WHAT IS CLAIMED IS:

1. A mobile workstation for use in connection with a distributed biometric identification system, said workstation comprising:

a portable computer;

a biometric data input system coupled to said portable computer;

a portable communications terminal coupled to said portable computer;

said communications terminal capable of initiating the establishment of a communication link between said workstation and a file server remotely located from said workstation, at least a portion of said communications link comprising a wireless communications link;

said biometric data input system capable of receiving input biometric information and providing said input biometric information to said computer; and

said computer programmed to control said portable communications terminal to being said initiation of said communication link between said workstation and said file server, and transmit said input biometric information over said communication link to said remote file server.

2. The workstation of Claim 1 wherein said computer receives from said file server over said communication link stored biometric information stored at said file server that matches said input biometric data transmitted from said workstation to said file server.

3. The workstation of Claim 1 wherein said computer receives from said file server over said communication link information indicating that no stored biometric information at said file server matches said input biometric data transmitted from said workstation to said file server.

4. The workstation of Claim 1 wherein:

said input biometric data comprises input fingerprint data;

said stored biometric data comprises stored fingerprint data; and

said computer receives from said file server over said communication link stored fingerprint information that matches said input fingerprint data transmitted to said file server from said workstation.

5. The workstation of Claim 1 wherein:

said input biometric data comprises input photographic data;

said stored biometric data comprises stored photographic data; and

said computer receives from said file server over said communication link stored photographic information that matches said input photographic data transmitted to said file server from said workstation.

6. The workstation of Claim 1 wherein said portable computer comprises a laptop computer.

7. The workstation of Claim 1 wherein said biometric data input system comprises a fingerprint scanner.

8. The workstation of Claim 1 wherein said biometric data input system comprises a camera.

9. The workstation of Claim 6 wherein said biometric data input system comprises a fingerprint scanner and a camera.

10. The workstation of Claim 1 wherein said portable communications terminal comprises a radiotelephone.

11. The workstation of Claim 10 wherein said radiotelephone comprises a cellular telephone.

12. The workstation of Claim 10 wherein said initiating comprising dialing a telephone number to establish a telephone line connection with said remotely located file server.

13.The workstation of Claim 1 wherein said portable communications terminal comprises a radiotelephone.

14. The workstation of Claim 1 wherein said portable communications terminal comprises a portable satellite terminal.

15. The workstation of Claim 14 wherein said portable satellite terminal comprises a satellite dish antenna.

16. A mobile workstation for use in connection with a distributed biometric identification system, said workstation comprising:

a portable computer;

a biometric data input system coupled to said portable computer;

a portable communications terminal coupled to said portable computer;

said communications terminal capable of initiating the establishment of a communication link between said workstation and a file server remotely located from said workstation, at least a portion of said communications link comprising a public switched telephone network (PSTN);

said biometric data input system capable of receiving input biometric information and providing said input biometric information to said computer; and

said computer programmed to control said portable communications terminal to begin said initiation of said communication link between said workstation and said file server, and transmit said input biometric information over said communication link to said remote file server.

17. The workstation of Claim 16 wherein:

said portable communications terminal comprises a telephone dialing apparatus; and

said initiating comprises dialing a telephone number to establish a telephone line connection with said remotely located file server over said PSTN.

18. The workstation of Claim 17 wherein:

said telephone dialing apparatus comprises a radiotelephone; and

at least a portion of said communications link further comprises a wireless communications link.

19. A mobile workstation for use in connection with a distributed biometric identification system, said workstation comprising:

a portable computer;

a fingerprint scanner coupled to said portable computer;

a camera coupled to said portable computer;

a portable communications terminal coupled to said portable computer;

said communications terminal capable of initiating the establishment of a communication link between said workstation and a file server remotely located from said workstation, at least a portion of said communications link comprising a wireless communications link;

said fingerprint scanner capable of receiving input fingerprint information and providing said input fingerprint information to said computer;

said camera capable of receiving input photographic information and providing said input photographic information to said computer;

said computer programmed to control said portable communications terminal to begin said initiation of said communication link between said workstation and said file server, and transmit said input biometric information over said communication link to said remote file server;

said computer further programmed to receive from said file server over said communication link stored fingerprint and photographic information stored at said file server that matches said input fingerprint and photographic data transmitted from said workstation to said file server; and

said computer further programmed to receive from said file server over said communication link information indicating that no stored fingerprint or photographic information at said file server matches said input fingerprint or photographic data transmitted from said workstation to said file server.

20. The workstation of Claim 19 wherein:

said portable computer comprises a laptop computer;

said portable communications terminal comprises a telephone dialing apparatus; and

said initiating comprises dialing a telephone number to establish a telephone line connection with said remotely located file server.

21. A mobile workstation for use in connection with a distributed biometric identification system, said workstation comprising:

a portable carrying case containing a portable computer, a biometric data input system coupled to said portable computer, a portable communications terminal coupled to said portable computer, and a power strip for coupling power to said computer, biometric data input system, and communications terminal;

said communications terminal capable of initiating the establishment of a communication link between said workstation and a file server remotely located from said workstation, at least a portion of said communications link comprising a wireless communications link;

said biometric data input system capable of receiving input biometric information and providing said input biometric information to said computer; and

said computer programmed to control said portable communications terminal to being said initiation of said communication link between said workstation and said file server, and transmit said input biometric information over said communication link to said remote file server.

22. The workstation of Claim 21 wherein said carrying case further comprises internal compartments for securing each of said computer, biometric data input system, and said communications terminal.

23. The workstation of Claim 22 wherein said internal compartments comprise cushion material.

24. A method of coupling biometric data to a file server for use in connection with a distributed biometric identification system, the steps comprising:

gathering input biometric data at a first location;

initiating the establishment of a communication link between said first location and a file server remotely located from said first location, at least a portion of said communications link comprising a wireless communications link; and

transmitting said input biometric information over said communication link to said remote file server.

25. The method of Claim 24 further comprises the step of:

receiving at said first location over said communication link stored biometric information that matches said input biometric data transmitted from said first location to said file server.

26. The method of Claim 24 further comprising the step of:

receiving at said first location over said communication link information indicating that no stored biometric information at said file server matches said input biometric data transmitted from said first location to said file server.

27. The method of Claim 24 wherein:

said input biometric data comprises input fingerprint data;

said stored biometric data comprises stored fingerprint data; and

said first location receives from said file over said communication link stored fingerprint information that matches said input fingerprint data transmitted to said file server from said first location.

28. The method of Claim 24 wherein:

said input biometric data comprises input photographic data;

said stored biometric data comprises stored photographic data; and

said first location receives from said file server over said communication link stored photographic information that matches said input photographic data transmitted to said file server from said first location.

29. The method of Claim 24 wherein said initiating comprising dialing a telephone number to establish a telephone line connection with said remotely located file server.

30. A mobile workstation for use in connection with a distributed biometric identification system, said workstation comprising:

a portable computer having a main body, a front panel hinged to said main body, and a back panel hinged to said main body;

said front panel having a stowed position adjacent said main body and a deployed position away from said main body;

said back panel having a stowed position adjacent said main body and a deployed position away from said main body;

a biometric data input system coupled to said portable computer and at least partially housed in said back panel;

a portable communications terminal coupled to said portable computer and at least partially housed in said back panel;

said communications terminal capable of initiating the establishment of a communication link between said workstation and a file server remotely located from said workstation, at least a portion of said communications link comprising a wireless communications link;

said biometric data input system capable of receiving input biometric information and providing said input biometric information to said computer; and

said computer programmed to control said portable communications terminal to begin said initiation of said communication link between said workstation and said file server, and transmit said input biometric information over said communication link to said remote file server.

31. The workstation of Claim 30 wherein said computer receives from said file server over said communication link stored biometric information stored at said file server that matches said input biometric data transmitted from said workstation to said file server.

32. The workstation of Claim 30 wherein said computer receives from said file server over said communication link information indicating that no stored biometric information at said file server matches said input biometric data transmitted from said workstation to said file server.

33. The workstation of Claim 30 wherein:

said input biometric data comprises input fingerprint data;

said stored biometric data comprises stored fingerprint data; and

said computer receives from said file server over said communication link stored fingerprint information that matches said input fingerprint data transmitted to said file server from said workstation.

34. The workstation of Claim 30 wherein:

said input biometric data comprises input photographic data;

said stored biometric data comprises stored photographic data; and

said computer receives from said file server over said communication link stored photographic information that matches said input photographic data transmitted to said file server from said workstation.

35. The workstation of Claim 30 wherein said biometric data input system comprises a fingerprint scanner.

36. The workstation of Claim 30 wherein said biometric data input system comprises a camera.

37. The workstation of Claim 30 wherein said portable communications terminal comprises a radiotelephone.

38. The workstation of Claim 37 wherein said radiotelephone comprises a cellular telephone.

39. The workstation of Claim 37 wherein said initiating comprising dialing a telephone number to establish a telephone line connection with said remotely located file server.

40. The workstation of Claim 30 wherein:

said main body houses a display;

said front panel houses a keyboard; and

said display and said keyboard are exposed when said front panel is in said deployed position, and said display and said keyboard are covered when said front panel is in said stowed position.

41. A mobile workstation for use in connection with a distributed biometric identification system, said workstation comprising:

a portable computer having a main body, a front panel hinged to said main body, and a back panel hinged to said main body;

said front panel having a stowed position adjacent said main body and a deployed position away from said main body;

said back panel having a stowed position adjacent said main body and a deployed position away from said main body;

a biometric data input system coupled to said portable computer and at least partially housed in said back panel;

a satellite communications terminal coupled to said portable computer;

said satellite communications terminal capable of initiating the establishment of a communication link between said workstation and a file server remotely located from said workstation, at least a portion of said communications link comprising a wireless communications link established via a satellite;

said biometric data input system capable of receiving input biometric information and providing said input biometric information to said computer; and

said computer programmed to control said portable communications terminal to begin said initiation of said communication link between said workstation and said file server, and transmit said input biometric information over said communication link to said remote file server.

42. The workstation of Claim 41 wherein said satellite communications terminal comprises a satellite dish antenna.

43. A mobile workstation for use in connection with a distributed biometric identification system, said workstation comprising:

a portable computer having a main body, a front panel hinged to said main body, and a back panel hinged to said main body;

said front panel having a stowed position adjacent said main body and a deployed position away from said main body;

said back panel having a stowed position adjacent said main body and a deployed position away from said main body;

a biometric data input system coupled to said portable computer and at least partially housed in said back panel;

a portable communications terminal coupled to said portable computer and at least partially housed in said back panel;

said communications terminal capable of initiating the establishment of a communication link between said workstation and a file server remotely located from said workstation, at least a portion of said communications link comprising a public switched telephone network (PSTN);

said biometric data input system capable of receiving input biometric information and providing said input biometric information to said computer; and

said computer programmed to control said portable communications terminal to begin said initiation of said communication link between said workstation and said file server, and transmit said input biometric information over said communication link to said remote file server.

44. The workstation of Claim 43 wherein:

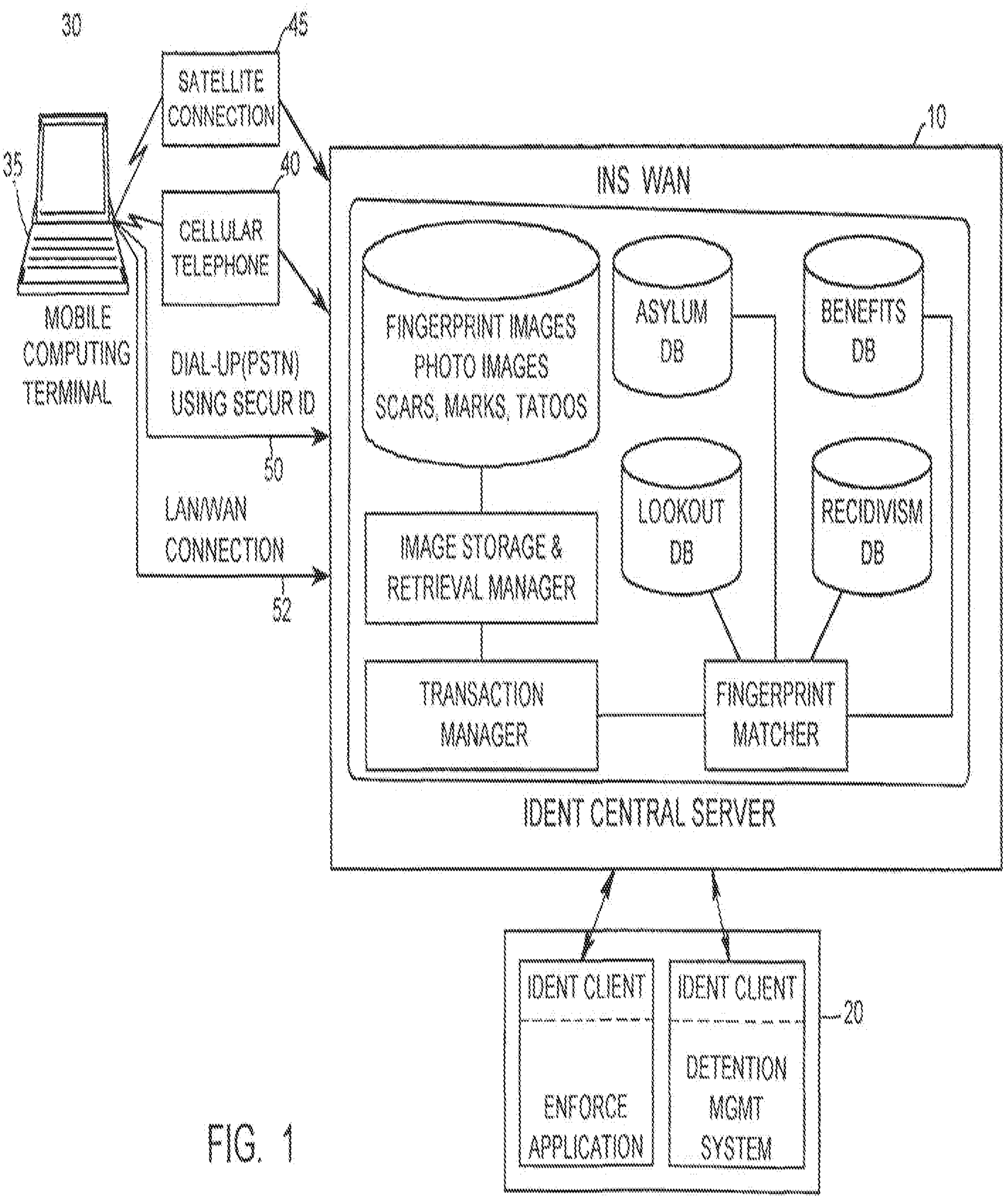
said portable communications terminal comprise said telephone dialing apparatus; and

said initiating comprises dialing a telephone number to establish a telephone line connection with said remotely located file server over said PSTN.

