moving tour through the image that creates a perception of experiencing a video presentation.

Background of the Invention

Live video images can undergo pan, tilt, rotate, and magnify operations via an affine transformation algorithm as documented patented in U.S. Patent No. 5,185,667, assigned to the same assignee as this disclosure. This method captures a live video or still photographic image, removes the distortion associated with the lens optics, and reconstructs a portion of the image that is of interest based on operator requests for pan, tilt, rotation, and magnification. One application of the dewarping technique disclosed by this patent is the dewarping of hemispherical images. The capturing and dewarping of hemispherical images is disclosed in greater detail in U.S. Patent No. 5,185,667, expressly incorporated herein by reference. The ability to simultaneously distribute these images and allow multiple users to independently view the image in any desired direction is documented and patented in U.S. Patent No. 5,384,588, assigned to the same assignee as this disclosure and, hereby, incorporated by reference.

Another patent which may be of reference for various parts of the invention described in greater detail below is U.S. Patent No. 5,990,941 entitled "Method and Apparatus for the Interactive Display of Any Portion of a Spherical Image" of Laban Phelps Jackson, Alexis S. Pecoraro, Peter Hansen, Martin L. Bauer, and H. Lee Martin.

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Video images, as described in each of the above-referenced patents, require approximately 30 frames per second to appear as a real-time video image. Unfortunately, a problem with real-time video rates is the great amount of memory and processing speed required to display these images. Alternatively, if a user wanted to download a real-time video clip from a distant source via a modem (for example, a bulletin board system or a global network of computers), the user must have a high speed modem with a wide bandwidth (for example, a minimum 128 kps ISDN line or a T1 or a T3) with a relatively powerful computer to download these images and display them in real-time. As most users do not have high speed modems or relatively power computers, not to mention, a bandwidth capable of handling real-time videos, most users are at a disadvantage. Even compressing the video data fails to achieve good results.

Other techniques of transmitting images include transmitting a single still image after single still image. This saves bandwidth but is no more exciting than watching a slide presentation with someone else operating the slide projector. This is because the viewer is presented with a bland, static, two-dimensional image.

In a different field of endeavor, a technique is known in the robotics industry which is known as "teach/playback". The "teaching" mode of a "teach/playback" technique relates to the recording of a series of movements of a user controlled device. Later, in the "playback" mode, the recorded movements are played back for subsequent purposes. An instance of the "teach/playback" technique is in the automotive industry where a robot operator "teaches" a robotic system how to perform a complex series of tasks involving various manipulations. For example, the robotic system may be taught how to weld portions of a car's body panels to a car's frame. In the playback mode, the robotic

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system repeatedly follows its memorized commands and welds body panels to frames as per its instructions. The "teach/playback" technique of programming manipulative systems has its drawbacks. For instance, systems operating under a "teach/playback" technique are inherently limited to perform only the recorded instructions.

It is an object of the present invention to at least partly address these and other problems associated with the prior art.

Summary of the Invention

Accordingly the invention provides a device, apparatus and method for sequencing images from an image data file in a sequence controlled by sequencing data or user input to produce sequenced output images.

Preferred embodiments of the invention allow a multiplicity of predetermined paths to be followed faithfully in such a way as to be replicable. Preferred embodiments of the invention are adapted to address the problems associated with the transmission of sequenced images (i.e. video) over small bandwidth connections, by using a sequence of move commands on the still spherical image data file or a flat equivalent image data file or a substantial portion of either to imitate a video of an environment or object. Additionally, embodiments of the invention allow the user to take control of the viewing direction giving a new dimension to interactive television, namely, personalized control of what is viewed.

Preferred embodiments of the invention incorporate features which:

- provide a user experience that appears to be video, but

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which uses spherical still images with sequencing instructions as its command file;

- provide imaging experience using digital files that can be bundled with other files to present a multimedia experience;

- provide a continuation viewing experience by decompressing the next image to be viewed (and audio files to be heard) while displaying current image and playing a current audio file;

- allow the user to interrupt the "video" sequence at any time and take control of the viewing direction and magnification;

- allow the data required for this viewing experience to reside in a remote location and be downloaded to one or many users simultaneously (or sequentially, or as requested) via telecommunication networks including at least local area networks, wide area networks, global area networks, satellite networks and other related networks by means of satellite downloading, modem downloading, broadcast downloading or other equivalent downloading means;

- provide the ability to magnify, pan, tilt, zoom, and rotate the image via a simple user interface;

- provide the ability of panning, tilting, zooming, and rotating with simple inputs made by an unskilled user through standard input means including joysticks, keyboard, mice, touchpads, or equivalent means;

- simultaneously display the multimedia experience for a plurality of users through common downloaded or

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broadcast information, allowing all to be sequenced at the same time or to be user controlled in different directions in any of an infinite number of directions as selected by the users.

Embodiments of the invention preferably operate so that, upon execution of a predetermined instruction set, a viewer is presented with a moving tour of a hemispherical/spherical image. At any time, the viewer may take control of the tour of the displayed image and explore the image on his own. By using a high resolution static image, the display of a high quality video image at real-time video rates (30 frames per second) is achieved. The result is obtained with only a fraction of the data needed to accomplish the same result as compared to compressed video data. Where a video sequence for 10 seconds of operation would require 300 separate images, the subject invention requires only one image with a limited number of sequencing commands to drive the presentation.

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EDITORIAL NOTE

No. 21297/97

This specification does not contain pages numbered 6 and 7.