45. The workstation of Claim 44 wherein:

said telephone dialing apparatus comprises a radiotelephone; and

at least a portion of said communications link further comprises a wireless communications link.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MOBILE COMPUTING TERMINAL
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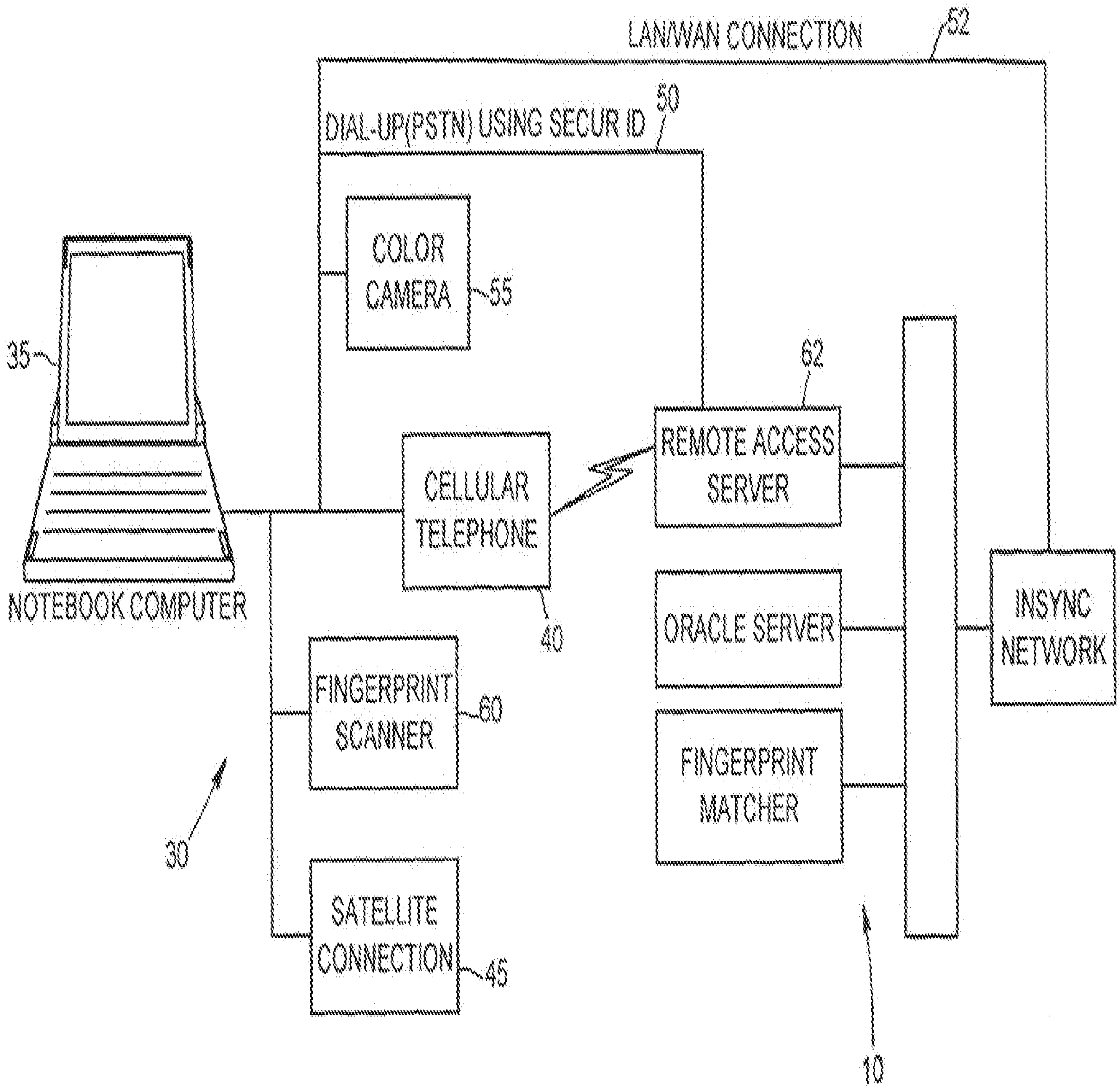
LAN/WAN CONNECTION
52
10
INS WAN
FINGERPRINT IMAGES
PHOTO IMAGES
SCARS, MARKS, TATOOS
ASYLUM DB
BENEFITS DB
LOOKOUT DB
RECIDIVISM DB
IMAGE STORAGE & RETRIEVAL MANAGER
TRANSACTION MANAGER
FINGERPRINT MATCHER
IDENT CENTRAL SERVER
IDENT CLIENT
ENFORCE APPLICATION
IDENT CLIENT
DETENTION MGMT SYSTEM
20

FIG. 1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DIAL-UP(PSTN) USING SECUR ID
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NOTEBOOK COMPUTER
CELLULAR TELEPHONE
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REMOTE ACCESS SERVER
62
ORACLE SERVER
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INSYNC NETWORK
FINGERPRINT SCANNER
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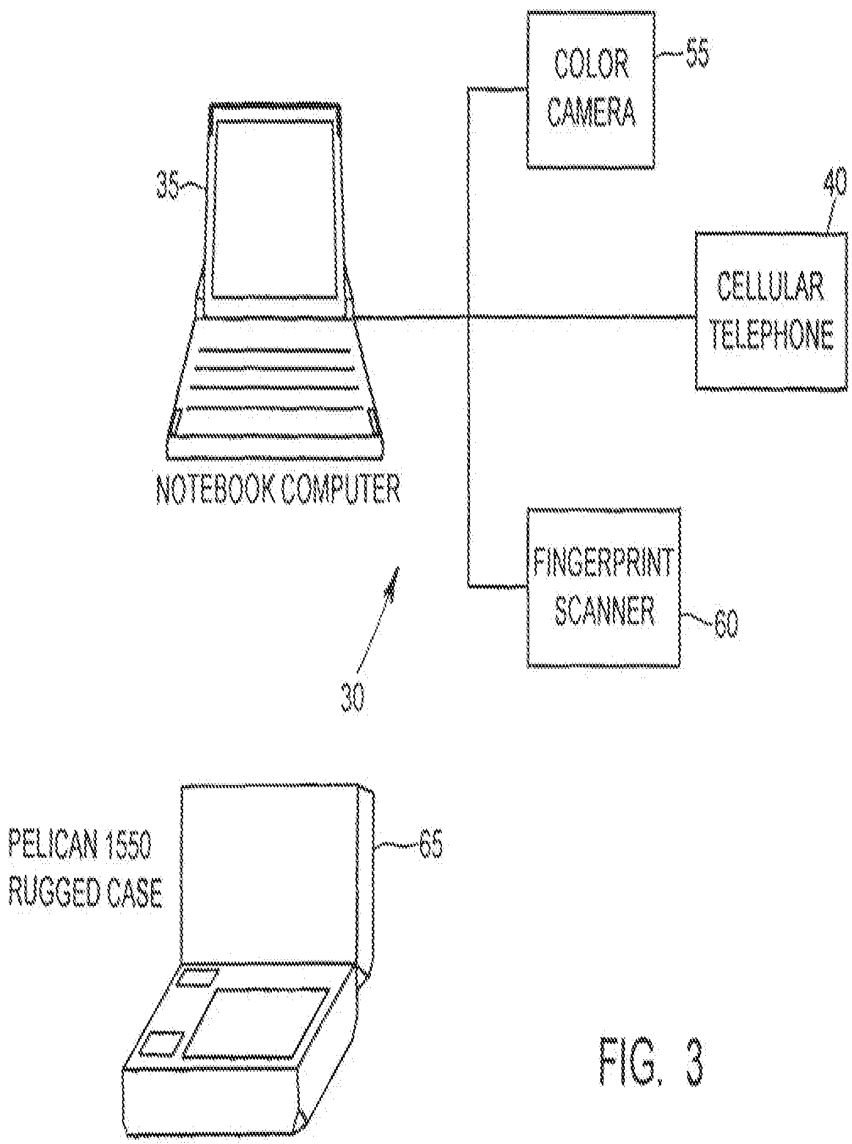
SATELLITE CONNECTION
45
10

FIG. 2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NOTEBOOK COMPUTER
FINGERPRINT SCANNER
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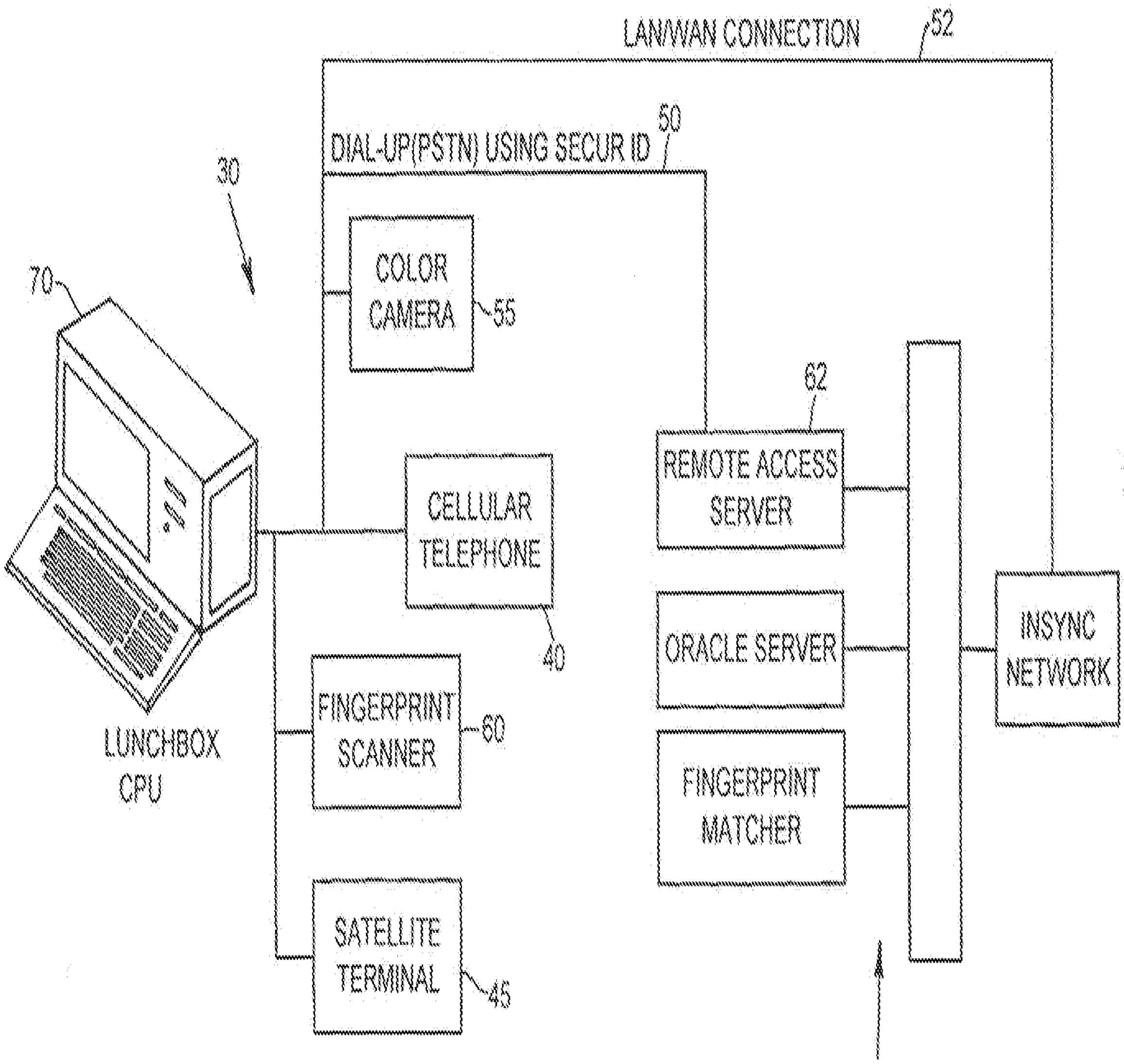
PELICAN 1550 RUGGED CASE
65

FIG. 3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REMOTE ACCESS SERVER
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40
ORACLE SERVER
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FINGERPRINT MATCHER
LUNCHBOX CPU
SATELLITE TERMINAL
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10

FIG. 4

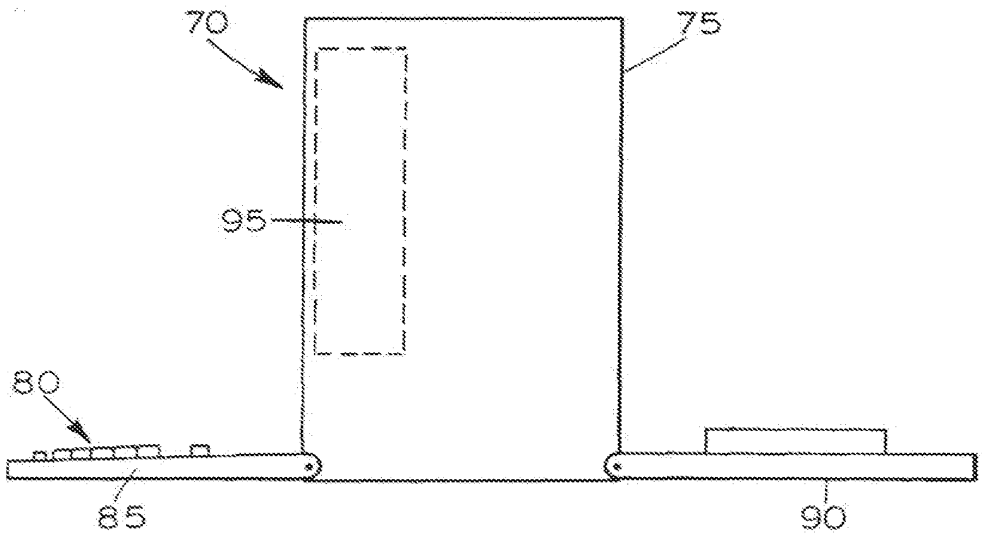
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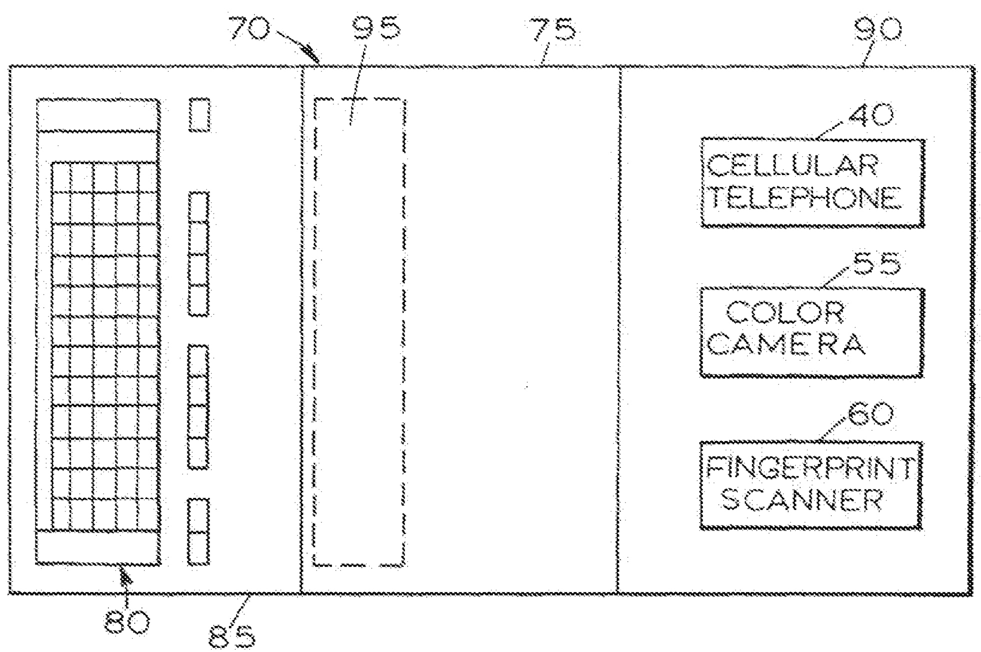
FIG. 5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COLOR CAMERA
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FINGERPRINT SCANNER
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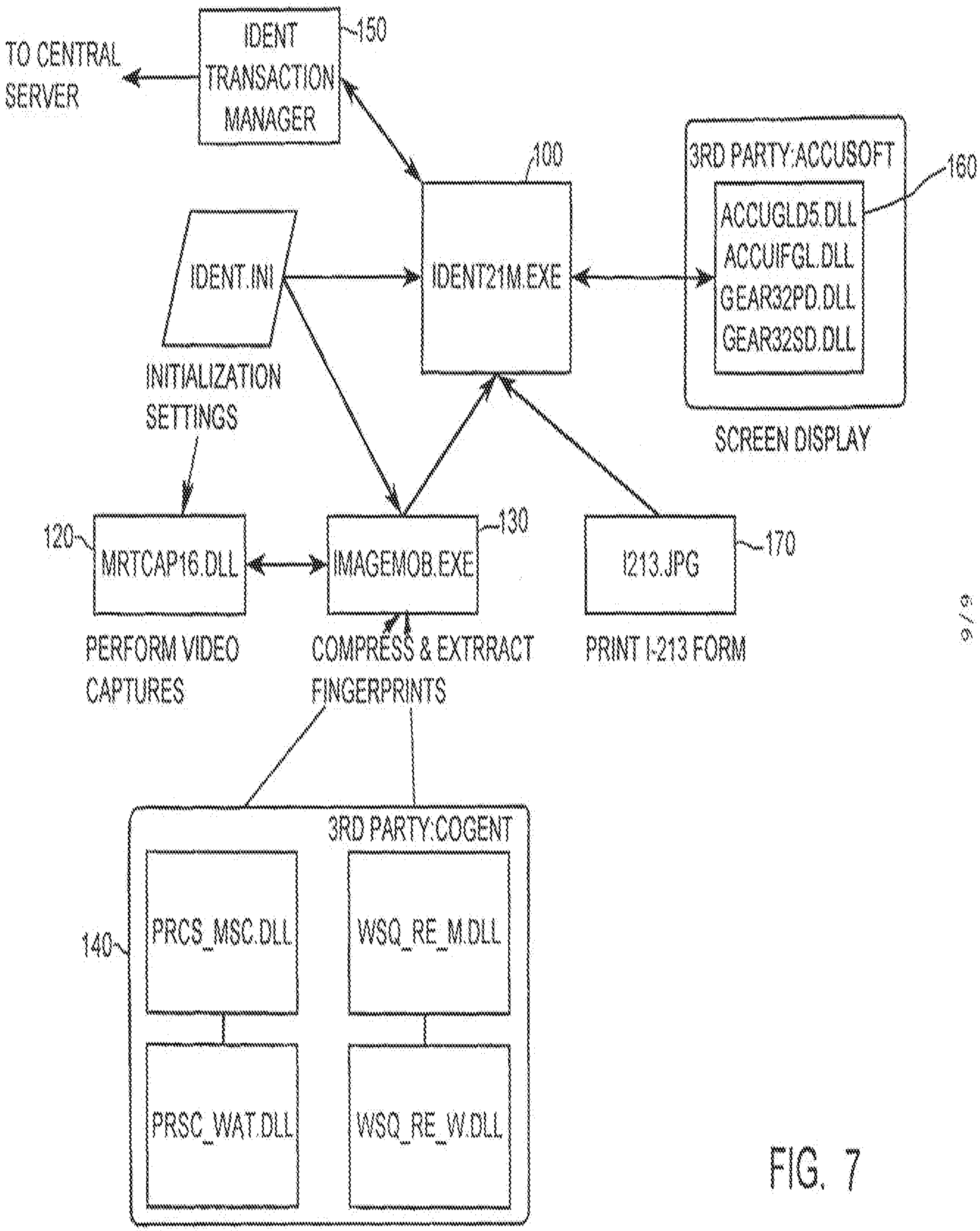
FIG. 6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100
IDENT21M.EXE
IDENT.INI
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ACCUGLD5.DLL
ACCUIFGL.DLL
GEAR32PD.DLL
GEAR32SD.DLL
SCREEN DISPLAY
120
MRTCAP16.DLL
PERFORM VIDEO CAPTURES
130
IMAGEMOB.EXE
COMPRESS & EXTRRACT FINGERPRINTS
170
I213.JPG
PRINT I-213 FORM
3RD PARTY:COGENT
140
PRCS_MSC.DLL
WSQ_RE_M.DLL
PRSC_WAT.DLL
WSQ_RE_W.DLL

FIG. 7

INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/US 98/20089

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G07C9/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G07C H04Q

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 94 22371 A (DIGITAL BIOMETRICS INC) 13 October 1994 see abstract; claims; figures see page 3, line 19 - page 4, line 7 see page 5, line 5 - page 6, line 3 see page 8, line 18 - line 33 -/--	1-5, 7-10,12, 13,16, 19,21, 24,27, 28,30, 33-37, 40-45

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

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 February 1999	26/02/1999

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

1

INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/US 98/20089

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 18169 A (KRETZSCHMAR LOREN ;DAVIS VICTORIA (US)) 13 June 1996 see abstract; claims; figures see page 4, line 24 - page 6, line 33 see page 7, line 17 - page 8, line 15	1-4,7, 10-13, 16-19, 21,24, 25, 30-38, 41-45
A	WO 93 10508 A (DIGITAL BIOMETRICS INC) 27 May 1993 see abstract; claims; figures	1,16,18, 21,24, 30,41,43
A	WO 94 10659 A (JASPER CONSULTING INC) 11 May 1994	
A	EP 0 593 386 A (IBM) 20 April 1994	
A	EP 0 791 899 A (HARRIS CORP) 27 August 1997	

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 98/20089

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
WO 9422371	A	13-10-1994	US	5467403	A	14-11-1995
			AU	6393294	A	24-10-1994
WO 9618169	A	13-06-1996	AU	4894796	A	26-06-1996
WO 9310508	A	27-05-1993	US	5222152	A	22-06-1993
			AT	139357	T	15-06-1996
			AU	659979	B	01-06-1995
			AU	3179793	A	15-06-1993
			CA	2123509	A	27-05-1993
			DE	69211564	D	18-07-1996
			DE	69211564	T	06-02-1997
			EP	0613576	A	07-09-1994
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			US	5420936	A	30-05-1995
EP 0791899	A	27-08-1997	JP	9251530	A	22-09-1997

Form PCT/ISA/210 (patent family annex) (July 1992)

Electronic Acknowledgement Receipt

EFS ID:	10290617
Application Number:	13069124
International Application Number:	
Confirmation Number:	9532
Title of Invention:	Image Capture and Identification System and Process
First Named Inventor/Applicant Name:	Wayne C. Boncyk
Customer Number:	24392
Filer:	Martin Fessenmaier/Laryssa Weiland
Filer Authorized By:	Martin Fessenmaier
Attorney Docket Number:	101044.0001US14
Receipt Date:	13-JUN-2011
Filing Date:	22-MAR-2011
Time Stamp:	15:59:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	updated_IDS.pdf	617214 4da1022dcaaec3be62b8cedf1b2df12b5c77e5cc	no	9

Warnings:

Information:

2	Foreign Reference	EP920179.pdf	111960 f2dec397dac39151812cb6cdfb3634e29fb340c8	no	3
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3	Foreign Reference	EP01355258.pdf	503666 baf29cb270eff5d49d9e1e519f59797646139eed	no	20
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9	Foreign Reference	WO0124050.pdf	988174 2e387a23420a94032ca94dec23937cab367b463b	no	35
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11	Foreign Reference	WO0282799.pdf	1118653 afe406f4cf3112326b838bf8ef9de33566765 3a0	no	27
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			Total Files Size (in bytes):	16927885	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
13/069,124

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	82		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	270		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	110		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	38 minus 20 =	* 18	x 26 =	468	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*	x 110 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
			TOTAL	930		TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/069,124	03/22/2011		930	101044.0001US14	38	1

CONFIRMATION NO. 9532

UPDATED FILING RECEIPT

OC000000048198839

24392
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

Date Mailed: 06/17/2011

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Wayne C. Boncyk, Evergreen, CA;
Ronald H. Cohen, Pasadena, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a DIV of 13/037,317 02/28/2011
which is a DIV of 12/333,630 12/12/2008 PAT 7,899,243
which is a DIV of 10/492,243 05/20/2004 PAT 7,477,780 *
which is a 371 of PCT/US02/35407 11/05/2002
which is a CON of 09/992,942 11/05/2001 PAT 7,016,532
which claims benefit of 60/246,295 11/06/2000
and claims benefit of 60/317,521 09/05/2001
(*)Data provided by applicant is not consistent with PTO records.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 04/01/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/069,124**

Projected Publication Date: 09/22/2011

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

Image Capture and Identification System and Process

Preliminary Class

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Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13069124
	Filing Date	2011-03-22
	First Named Inventor	Boncyk, Wayne C.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	101044.0001US14

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Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7916138	B2	2011-03-29	John et al.	
	2	7889193	B2	2011-02-15	Platonov et al.	
	3	7768534	B2	2010-08-03	Pentenrieder et al.	
	4	7765126	B2	2010-07-27	Hudetz et al.	
	5	7696905	B2	2010-04-13	Ellenby et al.	
	6	7641342	B2	2010-01-05	Eberl et al.	
	7	7430588	B2	2006-07-13	Hunter	
	8	7383209	B2	2005-11-03	Hudetz et al.	