The omnidirectional viewing system produces the equivalent of pan, tilt, and zoom within a spherical digitized photograph or sequence of digital images (digital video), or subset thereof, with no moving parts. This invention can also pan, tilt and magnify portions of a high resolution image, only revealing those portions of the image presently of interest to the user.

The small data capacity required for this form of presentation results from the fundamental data source comprising a still image that is time sequenced through its motion by simple ASCII text commands that are automatically interpreted in the running program. In one preferred embodiment, the ASCII command file is generated by the recording of an operator's viewing of a displayed image. In an alternate embodiment, the operator directly feeds commands into an text file which later controls the viewing of the still image.

The disclosed system includes a means for receiving a digital file that is composed of two hemispherical fisheye images or a single high resolution digitized image, receiving a second command file consisting of the sequence of viewing directions used to animate the still image to provide the perception of video, transforming a portion of said image based upon command file operations or user commands, and producing a continuous sequence of output images that are in correct perspective for viewing. The collection of commands used to control what a view initially sees are stored in a command sequencing data file. A user can exit from the displays control by the commands stored in the command

sequencing data file and, when finished, return control to the command sequencing data file.

The resulting display provides a perception of a video image sequence even though the source data may only be composed of a digitized still photograph. In one preferred embodiment, the transmitted image is produced by a combination of two fisheye photographic images which provides a spherical data set from which to extract the sequenced field-of-view. This image data is augmented with a command file that determines the sequence of images to be displayed from the image file in such a way as to provide the appearance of a video image to the output display. These incoming data files, image and command, are captured into an electronic memory buffer and the image file is transformed to the display as directed by the command file or by the user if the command file is interrupted. The image transformation is performed computationally by a microprocessor common in many personal computer systems. Additionally, related computational devices may be used including co-processors, dedicated computers, ASICs, and equivalents thereof. The display of the sequenced image is accomplished in a window on a common computer monitor. Additionally, the display systems may include LCD's, CRT's, overhead projection devices, projection screen displays and equivlaents thereof. The experience provided by the method and apparatus can be augmented with the inclusion of audio to allow the

resulting output on a "multi-media" personal computer to be similar to that of standard television.

A portion of the captured image containing a region-of-interest is transformed into a perspective correct image by image processing computer means and sequenced by the command file or by direct intervention of the user. The image processing computer provides direct mapping of the image region-of-interest into a corrected image using an orthogonal set of transformation algorithms. The viewing orientation is designated by a command signal generated by either a human operator or computer sequenced input.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a schematic block diagram of the present invention illustrating the major components thereof.

Figure 2 shows the user interface for the user control of the viewing direction and magnification.

Figure 3 shows the command file for a simple sequence.

Figure 4 shows a typical sequence as it might be viewed from the command file of Figure 3.

Figure 5 shows the sequence of Figures 3 and 4 in a hemispherical image.

Figure 6 shows the projection of a view rectangle on a three-dimensional image as projected from a viewer's location.

DETAILED DESCRIPTION

The principles of the present invention can be understood by reference to Figure 1. Fisheye or wide angle lens 1 captures a hemispherical or wide angle image. Lens 1 focuses the captured image onto camera 2. Camera 2 is more fully disclosed in co-pending U.S. Serial No. 08/494,599, entitled "Method and Apparatus for Simultaneous Capture of a Spherical Image", expressly incorporated herein by reference. The types of cameras employed are chosen from the group comprising of at least still cameras with loaded film or digital image capture, motion picture cameras with loaded film or digital image capture, the KODAK™ digital image capture system, video, linear scanning CID, CCD, or CMOS APS camera arrays and other equivalent image capture devices. The two general types of available cameras are shown by camera 2a and camera 2b. Camera 2a is a chemical camera into which film is loaded, exposed, and later developed. Camera 2b is a digital image capture camera more fully discussed in U.S. Serial No. 08/494,599, filed June 23, 1995, referenced above. Tripod 4 supports the camera 2, providing a stable image capture platform. When two back-to-back cameras are used (as disclosed in greater detail in U.S. Serial No. 08/494,599, referenced above), tripod 4 holds the two cameras in a back-to-back relationship. The pair of cameras capture the environment in two matching hemispheres. The resulting exposed film is then processed and digitized via scanning 5 into a digital data file 6 of the entire environment.

Preferably, the resolution of an image file is at least 2000 pixels by 2000 pixels. While resolutions of 512 x 512 have been developed for slower computers and transmission mediums, large image sizes are preferred. A standard compressed image file of 128 kb may be decompressed in memory to 2 megs decompressed. However, while larger file sizes are preferred as they offer greater resolution and color depth, larger files take a longer time to download and process.

Command sequencing data file 7 stores commands which control the view as displayed on a user's monitor. Command sequencing data file 7 also stores commands which retrieve new image files and play multimedia (for example, video clips) and sound files. The combination of these three sets of commands enables a complete, multimedia experience. The command sequenece data file may be a file stored in the RAM or ROM of a computational device, a hard drive, a tape, a CD-ROM, hardwired into an ASIC, and equivalents thereof. Additionally, the image data file may be a file stored in the RAM or ROM of a computational device, a hard drive, a tape, a CD-ROM, hardwired into an ASIC, and equivalents thereof.