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	Art Unit		
	Examiner Name		
	Attorney Docket Number		101044.0001US14

	9	7245273	B2	2002-08-01	Eberl et al.	
	10	7031875	B2	2006-04-18	Ellenby et al.	
	11	7031536	B2	2006-04-18	Kajiwara	
	12	6993573	B2	2006-01-31	Hunter	
	13	6865608	B2	2005-03-08	Hunter	
	14	6804726	B1	2004-10-12	Ellenby et al.	
	15	6766363	B1	2004-07-20	Rothschild	
	16	6690370	B2	2004-02-10	Ellenby et al.	
	17	6675165	B1	2004-01-06	Rothschild	
	18	6651053	B1	2003-11-18	Rothschild	
	19	6542933	B1	2003-04-01	Durst, Jr. et al.	

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	Examiner Name	
	Attorney Docket Number	101044.0001US14

	20	6535210	B1	2003-03-18	Ellenby et al.	
	21	6522292	B1	2003-02-18	Ellenby et al.	
	22	6434561	B1	2002-08-13	Durst, Jr. et al.	
	23	6430554	B1	2002-08-06	Rothschild	
	24	6414696	B1	2002-07-02	Ellenby et al.	
	25	6396475	B1	2002-05-28	Ellenby et al.	
	26	6307556	B1	2001-10-23	Ellenby et al.	
	27	6278461	B1	2001-08-21	Ellenby et al.	
	28	6199048	B1	2001-03-06	Hudetz et al.	
	29	6173239	B1	2001-01-09	Ellenby	
	30	6108656	A	2000-08-22	Durst et al.	

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	Art Unit	
	Examiner Name	
	Attorney Docket Number	101044.0001US14

	31	6098118	A	2000-08-01	Ellenby et al.	
	32	6064398	A	2000-05-16	Ellenby et al.	
	33	6037936	A	2000-03-14	Ellenby et al.	
	34	6031545	A	2000-02-29	Ellenby et al.	
	35	5991827	A	1999-11-23	Ellenby et al.	
	36	5978773	A	1999-11-02	Hudetz et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100188638	A1	2010-07-29	Eberl et al.	
	2	20100045933	A1	2010-02-25	Eberl et al.	
	3	20080157946	A1	2008-07-03	Eberl et al.	

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	4	20070182739	A1	2007-08-09	Platonov et al.	
	5	20070146391	A1	2007-06-28	PENTENRIEDER et al.	
	6	20070109619	A1	2007-05-17	Eberl et al.	
	7	20060190812	A1	2006-08-24	Ellenby et al.	
	8	20060161379	A1	2006-07-20	Ellenby et al.	
	9	20050024501	A1	2005-02-03	Ellenby et al.	
	10	20020163521	A1	2002-11-07	Ellenby et al.	
	11	20010047426	A1	2001-11-29	Hunter	
	12	20010044824	A1	2001-11-22	Hunter et al.	
	13	20010032252	A1	2001-10-18	Durst et al.	
	14	20010011276	A1	2001-08-02	DURST JR. et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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	1		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13069124
	Filing Date	2011-03-22
	First Named Inventor	Boncyk, Wayne C.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	101044.0001US14

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☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Nicholas J. Witchey/	Date (YYYY-MM-DD)	2011-07-22
Name/Print	Nicholas J. Witchey	Registration Number	63481

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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13069124
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	First Named Inventor	Boncyk, Wayne C.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	101044.0001US14

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5933829	A	1999-08-03	Durst et al.	
	2	5815411	A	1998-09-29	Ellenby et al.	
	3	5742521	A	1998-04-21	Ellenby et al.	
	4	5682332	A	1997-10-28	Ellenby et al.	
	5	5625765	A	1997-04-29	Ellenby et al.	

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	Application Number	13069124
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	First Named Inventor	Boncyk, Wayne C.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	101044.0001US14

Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5
	1	9942947	WO	A2	1999-08-26	ELLENBY		☐
	2	9942946	WO	A2	1999-08-26	ELLENBY		☐
	3	02073818	WO	A1	2002-09-19	ELLENBY		☐
	4	02059716	WO	A2	2002-08-01	ELLENBY		☐
	5	1354260	EP	A2	2003-10-22	ELLENBY		☐
	6	1012725	EP	A1	2000-06-28	ELLENBY		☐
	7	0171282	WO	A1	2001-09-27	ELLENBY		☐
	8	0163487	WO	A1	2001-08-30	ELLENBY		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13069124
	Filing Date	2011-03-22
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	Art Unit	
	Examiner Name	
	Attorney Docket Number	101044.0001US14

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	Filing Date		2011-03-22
	First Named Inventor	Boncyk, Wayne C.	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		101044.0001US14

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OR

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☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

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Signature	/Nicholas J. Witchey/	Date (YYYY-MM-DD)	2011-07-21
Name/Print	Nicholas J. Witchey	Registration Number	63481

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G06F 13/00

A1

(11) International Publication Number: WO 97/44737

(43) International Publication Date: 27 November 1997 (27.11.97)

(21) International Application Number: PCT/US97/08702

(22) International Filing Date: 21 May 1997 (21.05.97)

(30) Priority Data:
60/018,405 22 May 1996 (22.05.96) US

(60) Parent Application or Grant
(63) Related by Continuation
US 60/018,405 (CIP)
Filed on 22 May 1996 (22.05.96)

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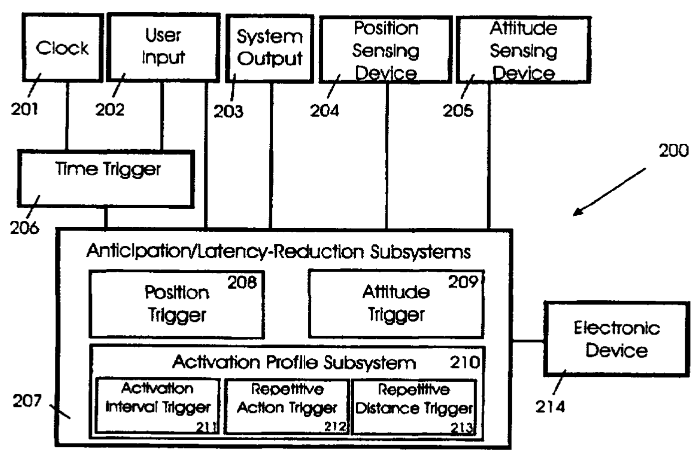
(81) Designated States: AU, CA, CH, JP, KR, NZ, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: MEHTOD AND APPARATUS FOR CONTROLLING ELECTRICAL DEVICES IN RESPONSE TO SENSED CONDITIONS



(57) Abstract

A system (200) is disclosed that senses physical characteristics of an electronic device (214). The system (200) controls the electronic device (214) in response to the sensed physical characteristics. The system (200) includes a control subsystem. The control subsystem includes a time trigger (206) and an anticipation/latency reduction subsystem (207). The anticipation/latency reduction subsystem (207) includes additional subsystems such as a time trigger (206), a position trigger (208) and an attitude trigger (209). The various triggers can be implemented using processors that execute software. The control subsystem receives signals from the sensing devices (204, 205). Physical characteristics information obtained from these signals is provided to the various triggers (206, 208, 209, 211, 212, 213). In response to this physical characteristic information, the various triggers (206, 208, 209, 211, 212, 213) process the physical characteristic information such that the system (200) controls the electronic device (214).

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METHOD AND APPARATUS FOR CONTROLLING ELECTRICAL DEVICES IN RESPONSE TO SENSED CONDITIONS

This application claims the benefit of provisional patent application no. 60/018,405, entitled Systems and Methods For Anticipating User Actions For Improving Electrical Device Performance, filed May 22, 1996 by inventors John Ellenby, Peter Malcolm Ellenby and Thomas William Ellenby. Provisional patent application no. 60/018,405 is hereby incorporated herein by this reference.

FIELD OF THE INVENTION

The present invention relates to methods and apparatus for improving the performance of electrical devices, and more particularly to methods and apparatus that sense a variety of conditions and that control electrical devices in response to the conditions sensed.

BACKGROUND

Electronic devices are typically designed to perform specific functions. From the moment an electronic device is turned on, it may be fully functional to perform its designed task. This approach may be fine for simple devices. This approach, however, may present disadvantages in complex systems. For example, a complex system may consume relatively large amounts of power. If the complex system is fully functional at all times, power consumption typically remains high even when the system is not actually being used. This relatively high power consumption can be a particularly important concern for battery-powered systems where high power consumption can cause a short operational life.

Another characteristic of conventional electronic devices is that they may have several modes of operation and may be designed to start in one of those modes when turned on. Such devices may switch modes only in response to a physical user interaction, such as pressing a predetermined button, for example. Such a design may work for simple devices. Complex systems, however, may take a relatively long time to switch from one mode of operation to another. In addition, it may be inconvenient for a user to have to manually switch the system between modes. If a complex system is designed to always start in one mode when turned on, or to switch to another mode only when manually selected, the length of the switching time and the time required by the user to get to the system to initiate the switch could hinder the performance of the electronic system.

Accordingly, there has been a need for a method and apparatus that increases battery life of an electrical device by allowing the device to power up and power down components therein at appropriate times. There has also been a need for a method and apparatus that reduces the latency (i.e. the delay) between the time a user decides to operate a device in a certain mode and the actual mode switching. Latency can also refer to the latency between the time that the user decides to turn a device on or off and the actual switching on or off of the device.

SUMMARY

An aspect of the invention is to provide a method and/or apparatus that controls an electrical device by sensing whether or not a user is using or is about to use the device. The method and/or apparatus can cause the electrical device to activate power hungry components only when they are likely to be needed. The method and/or apparatus can also cause the electrical device to de-activate power hungry components when they are not needed.

An aspect of the invention is to provide a method and/or apparatus that controls an electrical device by sensing when a user would like to switch to a desired mode of operation of the electrical device and to switch the modes of the device in response thereto. An aspect of the invention is to activate and/or deactive components or to switch between modes of an electrical device in

response to a variety of events and/or conditions, such as change in position of the device, distance of the device to or from a target object or target position, visual events or repetitive events, for example. Alternate embodiments of the invention might observe different types of condition, such as rate of acceleration or change in rate of acceleration of the device. Embodiments of the present invention can progressively activate components of the electrical device as it becomes more and more likely that the components are going to be needed by the electrical device. In particular, if it appears based upon sensed conditions that the electrical device is going to go into a desired mode and that particular components of the electrical device are going to be needed in the desired mode, the embodiment of the invention can activate individual components of the electrical device at different points in time as it becomes more and more likely that the components will be needed. This progressive activation could be staged in such a way that as more indications are sensed that the particular components are going to be needed (e.g. indications of user intent to put the electronic device into a particular mode are sensed), then the resources dedicated to the desired mode, for example, will be increased. Similarly, embodiments of the present invention could allow progressive deactivation of components of the electrical device as it becomes less and less likely that the components will be needed.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features and advantages of the present invention will become more apparent to those skilled in the art from the following detailed description in conjunction with the appended drawings in which:

Figure 1 illustrates system 100 which is an embodiment of the invention;

Figure 2 illustrates a system 200 which is an alternate embodiment of the invention;

Figure 3 illustrates the main flow of operation of the system 100;

Figure 4 illustrates the main flow of the operation of system 200;

Figure 5 illustrates the operation of a time trigger that can be used by embodiments of the invention;

Figure 6 illustrates the operation of an activation profile sub-system that can be used by embodiments of the invention;

Figure 7 illustrates the operation of an activation interval trigger that can be used by embodiments of the invention;

Figure 8 illustrates the operation of a repetitive action trigger that can be used by embodiments of the invention;

Figure 9 illustrates the operation of a repetitive distance trigger that can be used by embodiments of the invention;

Figure 10 illustrates the operation of an attitude trigger that can be used by embodiments of the invention;

Figure 11 illustrates the operation of a position trigger that can be used by embodiments of the invention;

Figure 12 illustrates a time trigger that can be used by embodiments of the invention;

Figure 13 illustrates an attitude trigger that can be used by embodiments of the invention;

Figure 14 illustrates a position trigger that can be used by embodiments of the invention;

Figure 15 illustrates system 1500 which is an alternate embodiment of the invention;

Figure 16 illustrates the main flow of operation of the system 1500;

Figures 17 and 18 illustrate the operation of a Graphics Limitation Due to Unit Motion sub-system that can be used by embodiments of the invention;

Figure 19 illustrates the operation of a display usage sub-system that can be used by embodiments of the invention;

Figure 20 illustrates the operation of a sleep sub-system that can be used by embodiments of the invention;

Figure 21 illustrates a Graphics Limitation Due to Unit Motion Subsystem that can be used by an embodiment of the present invention;

Figure 22 illustrates the hardware of the activation interval trigger of Figs. 2 and 7;

Figure 23 illustrates the hardware of the repetitive action trigger of Figs 2 and 8;

Figure 24 illustrates the hardware of the repetitive distance trigger of Figs 2 and 9;

Figure 25 illustrates the hardware of the graphics limitation due to unit motion subsystem;

Figure 26 illustrates the hardware of the display usage subsystem 1517.

DETAILED DESCRIPTION

An embodiment of the present invention comprises a novel system for improving the performance of electronic devices and related methods. The following description is presented to enable a person skilled in the art to make and use the invention. Descriptions of specific applications are provided only as examples. Various modifications to the preferred embodiments will be readily apparent to those skilled in the art, and general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the invention. Thus, the present invention is not intended to be limited to the embodiments disclosed, but is to be accorded the widest scope consistent with the principles and features disclosed herein.

Fig. 1 illustrates a block diagram of system 100 which is a first embodiment of the invention. This system 100 is a device usage detection system that monitors the physical characteristics of an electronic device 110 or monitors other predefined conditions in order to activate or otherwise control the electronic device 110. System 100 activates or controls device 110 when the system detects indications of intent to use or other predefined conditions. System 100 comprises a clock 101, a user input 102, a system output 103, a position sensing device 104, an attitude sensing device 105, a time trigger 106, and an anticipation/latency-reduction subsystem 107. The clock 101, the time trigger 106, and the anticipation/latency reduction subsystem 107 form a control subsystem. Alternate embodiments are not limited to this particular control system or to control systems that have structure equivalent to this particular control system. The user input 102 can be any form of input mechanism including without limitation a keyboard, a mouse, scroll keys and a graphical user interface, or some form of magnetic, optical or electronic storage, for example. The system output 103 can be any form of output that enables the system 100 to communicate externally, either with a user or another type of electronic device for example. Thus, it could be a display or some form of communications port such as a network port. Both input and output could be achieved using remote transmission techniques such as wireless and/or infrared transmissions, for example. Communication between the sensing devices and the control subsystem can also be accomplished using a variety of techniques including remote transmissions. The position sensing device 104 typically is a satellite based positioning system, such as GPS or GLONAS, though other position sensing devices, or inertial navigation systems, for example, can be used. The attitude sensing device 105 typically is a magnetic flux sensing device 105, such as a flux gate compass or tri-axial magnetometer, though other attitude sensing devices, such as inclinometers and laser ring gyros, can be used. The anticipation/latency-reduction subsystem 107 further comprises a position trigger 108 and an attitude trigger 109. Embodiments of the time trigger 106, the attitude trigger 109 and the position trigger 108 are shown in Figs. 12, 13 and 14, respectively.

As shown in Fig. 1, the output of the clock 101 and the user input 102 are coupled to the time trigger 106. The user input 102, the outputs of the time trigger 106, the position sensing device 104, and the attitude sensing device 105 are coupled to the anticipation/latency-reduction subsystem 107, and hence to the position trigger 108 and the attitude trigger 109. The output of the anticipation/latency subsystems 107 is coupled to the electronic device 110.

Figure 3 is a flowchart 300 of the general operation of the system 100. In step 301, the user activates the system monitor mode. In this mode, the system 100 monitors the time trigger 106, step 302, and periodically monitors the anticipation/latency subsystem 107, step 303, for certain defined conditions. If the certain defined conditions are met, the system 100 activates the electronic device 110, step 304. The signal used to control the electronic device in response to sensed physical conditions of the electronic device, for example, shall be referred to as a control signal. In embodiments of the invention, such defined conditions might be the electronic device 110 coming within or going out of a pre-defined distance of a certain object or position, a user coming within or going out of a predefined proximity to the electronic device 110, vibration of the electronic device 110, or attitude of the electronic device. Alternate embodiments might sense other physical characteristics of the electronic device 110 including without limitation acceleration or change in acceleration of the electronic device 110, for example. Activation or deactivation of the electronic device can be thought of as switching modes of the electronic device. Such mode switching might involve activation and/or deactivation of the entire device or activation and/or deactivation of only portions of the device.

Figure 5 is a flowchart 500 of the operation of the time trigger 106. This trigger 106 implements a delay between the periods in which the system 100 monitors its anticipation/latency reduction subsystems. It also implements time activation routines. In a time activation routine, a user might indicate that it would like the device 110 to be activated or deactivated within a specified period of time from the time the activation routine is initiated. The user might use such an activation routine to instruct the trigger 106 to activate the device 110 every 10 minutes. In alternate embodiments of the invention, a time activation routine may be used to progressively activate portions of the device 110 at a number of user specified times. Such a system might be used where it is desirable to turn on different components of the device 110 at different times. Thus, such a system might turn on first components that take longer to power up or to turn on last components that consume the most power. Such a system might also be used to provide levels of sensing. In particular, the system might use a sensing device that obtains a rough estimate of position until the electronic device comes within a certain range of a target location. Once within that range, the system might power up another sensing device (e.g. more accurate than the first sensing device, but that consumes more power).

In step 501, a monitor limit W is defined by the software used by trigger 106. Limit W, which is stored by trigger 106, is a delay between the monitoring periods in which the system 100 monitors the subsytems 107. For example, if W = 50ms the system 100 operates in the time trigger 106 for 50ms. After 50ms, the system 100 branches to monitor the anticipation/latency reduction subsystems 107. The limit W can be adjusted depending on how long the user would like the time trigger 106 to operate before the trigger 106 branches to monitor the subsystems 107. Alternate embodiments may use similar delays in other triggers.

In step 502 of Fig. 5, the system 100 transmits a present time signal from the clock 101 to the time trigger 106. Triggers 108 and 109, discussed below, provide examples of how the system 100 uses a variety of subsytems (e.g. the triggers 108 and 109) and sensing devices (e.g. devices 104 and 105) to monitor conditions. Steps 503-509 of Fig. 5 deal with time activation routines used by the time trigger 106 to activate the electronic device 110 or a portion of the electronic device 110 at user defined periods of time. In step 503 the trigger 106 determines if such an activation routine is active. If not, the flowchart 500 branches to step 510. If such a routine is active, the flowchart 500 branches to step 504. In step 504, the trigger 106 determines if the time activation routine has just been initiated. If so, the trigger 106 stores the present time as the "last checked" time Y, step 506, and prompts the user to input the desired activation time interval X, step 507, and stores X, step 508. This interval X is the time that the trigger 106 waits from the "last checked" time Y (i.e. the time at which the time activation routine is initiated) to activate the device 110. If, in step 504, the trigger 106 determines that the time activation routine was already active, the trigger 106 branches to step 505. In step 505, the trigger 106 calculates the elapsed time from the last checked time Y to the present time and then in step 509 compares this elapsed time to the activation interval X. If the elapsed time is greater than or equal to X, the flowchart branches to step 304 of Fig. 3 and the system 100 fully activates the device 110. If in step 509 the elapsed time is less than X, the flowchart 500 branches to step 510 of Fig. 5. In step 510, the trigger 106 receives a new present time signal and calculates the time difference between the last received time signal received in step 502 and the new present time signal received in step 510. The trigger 106 adds the calculated difference to the elapsed time Z. The trigger 106, in step 512, then compares the elapsed time Z to the monitor limit W. If Z is greater than or equal to W, the trigger 106 sets Z to zero, step 514, and then proceeds to step 1001 of Fig. 10 to check the anticipation/latency-reduction subsystems 107. Thus, step 512 limits the amount of time the time trigger 106 operates before the system 100 branches to monitor the anticipation/latency reduction subsystems 107. If in step 512 Z is less than W, the trigger 106 checks to see if the user has turned off device 110, step 513, and then returns to step 502 to receive the next present time signal. Step 513 might also be used to determine if the system 100 itself has turned off the device 110 or to determine if some other device has turned off the device 110.

Figure 10 is a flowchart 1000 of the operation of the attitude trigger 109. The physical characteristics of the electronic device that are sensed by the attitude sensing device shall be referred to as attitude characteristics. The attitude trigger receives attitude information representing these attitude characteristics. This attitude information is obtained from an attitude signal that comes from the attitude sensing device. In the present embodiment, the attitude trigger 109 is implemented using hardware that executes software. The hardware is described with reference to Fig. 13. The flowchart 1000 illustrates the operation of the attitude trigger 109's software. The attitude trigger checks to determine whether or not the attitude of the electronic device 110 is changing at higher than a specified rate or if the attitude of the electronic device 110 has changed more than a specified amount from a steady state attitude. If the attitude is changing at higher than this specified rate or has changed more than the specified amount, the system 100 activates the electronic device 110. Step 1001 of flowchart 1000 defines a "degrees per second" activation limit C, a "degrees from steady state" activation limit D, and a "record new steady state A" limit E. In step 1002, the trigger 109 receives a present attitude signal from the attitude sensing device 105 and, in step 1003, checks to see if a value for "steady state" attitude A and "last received" attitude B have been stored previously. If values for A and B have not been stored, the trigger 109, in step 1004, stores the present attitude received from the attitude sensor as both A and B and the flowchart 1000 then branches to step 1101 of Fig. 11 to check the position trigger 108. If step 1003 determines that values for A and B have been stored previously, the flowchart 1000 branches to step 1005 where the trigger 109 calculates the difference between the present attitude and "last received" attitude B. The trigger 109 then divides this attitude difference by W to give a degrees per second value that represents a rate of change of the attitude of the electronic device 110, step 1006. The trigger 109 then compares this calculated degrees per second with the "degrees per second" activation limit C, step 1006. If the calculated degrees per second value exceeds C, the flowchart 1000 branches to step 304 of Fig. 3, and the system 100 fully activates the device 110. If the calculated degrees per second value does not exceed C, the flowchart 1000 branches to step 1007.

In step 1007, the trigger 109 determines the difference between the present attitude and the last received attitude B. This difference is compared to the "record new steady state A" limit E. Limit E is an attitude change threshold. Attitude changes that are less than this threshold, for example, will not cause the steady state attitude A and the present attitude B to be updated. Attitude changes that are greater than or equal to this threshold will cause these attitudes A and B to be updated. This limit E, thus prevents minor motion of the electronic device 110 from being recorded as a new steady state value A. In other words, the limit E prevents the trigger 109 from resetting the steady state value A due to slight or insignificant movements of the system 100 or the electronic device 110.

Thus, if the change in attitude exceeds E, the flowchart 1000 branches to step 1008 where the present attitude reading is stored as both the "steady state" attitude A and the "last received" attitude B. If the change in attitude does not exceed E, the flowchart branches to step 1009 where the trigger 109 calculates the difference between the present attitude and "steady state" attitude A. The trigger 109 then compares this difference to the "degrees from steady state" activation limit D, step 1010. If the difference exceeds D, the flowchart 1000 branches to step 304 of Fig. 3, and the system 100 activates the device 110. If the difference does not exceed D the flowchart branches to step 1011 to store the present attitude reading as B and then to step 1101 of Fig. 11 to check the position trigger 108. Thus, if the device 110 is not activated by the attitude trigger 109, the system 100 moves on to monitor the position trigger 108.

Figure 11 is a flowchart 1100 of the operation of the position trigger 108. The physical characteristics of the electronic device that are sensed by the position sensing device shall be referred to as position characteristics. The position trigger receives position information representing these position characteristics. This position information is obtained from a position signal that comes from the position sensing device. In the present embodiment, this operation is implemented using hardware to execute software. The hardware used to implement the position trigger is discussed with reference to Fig. 14. The flowchart 1100 illustrates the operation of the software. The position trigger executes position activation routines. The position trigger 108 checks to determine whether or not the position of the electronic device 110 has changed by a specified amount from its position at the time a position activation routine is activated. The position 108 also checks the proximity of the electronic device 110 to areas or points of interest specified by the user, for example. In step 1101 the position monitoring mode is activated and the position sensing device 104 transmits position information to the trigger 108. Steps 1102-1109 deal with position activation routines that activate the electronic device 110 or a portion of the electronic device 110 at user defined distances of movement or user defined positions. For example, the user can set the system 100 to activate the electronic device 110 every 50 feet. In step 1102, the trigger 108 determines if such an activation routine is active. If not, the flowchart 1100 branches to step 1110. If such a routine is active, the flowchart 1100 branches to step 1103 to determine if the active position activation routine has just been initiated. If the routine has just been initiated, the trigger 108 stores the present position of device 110 received in step 1101 as the "last stop" position G, step 1104, prompts the user to input the desired activation distance F, step 1105, and stores F, step 1106. If step 1103 determines that such an activation routine was already active, the trigger 108 calculates the distance from G to the present position, step 1107, and then compares this calculated distance to the user specified activation distance F, step 1108. If the calculated distance is greater than or equal to distance F, the flowchart 1100 branches to step 304 of Fig. 3 and the system 100 fully activates the device 110. If the calculated distance is less than F, the flowchart 1100 branches to step 1110. Alternate embodiments of the invention could work with position activation routines that handle a number of user specified distances. These distances could be used to provide a progressive power-up or power down of the device 110, for example. In particular, specified portions of the device 110 could be powered up or down at various distances to achieve a progressive power up or down of the device 110.