Referring to Figure 1, the image data file 6 and command sequencing data file 7 are then distributed to a user's personal computer 10. Preferably, computer 10 is at least an Intel 486i/66 or equivalent with 8 megabytes of RAM and running Microsoft's Windows 95. Improved response times are achieved with upgrades to the hardware. For example, using a Pentium™ class computer would

improve response times. The distribution means includes distribution by CD-ROM 8 or over a communications network 9. Communications network includes at least local area networks, wide area networks, global area networks using twisted pair or ISDN lines and satellite networks. The different ways of downloading image data files 6 and command sequencing data files 7 include satellite downloading, modem downloading (including from bulletin boards and the Internet), and broadcast downloading.

Alternatively, the files may be available through client/server arrangements where all processing occurs at a server location with resulting display at the client's location. In this regard, the files 6 and 7 do not have to be loaded directly to a user's computer but rather onto a central server. In this regard, the user's computer may access the server through any of the communication networks described above.

When both image data file 6 and command sequencing data file 7 are available for use by computer 10, computer 10 performs the sequencing operations as detailed in the command sequencing data file 7 on the image as stored in the image data file 6. When the image data file contains a hemispherical image (or any image that contains distortions due to lens optics), the computer 10 implements a mathematical transform to remove the optical distortion from the distorted image. The mathematical transform is fully described in US patent 5,185,667, expressly incorporated herein by reference. The use of the mathematical transform

corrects the distortion and perspective as desired by the command sequencing data file 7. The resulting planar image is displayed on monitor 11 providing an experience comparable to video even though the data is provided from a static image. The user may assume control of the displayed image to more fully explore the image file 6. The user inputs a command from one of the various command input devices of mouse 12, keyboard 13, or other computer input device, to interrupt the execution of the command sequencing data file 7. Examples of a command indicating the user wants to view the image on his own may include mouse clicks, depression of the space bar, movement of the mouse or trackball or equivalents thereof. The user is now able to look in any direction in the image file, providing an interactive viewing experience. Alternatively, the output of the computer 10 may be recorded on videotape, hard disk, CD-ROM, RAM, ROM, and equivalents thereof for storage and later viewing.

Figure 2 shows a user interface 15 as experienced by the user once a user has indicated that he wants to view the image on his own. The interface 15 may be displayed over the entire viewing screen of the monitor 11 in a translucent form. Alternatively, the interface 15 may be significantly smaller and translucent or opaque. As with windowing operating environments, the interface 15 may be moved out of the way by means of standard moving techniques (including grabbing a displayed handel of the image or through a series of mouse clicks of keystrokes).

The position of cursor 14 is controlled by the viewer's movement of mouse 12 (or trackball, touch pad, or other pointing device or by keyboard entry). As cursor 14 moves around the interface 15, cursor 14 changes shape as determined by its position relative to the center of interface 15. When the cursor 14 is in or outside any of the octants 15a-15h, the cursor assumes the shape of a hand as indicated by hand 14. As the cursor moves around, the orientation of the hand icon may change so that it is always pointing away from the center of interface 15 as represented by the hands in each of octants 15a-15h. Equivalent pointing cursors may be used including arrows, triangles, bars, moving icons, and equivalents thereof. When the cursor is inside regions 16a or 16b centered in interface 15, the cursor's iconic representation changes to that of magnifying glass 17.

When the mouse's control button is depressed, the image direction shifts in the direction pointed to by the hand and at a rate of speed associated with the hand's distance from the center of the display. In the center of the display, the hand icon turns into a magnifying glass 17, allowing zoom in (when the cursor is located in the above center region 16a of interface 15) and zoom out (when the cursor is located in the below center region 16b of interface 15) allowing the user to control the magnification or scaling features of the current view. Equivalent zooming cursors may be used including arrows, triangles, bars, moving icons, and equivalents thereof. Under user control, the system provides the

experience of pointing a virtual video camera in the environment stored in the image data file 6 in any desired direction.

Figure 3 shows the command data file 7 for a simple sequence. A starting set of implemented commands includes START, MOVE, ZOOM, PAUSE, LAUNCH, and END. With these simple commands, a tour through the still image data set can be create and a compelling sequence generated. The fundamental commands and a brief description of their purpose follows:

START: Starts the sequence from a store pan, tilt, and magnification.

MOVE: Moves the image to a new location in a designated time.

ZOOM: Magnifies the image to a new zoom in a designated time.

PAUSE: Waits a specified length of time before continuing.

LAUNCH: Launches a new file, either a sound, new image or other data form (text window, video, other) to continue the sequence.

END: Ends the execution of commands in the command sequencing data file 7.

In an alternate embodiment, other command sequencing data files be launched from inside other command sequencing files. Also, a jump feature to jump from one portion to another may be launched from inside another command sequencing file. This can be implemented in an editor environment.

The command file is created by a development software tool which may be similar to the interface as described above in relation to Figure 2 but with additional developer tools. These additional tools may include start recording function, stop recording functions, resume recording functions, launch a new file, link a new image file to a portion of the displayed images. To create a command sequence data file 7, the developer initiates a recording function, calls up a desired image data file 6, moves through the image data file and pauses or stops the recording function. The system stores the commands as input by the developer as the command sequence data file 7. If desired, the command sequence data file 7 can be edited with simple text editing tools. Command files can be developed from a series of commands that are similar in intent, but different in name from the ones listed herein.