Steps 1110-1112 deal with proximity of device 110 to areas or points of interest that the user has specified. For example, a user may indicate that he or she wants the device 110 or a portion of the device 110 to activate when the device comes within a certain distance of a designated point or area. The user may desire that the device 110 become active when the device is within a half a mile of Auckland harbor outer marker R2, for example. In step 1110, the system 100 checks to see if a user has specified any points/areas of interest. If not, the flowchart 1100 branches to step 502 of Fig. 5 and returns to monitoring the time trigger 106. If the user has specified such points/areas of interest, the flowchart 1100 branches to step 1111 where the trigger 108 determines the distance to or from each such point/area. In step 1112, the trigger 108 compares the user specified activation distance associated with each point/area to the determined distance. If any of the determined distances are less than the associated activation distance, the flowchart 1100 branches to step 304 of Fig. 3 and the system 100 fully activates the device 110. If none of the determined distances are less than the associated activation distance, the flowchart 1100 branches to step 502 of Fig. 5 and the system 100 returns to monitoring the time trigger 106 as described above.

Fig. 2 is a block diagram of a system 200 that is a second embodiment of the invention. The system 200 includes components that operate in the same manner as those described with respect to the system 100. The similar components are numbered similarly (e.g. time trigger 206 operates in the same manner as time trigger 106). In addition to having such similar components, system 200 includes an activation profile subsystem 210. This subsystem 210 is included as part of the anticipation/latency-reduction subsystem 207 of system 200.

Subsystem 210 is designed to allow the system 200 to recognize, over a period of use, repetitive actions taken by a user or other repetitive conditions that occur prior to activation of device 110. Based upon this recognition, the subsystem 210 develops specific activation profiles that are associated with particular repetitive actions or particular repetitive conditions. These activation profiles allow the system 200 to recognize the particular repetitive actions or conditions as an indication of impending use. In response, the system 200 can activate or begin progressive activation of the device 214. The activation profile subsystem 210 includes an activation interval trigger (AIT) 211, a repetitive action trigger (RAT) 212, and a repetitive distance trigger (RDT) 213. Alternate embodiments of the invention may be designed to respond to repetitive conditions other than the specific repetitive conditions discussed herein.

Fig. 4 is a flowchart 400 that shows the general operation of the system 200. The operation is much the same as the operation of system 100 with some modifications. Step 401 is substantially the same as step 301. Step 402 is different than step 302. In particular, the flowchart 500 of Fig. 5 substantially describes the operation of step 402 of Fig. 4. At step 512 of flowchart 500, however, if Z is greater than or equal to W, the flowchart 500 in system 200 executes step 514 and then branches to step 601 of Fig. 6 rather than branching to step 1001 of Fig. 10. This modification is shown by the replacement of Fig. 3's flow chart connnector 25 with Fig. 4's flow chart connector 3. Step 403 of Fig. 4 represents that operation of the Activation Profile subsystem 210 and the operation of the attitude trigger 208 and the position trigger 209. The operation of subsytem 210 is described in more detail below. As can be determined at the end of the activation profile flowcharts discussed below, the attitude and position triggers 209 and 208 operate in the same manner as the triggers 109 and 108, respectively, as was discussed above, except these triggers now operate after the activation profile subsystem 210. Accordingly, the operation of system 200 generally flows from Fig. 5 to Fig. 6 to Fig. 7 to Fig. 8 to Fig. 9 to Fig. 10 and then to Fig. 11, assuming the electronic device 214 is not activated during this flow. Once the operation in Fig. 11 is executed, the operation of system 200 loops back to step 502 of Fig. 5 through connector 5 of Fig. 11 assuming the electronic device 214 still has not been activated by the system 200. Thus, the system 200 may make multiple passes through these flowcharts before the device 214 is activated.

After branching from step 514 of Fig. 5 to step 601 of Fig. 6, the system 200 checks the activation profile subsystem 210. The activation profile subsystem 210 can be implemented in the same manner as the triggers 106, 109 and 108, for example, using a processor or processors that execute software or other types of hardware. Fig. 6 is a flowchart 600 that shows the basic operation of the software of the activation profile subsystem 210. In step 601 the subsystem 210 checks to see if an activation profile (AP) is active. I.e. step 601 determines if the subsystem 210 has been instructed by a user or by some other device (e.g by a computer) to look for particular repetitive conditions. If so, the flowchart 600 branches to step 602. If in step 601 the subsystem 210 determines that an activation profile is not active, the flowchart 600 branches to step 603.

In step 602, the subsystem 210 ascertains whether the system 200 has been instructed to use a different AP than the one that is presently active. Again, such an instruction might come from a user of system 200 or from some other device. If in step 602 system 200 determines that it has been instructed to use a different AP, the flowchart 600 branches to step 603. If in step 602 the system 200 determines that it has not been instructed to use a different AP, the flowchart 600 branches to step 701 of the flowchart 700. The flowchart 700 illustrates the operation of the AIT 211.

In step 603 the system 200 ascertains whether a user, for example, has selected an existing AP. If so, the software of the subsystem 210 branches to step 607. In step 607 the system 200 recalls the selected existing AP and provides the existing AP defined settings to each of the AP triggers 211, 212 and 213. As illustrated in step 607, an activation profile might use some or all of these triggers to sense conditions. As discussed below, each of these triggers senses different types of conditions. Alternate embodiments could use alternative triggers that sense other types of conditions. After entering the AP defined settings in the appropriate ones of the triggers 211, 212 and 213, the flowchart 600 branches to step 608 which is expanded in figures 7-9.

If in step 603 system 200 determines that an existing AP has not been selected, the flowchart 600 branches to step 604. In step 604 the system 200 ascertains whether it should save a new AP as it develops. An example of how

AP's might be developed is provided by the present embodiment which saves values in lists each time the system 200 passes through the AP subsystems 211, 212 and 213 as described below. Again, instruction to system 200 to save a new AP as it develops can come from a user of the system 200 or from some other device. If the system 200 has been instructed to save the new AP as it develops, the system 200 prompts the user to name the new AP, step 604. Upon receiving the name, the system 200 stores a default AP under that name, step 605, and the flowchart 600 then branches to Figure 7 through connector 26. The default AP can be defined in any manner appropriate to the particular application of the system 200. In the present embodiment, the default AP has no defined settings for the triggers 211, 212 and 213. Step 608 represents the operation of the activation profile triggers 211, 212 and 213. This operation starts with Fig. 7. The operation of the triggers 211, 212 and 213 is described in more detail below.

Fig. 7 is a flowchart 700 that shows the operation of the activation interval trigger 211. The activation interval trigger 211 is implemented using hardware and software. The hardware is discussed with reference to Fig. 22 below. The flowchart 700 represents the operation of the AIT software in the present embodiment. Again, the activation interval trigger 211 is used by the activation profile subsystem to detect repetitive conditions. This particular trigger 211 is for detecting repetitive elapsed times from the time the system 210 entered the monitor mode in step 401 to the "present time" at which the device 214 is activated. Thus, the system 200 will "learn" to turn the electronic device 214 on at a particular time from the time the system 200 enters the monitor mode if the electronic device 214 is previously repeatedly turned on at substantially the same time (within a predefined tolerance) of the time when the system 200 enters the monitor mode. While the present embodiment discusses "activation" of the electronic device, alternate embodiments could deal with deactivation. Accordingly, the AIT trigger and the activation interval value refer herein to such intervals whether the device 214 is being powered up or powered down.

In step 701, the AIT 211 ascertains whether or not an AIT interval value for the AIT 211 has been stored. If an interval value has been stored, the flowchart 700 branches to step 702. If an interval value for the AIT has not been stored, the flowchart 700 branches from step 701 to step 703. In step 702, the AIT 211 calculates the elapsed time from the time the system 200 entered the monitor mode to a "present time" where the present time is the time that was most recently read in step 502. This elapsed time shall be referred to as an observed activation interval value. Again, the monitor mode is activated in step 401. From step 702, the operation branches to step 704.

In step 704, the AIT 211 compares the elapsed time calculated in step 702 to the AIT interval value. If the elapsed time "matches" the AIT interval value, the flowchart 700 branches to step 404 of Fig. 4 and the system 200 fully activates the device 214. An elapsed time "matches" the AIT interval value when it is equal to or within some predefined range of the interval value. If the elapsed time does not match the AIT interval value, the flowchart 700 branches to step 703. As described below, this AIT interval can be a "learned" value.

In step 703 the AIT 211 ascertains whether the device 214 has already been activated (by the system 200 itself, by a user or by some other device). If the device 214 has not been activated, the operation as represented by flowchart 700 branches to step 801 of Fig. 8 to check the repetitive action trigger 212. If in step 703 the device 214 has been activated, the flowchart 700 branches to step 705. In step 705 the AIT 211 calculates the mode change time interval (MCTI) which is the time that has elapsed from the time the system 200 entered the monitor mode to the present time at which the trigger 212 detected that the electronic device 214 has been activated. In system 200 the electronic device 214 initially is powered off and then is powered up by the system 200. In an alternate embodiment, the device 214 may initially be powered on and then the system 200 may power down the device. Thus, the MCTI may refer to the time that has elapsed from the time the system 200 entered the monitor mode until the electronic device 214 is deactivated. If the system 200 is switching the device

214 from an off mode to an on mode, the MCTI may be referred to as a down time interval (DTI). If the system 200 is switching the device 214 from an on mode to an off mode, the MCTI may be referred to as a up time interval (UTI). The system 200 and the AIT 211 is described below in terms of down time intervals.

The AIT 211 maintains a list of DTI's. Again, each DTI is generated by one pass of the AIT 211 through the flowchart 700. The AIT 211 tracks the number of DTI's using a list. Each newly calculated DTI is placed at the top of this list of DTIs. The number of entries in this list is typically defined according to the needs of the particular application. For example, if the application is for a high motion environment, such as in an airplane, the number of DTI entries might be quite large. Under such circumstances the user may turn on the system 200 to activate the electronic device 214 a large number of times. A number of DTI entries may be generated as follows. After the time that the system 200 is turned on and the system 200 turns on the electronic device 214, the electronic device 214 might be turned off by the user, the system 200 itself or by some other electronic device. The system 200 would be turned off in response to the electronic device 214 turning off. After this point, the user might turn the system 200 back on, and another pass might be made through the flowchart 700, adding a second entry to the DTI list. If the DTI list becomes full, each newly calculated DTI is placed in the list (e.g. at the top of the list) and the oldest DTI is bumped off of the list (e.g. off the bottom of the list) for each new DTI added. Alternative approaches can be used to store relevant DTI's.

In step 706 the system 200 checks to see if the DTI list is full. If not, the flowchart 700 branches to step 801 of the flowchart 800 shown in Fig. 8. In step 801, the system 200 proceeds to update the other AP triggers (i.e. the RAT 212 and the RDT 213) if appropriate. If in step 706 the system 200 determines that the DTI list is full, the flowchart 700 branches to step 707. In step 707, the system 200 compares each of the entries in the DTI list to determine whether or not a majority of the DTIs are within the predefined tolerance limit of each other, step 708. This comparison can be accomplished in any manner that identifies a majority group of DTI's that are relatively close to each other (i.e. within the predefined tolerance of each other). Again, the predefined tolerance limit can be chosen as appropriate for the particular application. One approach determining whether a majority of DTI's are within a predefined tolerance of each other would be to determine the mean of all the entries in the DTI list. Each of the DTI's could then be compared to this mean. If a majority of the DTIs are within the predefined tolerance of the mean, the flowchart 700 branches to step 709 where the DTIs in this majority are averaged. Again, other approaches, including more sophisticated approaches, could be used to perform this identification of an appropriate majority. The average value of the DTI's in the identified majority is saved as a new AIT interval value for the AIT 211. From step 709, the flowchart 700 then branches to step 801 of Fig. 8 to proceed to update the other AP triggers if appropriate. If in step 707 the system 200 determines that a majority of the DTIs are not within the predefined tolerance of each other, the flowchart 700 branches to step 801 of Fig. 8 to proceed to update the other AP triggers if appropriate.

Fig. 8 is a flowchart 800 that shows the operation of the repetitive action trigger (RAT) 212. In the present embodiment, this operation is implemented by executing software using hardware. The flowchart 800 represents the operation of the software. The hardware used by the RAT 212 is described with reference to Fig. 23 below. The repetitive action trigger looks for a repetitive series of attitudes. Each attitude reading might be expressed as an (x,y,z) coordinate where x represents an attitude rotation around a vertical axis, y represents an attitude rotation around a horizontal axis and z represents an attitude rotation around an axis perpendicular to both the x and y axes. Thus, for example the electronic device 214 might move through the series of attitudes

$$[(0°,0°,0°), (20°,20°,0°), (45°,45°,0°), (90°,90°,0°), (90°,120°,0°), (90°,130°,0°)] \qquad (1)$$

before the device 214 is activated. If it moves through this series of attitudes (within predefined tolerances) regularly before the device 214 is activated, the system 200 can learn the series of attitudes. Then the system 200 can activate the device 214 upon detecting the learned series.

In step 801, the RAT 212 records an attitude reading (e.g. an x,y,z coordinate) from the attitude sensing device 205 and places the recorded attitude at the top of a list of attitude readings. The number of (x,y,z) attitude readings in this attitude list again is typically defined by the requirements of the particular application. Attitude readings are added to this attitude list until it is full. Again, each pass through the flowchart 800 generates a single (x,y,z) attitude reading that is added to the list. Once the attitude list is full, each newly recorded attitude reading is placed at the top of the list and for each new reading added, the oldest attitude reading is bumped off the bottom of the list. In step 802 the RAT 212 ascertains whether or not the device 214 has been activated. It may have been activated by a user, by the system 200 itself or by some other device. If the device 214 has been activated, the flowchart 800 branches to step 806. If the device 214 has not been activated, the flowchart 800 branches to step 803.

In step 803, the RAT 212 checks to see if a RAT attitude setting for the repetitive action trigger (RAT) 212 has been stored. If a RAT attitude setting has been stored, the flowchart 800 branches to step 804. If such a setting has not been stored, the flowchart 800 branches to step 901 of Fig. 9 to check the repetitive distance trigger 213. As discussed below, the RAT attitude setting could be a learned setting. The RAT attitude setting is actually a series of attitude readings (such as the series (1) shown above) for which the system 200 is looking.

In step 804 of flowchart 800, the RAT 212 compares each of the entries in the list of attitude readings (i.e. the observed attitude readings) with the corresponding attitudes in the RAT attitude setting. For example, it compares the first observed attitude with the first attitude in the RAT setting, the second observed attitude with the second attitude in the RAT setting, and so on. The

RAT attitude setting list may include one or more attitudes. In step 805 the RAT 212 ascertains whether each of the attitude readings in the attitude list matches the corresponding RAT attitude setting within a predefined tolerance. Again, a match occurs when the observed attitude reading is within a predefined tolerance of the corresponding attitude in the RAT attitude setting list. Again, the predefined tolerance can be determined according to the requirements of the particular application. If each of the corresponding attitudes in the two lists match within the predefined tolerance, the system 200 has determined that the electronic device 214 has moved through the searched for series of attitudes as defined by the RAT attitude setting. As a result, the flowchart 800 branches to step 404 of Fig. 4 and the system 200 fully activates the device 214. If the two lists do not match within the predefined tolerance, then the flowchart 800 branches to step 901 of Fig. 9 and the system 200 checks the repetitive distance trigger 213.

If in step 802 the RAT 212 branched to step 806, in step 806 the RAT 212 "learns" the attitude series that occured before the device 214 was turned on. In particular, the series of attitudes that occurred before the device 214 turned on is added to an activation motion routine (AMR) list. By moving through the flowchart 800 multiple times, multiple attitude series are added to the AMR list. Thus, the activation motion routine list is a list of lists or a list of "attitude series." In particular, each entry in the AMR list is itself a list of attitudes. The RAT 212 stores the attitude list from step 801 as an activation motion routine. The RAT 212 then places this AMR at the top of a list of AMRs. The number of entries in this AMR list is typically defined according to the requirements of the particular application. Each new AMR is added to the top of the AMR list. If the list is full, for each new AMR is added, the oldest AMR is bumped from the bottom of the list.

In step 807, the RAT 212 tests to ascertain whether or not the AMR list is in fact full. If it is not, the flowchart 800 branches to step 905 of the flowchart 900 of Fig. 9 to update the repetitive distance trigger setting if appropriate. If the AMR list is full, the flowchart 800 branches to steps 808 and 809. In steps 808 and 809, the RAT 212 compares the AMR's in the list and ascertains whether a majority of the AMRs are within an predefined tolerance of each other. One approach to doing this is to determine the mean of the corresponding attitude readings in all of the lists that make up the AMR. For example, the RAT 212 may calculate the mean of all of the first attitude readings in the lists that make up the AMR; then the mean of all the second attitude readings in the list that makes up the AMR; and so on. Upon calculating such a "mean attitude list," the RAT 212 compares each of the attitude readings in each entry of the AMR list to the corresponding attitude readings in the mean attitude list. If all of the attitude readings of a particular AMR entry are within a predetermined tolerance of the corresponding mean attitude from the mean attitude list, then the particular AMR is included in a group. If a majority of AMR's are included in this group, then the flowchart 800 branches from step 809 to step 810 where the corresponding attitude readings in each of the AMR entries in the majority are averaged and this list of average attitudes is saved as a new RAT attitude setting. Other techniques can be used to determine which of the AMR's are within a pre-defined tolerance of each other. From step 810 the flowchart branches to step 905 of Fig. 9 to update the repetitive distance trigger setting if necessary. In step 809, if a majority of the AMRs are not within the predefined tolerance of each other, the flowchart 800 branches to step 905 of Fig. 9 to update the repetitive distance trigger setting if appropriate.

Fig. 9 is a flowchart 900 that shows the operation of the repetitive distance trigger 213. In the present embodiment, this operation is implemented by executing software using hardware. The flowchart 900 represents the operation of the software. The hardware used by the RDT 213 is described with reference to Fig. 24 below. The repetitive distance trigger 213 monitors repetitive distances from the position of the electronic device 214 when the system 200 enters the monitor mode to the position of the electronic device 214 when the electronic device is turned on. The system 200 will "learn" to turn on at this same distance from this position of the electronic device 214 when the electronic device 214 entered the monitor mode.

In step 901 of flowchart 900, the RDT 213 ascertains whether a repetitive distance value for the repetitive distance trigger (RDT) has been stored in an application profile (AP). This repetitive distance value can be a learned value as described below. If a repetitive distance value has been stored, the flowchart 900 branches to step 902. If a repetitive distance value has not been stored, the flowchart 900 branches to step 903. In step 902 the RDT 213 calculates the distance from the present position of electronic device 214 to the position of electronic device 214 at the time the monitor mode was activated. This distance shall be referred to as an observed distance value. The flowchart 900 then branches from step 902 to step 904. In step 904 the RDT 213 compares the distance calculated in step 902 to the repetitive distance value. If the calculated distance "matches" the repetitive distance value, the flowchart 900 branches from step 904 to step 404 of Fig. 4 and the system 200 fully activates the device 214. A match occurs if the calculated distance falls within a specified range of the repetitive distance value. If the calculated distance does not match the repetitive distance value, the flowchart 900 branches to step 903. In step 903 the RDT 213 ascertains whether or not the device 214 has been activated. If the device 214 has not been activated, the flowchart 900 branches to step 1001 of Fig. 10 to proceed with checking the attitude trigger 209 and position trigger 208. This branch is shown by the connector 27 from Fig. 9 to Fig. 6 and the connector 25 from Fig. 6 to Fig. 10. The operation of triggers 209 and 208 are the same as the operation of the triggers 109 and 108, respectively, which have been described with reference to the system 100.

If in step 903 the device 214 has been activated, the flowchart 900 branches from step 903 to step 905. In step 905 the RDT 213 calculates the distance from the present position of electronic device 214 to the position of electronic device 214 at which monitor mode was activated. This distance shall be referred to as the mode change distance interval (MCDI). The mode change distance interval (MCDI) is the distance that the electronic device 214 has moved from the time the system 200 entered the monitor mode to the present time at which the trigger 213 detected that the electronic device 214 has been activated. Similar to the MCTI of the AIT 211, the MCDI can refer to a change of the device 214 from a powered down mode to a powered up mode (i.e. activation), as in the present embodiment. Such a MCDI can also be referred to as a down distance interval (DDI). Similarly, the MCDI can refer to a change of the device 214 from a powered up mode to a powered down mode. Such an MCDI can also be referred to as a up distance interval (UDI). The system 200 is described below in terms of down distance intervals.

Each pass through the flowchart 900 calculates a single DDI. The trigger 213 places the DDI calculated in step 905 at the top of a list of DDIs. The number of entries in this list of DDI's can be defined according to the requirements of each particular application. If the DDI list is full, the newly calculated DDI is placed at the top of the list and the oldest DDI is bumped off the bottom of the list. Alternate techniques can be used to store relevant DDI values. The trigger 213 branches from step 905 to step 906. In step 906 the system 200 ascertains whether or not the DDI list is full. If it is not full, the flowchart 900 branches to step 404 of Fig. 4 and the system 200 fully activates the device 214. After the device 214 is activated by the system 200, the device 214 may be turned off by the user, by the system 200 itself or by some other electronic device. Turning the system 200 back on after this point will generate a second DDI that will be added to the list of DDI's. If the DDI list is full, the flowchart 900 branches to step 907.

In step 907 the RDT 213 compares the entries in the DDI list to each other and branches to step 908. In step 908 the RDT 213 ascertains whether a majority of the DDIs are within the predefined tolerance of each other. This comparison can be accomplished in any manner that identifies a majority group of DDI's that are relatively close to each other (i.e. within the predefined tolerance of each other). Again, the predefined tolerance limit can be chosen as appropriate for the particular application. One approach determining whether a majority of DDI's are within a predefined tolerance of each other would be to determine the mean of all the entries in the DDI list. Each of the observed DDI's could then be compared to this mean. If a majority of the DDIs are within the predefined tolerance of the mean, the flowchart 900 branches to step 909 where the DDIs in this majority are averaged. Again, other approaches, including more sophisticated approaches, could be used to perform this identification of an appropriate majority.

If a majority of the DDIs are within the predefined tolerance of each other, the system 200 has identified a pattern of device 214 activations where the device 214 has been activated repeatedly at about the same distance from the position of the device 214 when the system 200 entered the monitor mode. If the majority are within this predefined tolerance, the flowchart 900 branches to step 909 where the DDIs in the majority are averaged. This average value is saved as a new value for the repetitive distance value. This step is where the system 200 "learns" the repetitive distance for which it is looking. From step 909 flowchart 900 branches to step 401 of Fig. 4 and the system 200 fully activates the device 214. If in step 908 a majority of the DDIs are not within the predefined tolerance off the repetitive distance value, the flowchart 900 branches to step 401 of Fig. 4 and the system 200 fully activates the device 214.

Fig. 15 illustrates a system 1500 that is coupled to a vision system 1514. This system 1500 illustrates an embodiment of the invention that is being used to control the vision system 1514. The vision system 1514 is a particular example of an electronic device such as the device 214. The vision system 1514 could be a traditional optical combiner type of instrument, such as a heads up display, or preferably a vision system of the type as disclosed in the PCT publication no. WO 95/07526. This published PCT application entitled “Electro-Optic Vision Systems Which Exploit Position and Attitude" having publication no. WO 95/07526 having international filing date June 16, 1994, Applicant Criticom Corp., having inventors John Ellenby and Thomas William Ellenby, and having

International application no. PCT/US94/06844 is hereby incorporated herein by this reference. The systems 1500 and 1514 are also used to illustrate additional concepts that relate to the reduction of graphics complexity when motion of the electrical device being controlled is detected. These systems are used to illustrate concepts that relate to the activation or deactivation of system displays based upon detected user proximity and concepts that relate to the conservation of power when system inactivity is detected, among others.

In Fig. 15, the components of system 1500 operate in the same manner as the similarly numbered components of system 200 of Fig. 2. The vision system 1514 includes a graphics limitation due to unit motion subsystem 1516, a display usage subsystem 1517, and a sleep subsystem 1518 and a display, such as a video monitor or a heads up display (not shown). The vision system 1514 also includes a piezo-electric gyro system 1515. This gyro system 1515 is associated with the image stabilization system (not shown) of the vision system 1514. An example of an image stabilization, such as a deformable prism image stabilization system that uses piezo-electronic gyros, is disclosed in International Publication No. WO 95/07526 having an international publication date of March 16, 1995 and having the Applicant Criticom Corporation. The systems of Fig. 15 can be used to implement a system such as the one described in this Publication WO 95/07526. In particular, the present embodiment may be used in a system where information about the real world position and/or attitude, for example, of graphical objects has been previously stored in some manner. Such data may represent something in the real world such as a real world objects, locations or area(s), for example. The graphical objects may or may not, however, be associated with these real world items. This stored information can then be provided to the system 1514. Based upon the position and/or attitude of the vision system 1514 and based upon the field of view of its imaging device, the system 1514 can recall the stored graphical objects and superimpose them, in the correct location, on a real time image of a particular view being observed by a user. The imaging device might be a camera (e.g a digital camera) with appropriate lenses.

The outputs of the clock 1501 and user input 1502 are coupled to the time trigger 1506. The outputs of the time trigger 1506, user input 1502, position sensing device 1504, and attitude sensing device 1505 are coupled to the anticipation/latency-reduction subsystems 1507, and hence to the position trigger 1508, attitude trigger 1509, activation interval trigger 1511, repetitive action trigger 1512, and the repetitive distance trigger 1513. The outputs of the anticipation/latency-reduction subsystems 1507, clock 1501, user input 1502, position sensing device 1504, attitude sensing device 1505, time trigger 1506, and piezo-electric gyros 1515 are coupled to the vision system 1514, and hence to the graphics limitation due to unit motion subsystem 1516, the display usage subsystem 1517, and the sleep subsystem 1518.

Figure 16 is a flowchart 1600 that shows the general operation of the system 1500. In step 1601 the user activates the monitor mode, telling the system 1500 to monitor the time trigger 1506 and the anticipation/latency reduction subsystems 1507. The flowchart 1600 then branches to step 1602, in which the system 1500 monitors the time trigger 1506 for a time specified by the monitor limit W, and then branches to step 1603. In step 1603 the system 1500 monitors the anticipation/latency-reduction subsystems 1507. The flowchart 1600 then branches to step 1604, in which the vision system 1514 is activated, and then branches to step 1605. In step 1605 the system 1500 monitors the graphics limitation due to unit motion subsystem 1516 of the vision system 1514. The flowchart 1600 branches from step 1605 to step 1606 where the system 1500 monitors the display usage subsystem 1517 of the vision system 1514. The flowchart then branches to step 1607 where the system 1500 monitors the sleep subsystem 1518 of the vision system 1514.