The command sequence shown in Figure 3 shows the commands recorded or input by a developer. When executed, these commands will produce a visual and audio tour of a screen. In this example, the file LOBBY.BUB relates to an image of a hotel lobby. The file ROOM.BUB relates to an image file of a room off of the hotel lobby. The file WELCOME.WAV relates to an audio introduction related to the LOBBY.BUB file. Here, WELCOME.WAV relates to an audio clip welcoming a user into a hotel's lobby. Executing the command sequence listed in Figure 3, the monitor 11 will display an image of the hotel lobby which is held for three seconds as shown in step

3A. An introductory sound file titled "Welcome" is then started as shown by step 3B. A two second pan of the room from the starting point to the right proceeds for 70 degrees as shown in step 3C. A zoom doubling the image size then occurs 3D over a span of 4 seconds with a launch of another image then occurring as shown in step 3E. The fields specified after the ROOM.BUB file indicate where on the new image the displayed rectangle should be located.

Looking specifically at the data fields accompanying each command, each of the fields PAN, TILT, ZOOM, and TIME have specific ranges which relate to the information display or played. The combination of fields describe what part of an image should be displayed. The PAN field relates to how far to the left or right of dead center is the image portion to be displayed. The PAN field is measured in terms of degrees from -180° to +180° with 0° directly ahead. Directly behind the viewer is denoted as -180° or +180° with the positive degrees increasing around to the view's right. TILT relates to the degrees up and down the display should vary from the mid-line of the image. TILT extends from -90° straight down to +90° straight up. ZOOM relates to the degree of magnification desired for a given image portion. Here, the zoom field of 3A is 1.1. This means that the degree of magnification will be 1.1 times as a default magnification. Finally, the TIME field relates to how much time is allotted to go from the previous display to the current display. For example, step 3C indicates that the displayed portion should pan to 70° to the right, with a

10° positive tilt, a zoom of 1.1 over a time of 2 seconds. Alternative representations may be used including Radians, Gradients, and equivalent counting systems.

Figure 4 shows a display rectangle 41 as it moves across an image 40. Image 40 is a virtual representation of the dewarped hemispherical image as captured by a wide angle lens. The progress of the rectangle 41 across the circle 40 of Figure 4 shows a typical sequence as it might be viewed from the command file of Figure 3. The circle 40 represents the entire spherical image data set of the lobby with the rectangle 41 showing the presently dewarped and displayed portion of the image. As steps 3C and 3D are executed, the displayed rectangle moves from the coordinates of the image plane of rectangle 41 to the coordinates of the image plane of rectangle 42 to the coordinates of the image plane of rectangle 43. The circle 40 is a virtual image as created in the memory of computer 10. The numbers 3A through 3D refer to the views commanded by the command file.

However, as dewarping an entire image as shown in Figure 4 may tax the memory requirements of the viewer's system, only the actually viewed portion needs to be dewarped. This technique is disclosed in greater detail in U.S. Patent No. 5,185,667. Figure 5 represents display rectangle 51 on a hemispherical image file 50 without the dewarping technique applied. The difference is that the display rectangle 51 still shows signs of spherical distortion contained in the spherical image.

Figure 6 shows a spherical depiction of an image 60 surrounding a viewing location 62 looking at viewing rectangle 61 as the viewing rectangle moves about under the control of the command sequence data file 7 or the viewer.

In order to provide the experience of video through small bandwidth communications channels (telephone modems), many compression techniques have been developed. Even the best of these techniques available today suffers from poor image quality, small image sizes, and the requirement of a continuous stream of data from the source to the user. The subject invention addresses these issues for a broad class of video sequences that deals with looking in different directions from a single vantage point at a static environment (an outdoor panorama, the interior of a car, the interior of a room, etc.). These environments can be viewed in a video presentation from the sequencing of angular and magnification commands that guide the presentation as if a camera had captured video data at the same location.

The resulting image sequence is of high quality because it begins as a high resolution still. The image size can be large or small without effecting the size of the data needed to construct the presentation. The data can be distributed in a batch form as the sequence is created from a still data file and its duration is determined by the command sequencing, not the bandwidth or storage size available to sustain the data stream. One advantage of transmitting the multimedia files as a compressed group of files in

a batch is that continuous linkage between the computer 10 and the communication network does not need to be maintained. In this regard, less system resources are used as the files do not need to be continuously downloaded. Preferably, while a viewer is viewing an image, the computer 10 is decompressing and formatting the next image file for display.

The bandwidth commonly available to distribute digital information is presently constrained by twisted pair system to approximately 28.8 kbs and will grow with future methods using fiber optics, satellite transmission, cable modems, etc. and related transmission systems. The subject invention provides a means and apparatus to address the distribution of compelling video experiences for certain applications via networks presently available.

From the foregoing description, it is or should be readily apparent that the described method of operation and apparatus permits a user to obtain a total immersive guided and unguided experience and that the disclosed system achieves the objectives sought. Of course, the foregoing description is that of preferred embodiments of the invention and various changes and modifications may be made without departing from the spirit and scope of the invention as defined by the appended claims. All of the above-referenced U. S. patents and patent applications referenced herein should be deemed to be incorporated by reference as to any subject

matter believed to be essential to an understanding of the present invention.

It will be understood that the term "comprises" or its grammatical variants as used herein is equivalent to the term "includes" and is not to be taken as excluding the presence of other elements or features.

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The claims defining the invention are as follows:

1. A device for sequencing images from a single still image data file providing the perception of video from batch data files which comprises:

a camera image capture system for receiving optical images and for producing output signals corresponding to said optical images:

a lens attached to said camera imaging system for producing hemispherical optical images, for optical conveyance to said camera imaging system;

a positioning device for registering two oppositely disposed hemispherical optical images thereby creating a spherical image of a remote environment;

an image scanning means for receiving said output signals from said camera imaging system and for digitizing said output signals from said camera imaging system to form an image data file containing image data;

a command data file means for sequencing said image data according to command sequencing data;

a data transmission means for sending said image and said command data files to personal computers worldwide;

a personal computer means for executing image transform processes for processing said image data in a sequence controlled by said command sequencing data or by user input according to selected viewing angles and magnification, and for producing sequenced output images;

output display means for user viewing of said sequenced output images; and

input means for selecting said viewing angles and magnification.

2. The device of claim 1 wherein said data transmission means further comprises at least one digital network for

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sending said image and command data files in a batch operation.

3. The device of claim 1 wherein said input means comprises at least one of a mouse, keyboard, or other means for controlling movement of a hand icon for navigating the image or a magnifying glass icon for zooming on the image.

4. The device of claim 1 wherein said command data file further includes links to audio, flat images, text, graphics, video clips and other spherical photographs.

5. The device of claim 3 wherein said input means further includes a pointing user interface for inputting a selected portion and magnification of said view to said transform processor means, and wherein motion direction is controlled by the direction the hand icon points in and velocity is controlled by the distance of the hand icon from the center of the display.

6. The device of Claim 1 wherein the transform is performed at rates at or approaching video rates resulting in a sequenced image presentation that provides the user with the perception of video without a continuous update of the input data.

7. An apparatus for sequencing images from a data file containing still image data, the apparatus providing the perception of video from batch data files, the apparatus comprising:

a camera image capture system for receiving optical images and for producing output corresponding to said optical images;

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a lens attached to said camera imaging system for producing hemispherical optical images for optical conveyance to said camera imaging system;

a positioning device that registers said hemispherical optical images so as to create a set of at least two hemispheres for creating a spherical image of a remote environment;

an image digitizing means for receiving and digitizing said output from said camera image capture system;

a command data file means for sequencing dewarped images from still image data according to stored command sequencing data;

a data transmission means for sending digital image and other data to a remote computer terminal in response to one of either user actuated commands or said command data file means;

a computer means for executing image transform processes for processing said digital image and other data in a sequence controlled by said command sequencing data or by user movement of a cursor about a displayed image according to selected viewing angles and magnification, the computer means for generating sequenced output images from said still image data;

an output display means for user viewing of said sequenced output images from the digital image data; and

an input means for selecting said viewing angles and magnification for navigating the image or for zooming on the image.

8. The apparatus of Claim 7 wherein said data transmission means comprises at least one digital network for sending said digital image and other data via a batch operation.

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9. The apparatus of Claim 7 further comprising user means for controlling the image and control the direction of view in any direction.

10. The apparatus of Claim 7 wherein said command data file further includes links to audio, flat images, text, graphics, video clips and other spherical photographs can be accomplished.

11. The apparatus of Claim 7 wherein said input means further includes a pointing user interface for inputting a selected portion and magnification of a spherical view to said transform processor means, and wherein motion direction is controlled by the direction a cursor points in and velocity is controlled by the distance said cursor is from the center of the display.

12. The apparatus of Claim 7 wherein the transform is performed at rates at or approaching video rates resulting in a sequenced image presentation that provides the user with the perception of video without a continuous update of the input data.

13. The apparatus of Claim 11 wherein said pointing user interface is controlled via one of either a mouse, keyboard, or other means for navigating the image or selecting the image for zooming.

14. The apparatus of Claim 7 wherein said input means comprises one of either a mouse, keyboard, or other means for navigating the image or zooming on the image.

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15. The apparatus of Claim 7 wherein said command data file means includes means for sequencing the dewarped images prior to transmitting said digital image data to said remote computer terminal.

16. The apparatus of Claims 7 wherein said command data file means includes means for sequencing the dewarped images at said remote computer terminal.

17. A method of sequencing images from a single, spherical still image data file for providing the perception of video from batch data files which comprises the steps of :

executing image transform processes for processing said spherical still image data file in a sequence controlled by a command data file or by user input according to selected viewing angles and magnification, and for producing sequenced output images in the sequence specified by one of either said command data file or said user input; and

outputting said sequenced output images to a display for displaying said sequenced output images.

18. The method of claim 17, further comprising the step of :

accepting user inputs specifying said viewing angles and magnification with either mouse, keyboard, or other means for navigating the image or for zooming on the image.

19. A method for sequencing images from a single still image data file providing the perception of video from batch data files which comprises the steps of :

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receiving hemispherical optical images and producing output corresponding to said hemispherical optical images;

registering said hemispherical optical images so as to create a set of at least two hemispheres thereby creating a spherical image of a remote environment;

receiving said output and digitizing output signals from said output to form an image data file containing image data;

controlling sequencing of said image data according to command sequencing data contained in a command data file;

sending digital image and other data to at least one remote computer terminal;

executing image transform processes for processing said image data in a sequence controlled by said command sequencing data or by a user moving a cursor about a displayed image according to selected viewing angles and magnification, and producing sequenced output images thereby;

outputting the command sequenced or user selected image sequence; and

accepting user input for selecting said viewing angles and magnification with either mouse, keyboard, or other means for navigating the image or for zooming on the image.

20. The method of Claim 19, wherein said step of sending digital image and other data is performed via a batch operation.

21. The method of Claim 19, further comprising the step of user manipulation of the image and control the direction of view in any direction.

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22. The method of Claim 19, further comprising the step of linking said command sequencing data to audio, flat images, text, graphics, video clips and other spherical photographs.

23. The method of Claim 19, wherein said accepting user input step further comprises the substep of :

receiving input of a selected portion and magnification of a spherical view in a transform processor means by way of a simple pointing user interface where motion direction is controlled by the direction a cursor points in and velocity is controlled by the distance said cursor is from the center of the display.

24. The method of Claim 19, wherein said image transform process is performed at rates at or approaching video rates resulting in a sequenced image presentation that provides the user with the perception of video without a continuous update of the input data.

25. The method of Claim 19, further comprising the step of navigating the image or selecting the image for zooming via said mouse, keyboard, or other means for controlling a cursor.

26. The method of Claim 19, further comprising the step of zooming on the image via said mouse, keyboard, or other means for controlling a cursor.

27. The method of Claim 19 further comprising the substeps of :

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sequencing dewarped images from still image data prior to sending said digital image and other data step; and

sending said sequenced dewarped images to said at least one remote computer terminal.

28. The method of claim 19, wherein said sending digital image and other data step occurs before said controlling the sequence of said images step.

29. A device for producing a sequence of images from a single still image data file comprising a perceptually distorted image, the device comprising:

a command data file means containing command sequencing data for sequencing said sequence of images according to viewing angle and magnification;

a data transmission means for sending said single still image data file and said command data file to a remote computer terminal; and

a computer means for executing image transform processes to generate a perspectively correct sequence of images from said single still image data file in a sequence controlled by said command sequencing data or by user input according to selected viewing angles and magnification, and for producing sequenced output images.

30. The device of claim 29, further comprising:

an output display means for user viewing of, said image sequence.

31. The device of claim 30, further comprising:

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an input means for selecting said viewing angles and magnification with either mouse, keyboard or other means for navigating the image or for zooming on the image.

32. A method for producing a sequence of images from a single still image data file comprising a perceptually distorted image, the method comprising the steps of:

sequencing said sequence of images according to command sequencing data in command data file means according to viewing angle and magnification;

sending said single still image data file and said command data file to a remote computer terminal; and

executing image transform processes to generate a perspectively correct sequence of images from said single still image data file in a sequence controlled by said command sequencing data or by user input according to selected viewing angles and magnification; and for producing sequenced output images.

33. The method of claim 32, further comprising the steps of:

displaying for user viewing said image sequence.

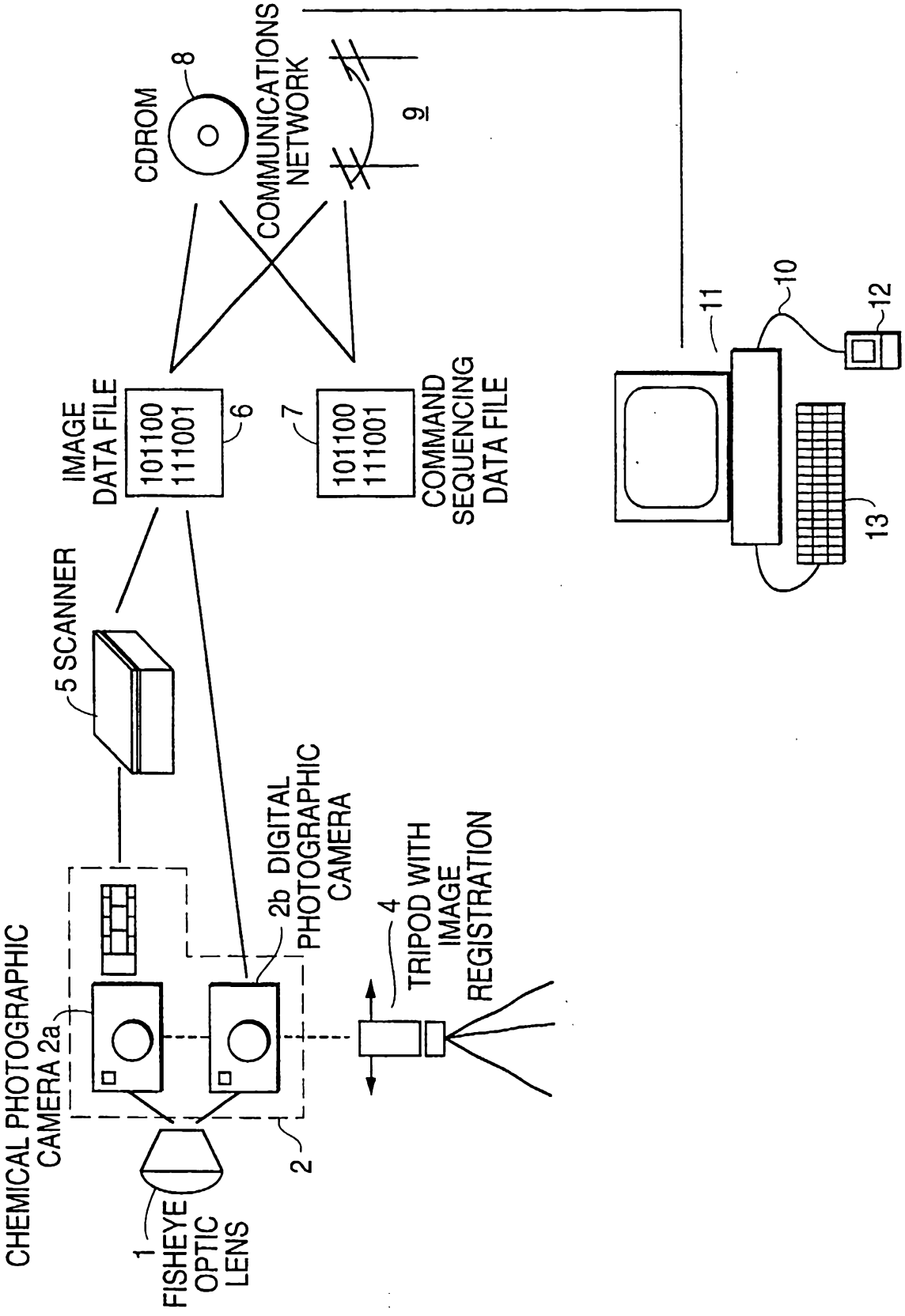
34. The method of claim 33, further comprising the step of:

accepting user inputs for selecting said viewing angles and magnification with either mouse, keyboard, or other means for navigating the image or for zooming on the image.

INTERACTIVE PICTURES CORPORATION
By their Registered Patent Attorneys
FREEHILLS CARTER SMITH & BEADLE **23 May, 2000**

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FIG. 1


CDROM
8
COMMUNICATIONS NETWORK
9
IMAGE DATA FILE
101100
111001
6
7
101100
111001
COMMAND SEQUENCING DATA FILE
11
10
12
13
5 SCANNER
2b DIGITAL PHOTOGRAPHIC CAMERA
4
TRIPOD WITH IMAGE REGISTRATION
CHEMICAL PHOTOGRAPHIC CAMERA 2a
2
1
FISHEYE OPTIC LENS

SUBSTITUTE SHEET (RULE 26)

FIG. 2

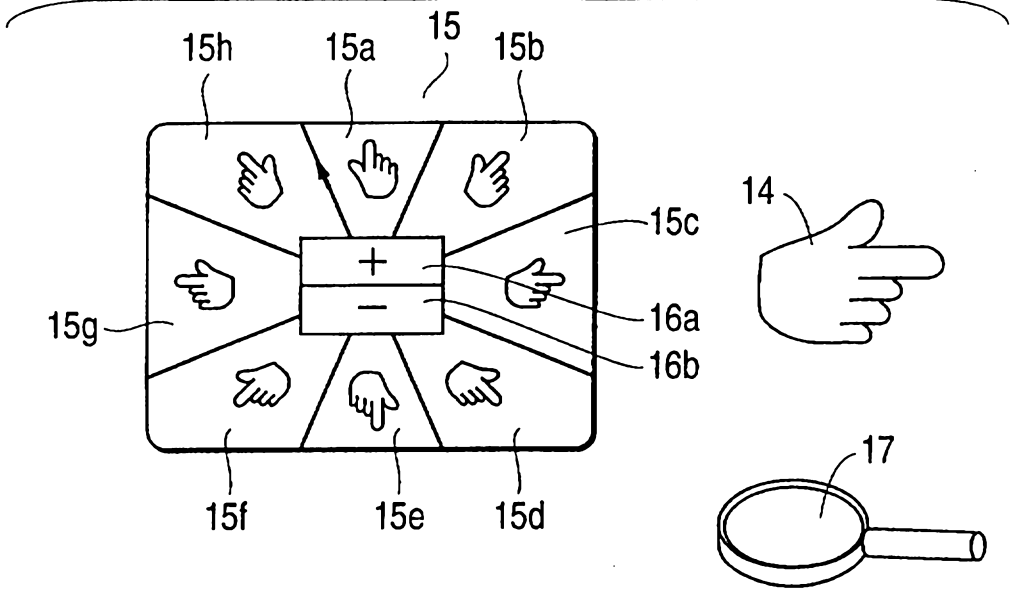


FIG. 3

3A	START LOBBY.BUB	PAN:0	TILT:10	ZOOM:1.1	TIME:3
3B	LAUNCH WELCOME.WAV				TIME:0
3C	MOVE	PAN:70	TILT:10	ZOOM:1.1	TIME:2
3D	ZOOM	PAN:70	TILT:10	ZOOM:2.2	TIME:4
3E	LAUNCH ROOM.BUB	PAN:5	TILT:20	ZOOM:1.0	TIME:1

FIG. 4

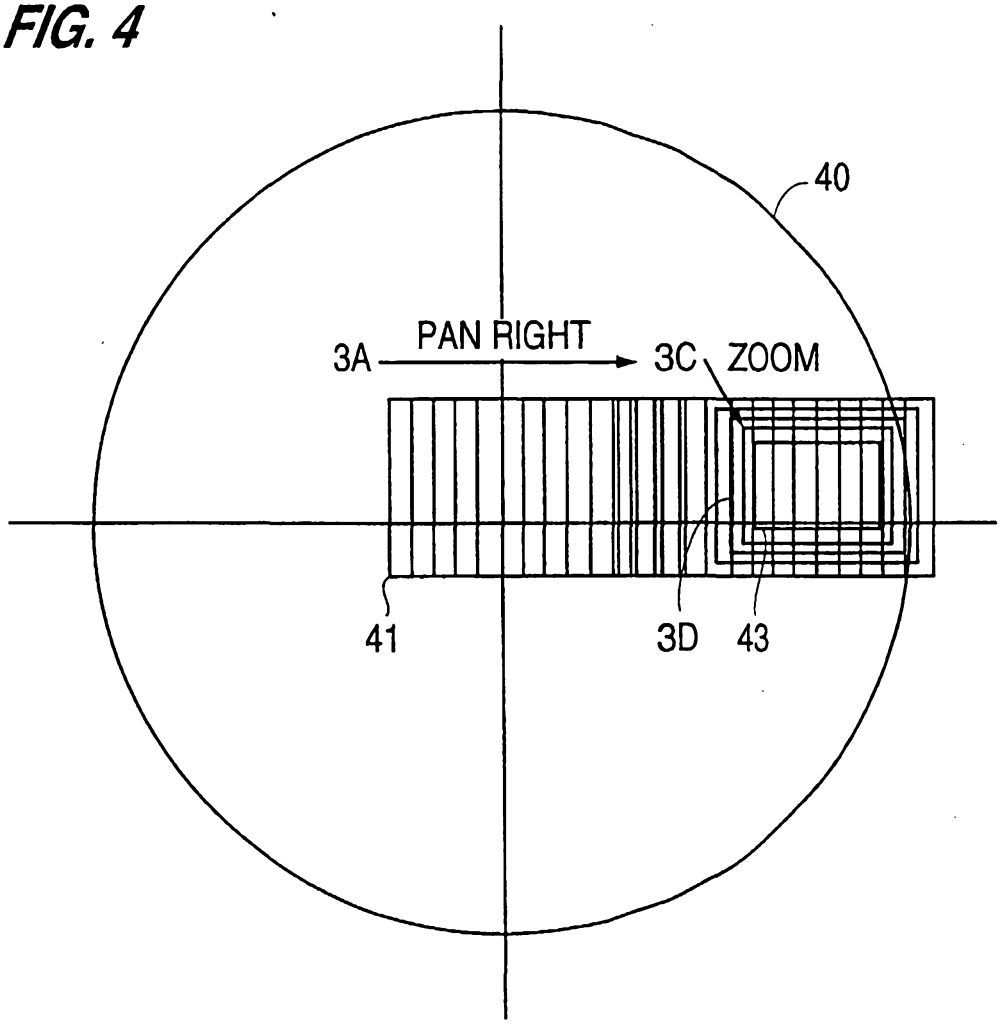


FIG. 5

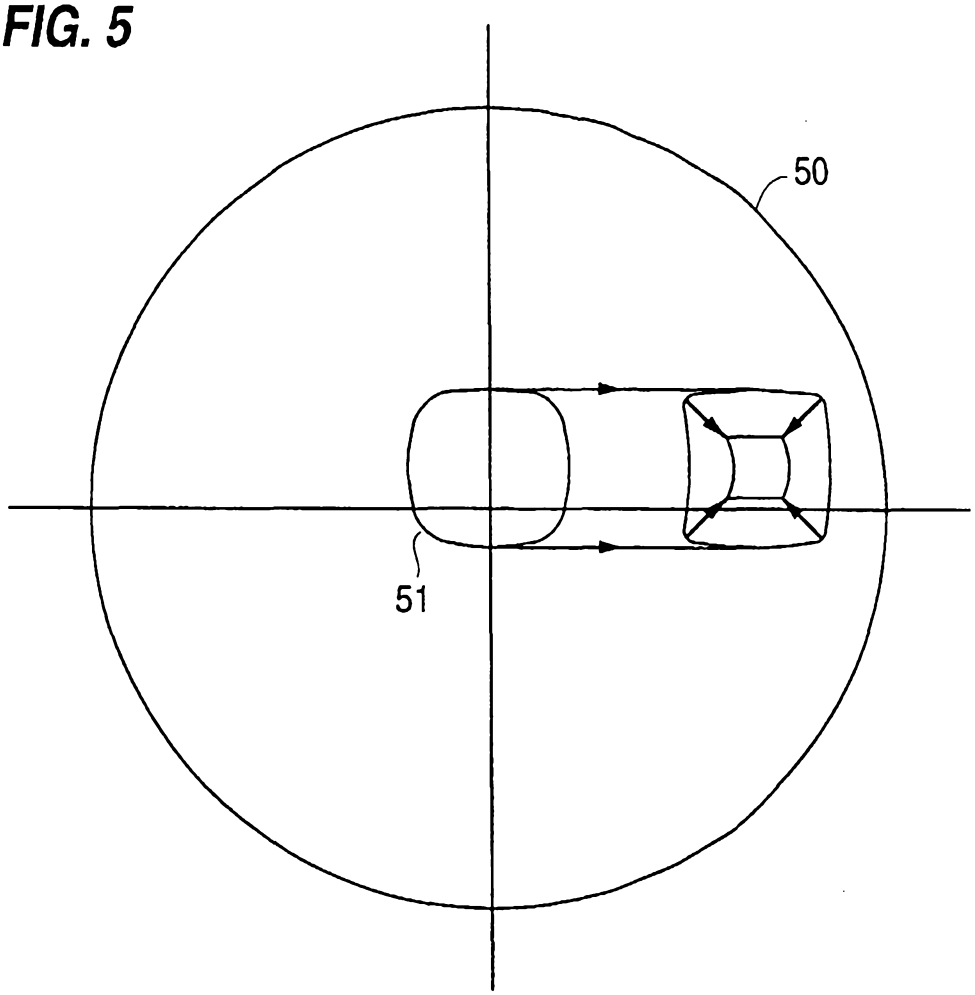


FIG. 6