Figures 17 and 18 show the operation of the graphics limitation due to unit motion subsystem 1516. Figure 21 is a block diagram of an embodiment of the hardware used to implement the graphics limitation due to unit motion subsystem 1516. Figs. 17 and 18 illustrate flowcharts 1700 and 1800 that show how the software that is used to implement the graphics limitation due to unit motion subsystem 1516 operates in relation to detected vibration of vision system 1514 as registered by the piezo-electric gyros 1515. In step 1701 the system 1516 defines the application specific vibration limit H. The vision system 1514 will begin to decrease the complexity of all graphics when the level of vibration rises above the limit H. The "level of vibration" is typically measured by a number of changes in motion (e.g. direction of motion) over a period of time. Thus, the "level of vibration" is a "vibration rate" which might be a rate of direction changes, for example. In step 1702 the subsystem 1516 receives motion signals from the piezo-electric gyros 1515 and time signals from the clock 1501 and calculates the vibration rate. These gyros are also typically associated with a deformable prism image stabilization system (not shown) of the vision system 1514, though the gyros may be independent of any other device 1514 subsystems. In step 1703 the system 1514 ascertains whether the calculated vibration rate exceeds the vibration limit H. If the calculated vibration rate does not exceed H, the flowchart 1700 branches to step 1801 of Fig. 18 which describes additional operations of the graphics limitation due to unit motion subsystem 1516. If the calculated vibration rate does exceed the vibration limit H, the flowchart 1700 branches to step 1704. In step 1704 the system 1514 ascertains whether the calculated vibration rate exceeds the ability of a stabilization system to stabilize the image displayed by the vision system. The image stabilization system is typically specified as being able to handle maximum vibration rate. If the calculated vibration rate does not exceed the ability of the vision system stabilization system to stabilize the image, the flowchart 1700 branches to step 1706. If the calculated vibration rate does exceed the ability of the vision system stabilization system to stabilize the image, the flowchart 1700 branches to step 1705.

In step 1705, the system 1516 reduces the "complexity level" of all recalled graphic objects by an appropriate number of "complexity levels" based upon the severity of the vibration detected. In the present embodiment, for example, the complexity level may be reduced by two or more levels in response to a determination that the vibration exceeds the ability of the stabilization system to compensate for the vibration. It may be appropriate in embodiments of the invention to reduce the complexity level by a greater amount when the stabilization system is no longer able to compensate for vibrations because, under such circumstances, the vibrations likely will be more severe.

Even when the stabilization system is able to handle the vibration, in the present embodiment the complexity level is reduced because the user likely will be vibrating. Accordingly, in step 1706 the system 1514 reduces by one "level" the "complexity level" of all of the graphic objects being displayed. In the present embodiment, to reduce complexity levels, one or more complexity levels may be defined to represent each graphic object. Thus, one graphic object may be represented by one complexity level. A second graphic object, on the other hand, may be represented by a plurality of complexity levels. The different complexity levels associated with a particular graphic object each visually represent that particular graphic object, but at different levels of complexity. These levels can range from highly complex, (e.g. a full blown raster image) to the minimum complexity required to impart the meaning of the graphic object to a user (e.g. a simple vector image).

The complexity of the graphic used represent a particular graphic object at any particular moment might be determined, for example, by assigning importance numbers to the graphic objects, for example, based upon the importance of a real world object with which the graphic object is associated. The importance number (IN) may be application defined. In a maritime navigation application, for example, the graphic objects associated with navigation markers may have a relatively high importance number. In a tourism application covering the same geographical area, however, the navigation markers are likely of lesser importance. Therefore, the graphic objects associated with the navigation markers may have a high importance number in the navigation application, but a lower importance number in the tourism application. The importance numbers assigned by an application could change as an application switches from one mode of operation to another. Using the above example, the system 1514 could be designed to operate in a particular geographical region with two modes of operation, navigation and tourism.

To change complexity levels, the system 1514 may control which graphical objects are displayed. For example, the system 1514 may display only the more important graphical objects when vibration occurs. Alternatively, the system 1514 may decrease complexity by progressively decreasing the resolution of some or all of the graphics objects being displayed based upon importance. Thus, for example, if the system 1514 was being used in the foregoing tourism context, the resolution of the markers might be decreased as a result of vibration so that the markers are displayed as only a rough geometric approximation. Alternatively, the markers may not be displayed at all in that context. To define the complexity levels, each complexity level is assigned a "complexity number." In the present embodiment, the complexity number is the number of calculations required to generate the graphical object associated with that particular complexity level. These different complexity levels are used by the system 1514 when allocating the resources of system 1514 for graphics generation.

Fig. 18 is a flowchart 1800 that shows the operation of a second portion of the graphics limitation due to unit motion subsystem 1516. This operation is similar to the operation described in Fig. 17 in the sense that it reduces complexity of graphic objects in response to detected conditions. The operation in Fig. 18, however, deals with a rate of attitude change rather than vibrations. In particular, subsystem 1516 in Fig. 18 operates in response to a detected attitude slew rate of vision system 1514. In the present embodiment, the slew rate of vision system 1514 is a rate of change of the attitude of the system 1514. In the present embodiment, subsystem 1516 is implemented using hardware that executes software. The hardware is described with reference to Fig. 25. Flowchart 1800 represents the operation of the software. In step 1801 of flowchart 1800 the subsystem 1516 defines a predefined attitude slew rate limit J. This limit J can be application specific; i.e. determined according to the requirements of the particular application. This limit J is the slew rate at which the system 1516 begins to reduce the complexity of graphic objects.

In step 1802 the system 1516 receives attitude signals from the attitude sensing device 1505 and clock signals from the clock 1501. The system 1516 calculates the actual attitude slew rate K of the vision system 1514 from these signals. In step 1803 the system 1516 ascertains whether the calculated attitude slew rate K exceeds the attitude slew rate limit J. If K does not exceed J, the flowchart 1800 branches to step 1901 of Fig. 19 and checks the display usage subsystem 1517. If K does exceed J, the flowchart 1800 branches to step 1804. In step 1804 the system 1514 reduces the complexity level of all graphics by one or more levels, the amount being defined by application specific complexity reduction slew rate thresholds. For example, if the measured slew rate K exceeds a first threshold, the complexity may be reduced to a complexity level associated with exceeding that first threshold. If the slew rate K exceeds a second threshold, the complexity may be reduced to a complexity level associated with exceeding that second threshold. The flowchart 1800 then branches to step 1901 of Fig. 19 and checks the display usage subsystem 1517.

Fig. 19 is a flowchart 1900 showing the operation of the display usage subsystem 1519 of the system 1514. This subsystem 1519 detects whether a user is actually looking at the display(s) (not shown) of the vision system 1514 and activates or deactivates the display(s) accordingly. Note that some of the activities associated with the display, such as warming up the backlighting, might not be deactivated at all. Such activities may instead remain active while the vision system 1514 as a whole is fully deactivated. In step 1901 the subsystem 1519 ascertains whether the display(s) is/are active. If the display(s) is/are active the flowchart branches to step 1902. If the display(s) is/are not active the flowchart branches to step 1903.

In step 1902 the subsystem 1519 ascertains whether a physical object is within the application/user defined display activation range threshold of the system 1514. In the present embodiment the subsystem 1519 is designed to detect the proximity of a user's eyes for example. Such a determination may be made using a low power sonic or light emitting range finder or some other similar device. The user may want to modify this activation threshold to allow wearers of eyeglasses to use the system. Eyeglasses might affect the proximity measurement by the range finder by providing a reflective surface that is nearer to the display then the user's eyes. The preferred display activation range threshold could be part of a users usage profile. Such a usage profile might inform the system 1500 and/or the system 1514 about certain attributes associated with a particular user.

If the system 1519 in step 1902 detects an object within the display activation range threshold, the flowchart 1900 branches to step 1905 in which the display remains activated. The flowchart 1900 then branches to step 2001 of Fig. 20 to check the sleep subsystem 1518. If an object is not detected within the display activation range threshold in step 1902, the flowchart 1900 branches from step 1902 to step 1904. In step 1904, the display(s) is/are deactivated. The flowchart 1900 then branches to step 2001 of Fig. 20 to check the sleep subsystem 1518. If the flowchart 1900 branched from step 1901 to step 1903, in step 1903 the system 1519 ascertains whether an object is within the application/user defined display activation range threshold. If an object is detected within the display activation range threshold, the flowchart 1900 branches from step 1903 to step 1906 where the displays are activated. The system 1519 then branches to step 2001 of Fig. 20 to check the sleep subsystem 1518. If in step 1903 an object is not detected within the display activation range threshold, the flowchart 1900 branches to step 2001 of fig. 20 to check the sleep subsystem 1518.

Fig. 20 is a flowchart 2000 that shows the operation of the sleep subsystem 1518. This flowchart 2000 can be read in conjunction with the flowcharts that illustrated system 200, for example. This subsystem 1518 returns the system 1500 to monitor mode, via connector 5, if the position or attitude of the vision system 1514 does not change over a user or application defined period of time. This subsystem 1518 illustrates an additional technique that can further reduce power consumption of the device being controlled by an embodiment of the invention.

The sleep subsystem 1518 is implemented by executing software using hardware. The operation of the software is illustrated by the flowchart 2000 of Fig. 20. The hardware to implement the sleep subsystem can be designed in any manner known in the art.

As shown in Fig. 20, in step 201 the sleep subsystem 1518 determines whether or not a user has activated a sleep routine. If not, the subsystem 1518 branches to step 2014. If so, the subsystem 1518 branches to step 2002. In step 2002 the subsystem 1518 defines a steady state time limit M. This time limit M is the time that the subsystem 1518 uses to determine if the system 1514 should be put to sleep. For example, if there have been no changes in attitude and position of the system 1514 within the previous time M, then the subsystem 1518 will put the system 1514 to sleep.

From step 2002, the subsystem 1518 branches to step 2003. In step 2003, the subsystem 1518 tests to determine if a sleep activation interval has been specified by a user or by some other device, for example. The sleep activation interval is used by the subsystem 1518 in the same manner as the time limit M. For example, if there have been no changes in attitude and position of the system 1514 within the previous time L, then the subsystem 1518 will put the system 1514 to sleep. The difference between M and L is that M is specified by the subsystem 1518 itself, whereas L is specified by a user. If a sleep activation interval L has been specified, the subsystem 1518 branches to step 2006. If a sleep activation interval has not been specified, the subsystem 1518 branches to step 2004.

In step 2006, the subsystem 1518 test to determine if it has started to countdown from L to zero. This countdown starts whenever neither of the position and attitude of the device 1514 are changing. If the subsystem 1518 has started this countdown, the subsystem 1518 branches to step 2007. If the subsystem 1518 has not started the countdown, the subsystem 1518 branches to step 2009.

In step 2009, the subsystem 1518 tests to determine if the position or attitude of the vision system 1514 has changed in the last M seconds. If at least one of the position and attitude has changed, then the subsystem 1518 branches to step 2014. If one of the position and attitude has not changed, then the subsystem 1518 branches to step 2010. In step 2010 the subsystem 1518 counts down from L to zero and then branches to step 2014.

If the subsystem 1518 branched to step 2004, the system 1500 prompts the user to define a sleep activation interval L. The subsystem 1518 then branches to step 2005. In step 2005 the user inputs to the system 1500 the time interval L. The system 1500 communicates this time interval to the subsystem 1518 and the subsystem 1518 stores this time interval as L. The subsystem 1518 then branches to step 2014.

If the subsystem 1518 branched to step 2007, the step 2007 tests to determine if the position or attitude of the vision system 1514 has changed in the last M seconds. If one of the position and attitude has changed, the subsystem 1518 branches to step 2008. In step 2008 the subsystem 1518 halts the countdown from L to zero and resets the counter performing the countdown to L. The subsystem 1518 branches from step 2008 to step 2014. If in step 2007 the subsystem 1518 determines that one of the position and attitude has not changed, the subsystem 1518 branches to step 2011. In step 2011 the subsystem 1518 tests to determine if the countdown equals zero. If the countdown does not equal zero, the subsystem 1518 branches to step 2014. If the countdown does equal zero, the subsystem 1518 branches from step 2011 to step 2012. In step 2012 the subsystem 1518 tests to determine if the device 1514 has been deactivated (e.g by the user or by some other device). If the device 1514 has been deactivated, the subsystem 1518 branches to step 2015 where the system 1500 switches off. If the device 1514 has not been deactivated, the subsystem 1518 branches from step 2012 to step 2013.

If the subsystem 1518 has branched to step 2014, in step 2014 the subsystem 1518 tests to determine if the user or some other device has put the system 1514 to sleep either manually or through the action of the other device. If the system 1514 has been put to sleep, the subsystem 1518 branches to step 2013. In step 2013 the system 1500 deactivates the display(s) and returns to step 502 of Fig. 5. If the system 1514 has not been put to sleep, the subsystem 1518 branches to step 2016. In step 2016 the subsystem 1518 tests to determine if the system 1514 has been deactivated. If the system 1514 has been deactivated, the system 1500 switces off. If the system 1514 has not been deactivated, the subsystem 1518 branches to step 1604 of Fig. 16.

The hardware that implements the time triggers 106 and 206 is illustrated in Fig. 12. The time triggers 106 and 206 include four RISC processors 1202, 1204, 1206 and 1208. These processors are programmed to each perform portions of the operations described with respect to Fig. 5. RISC processor 1202 stores the monitor limit W and compares the elapsed time reading Z with W. Processor 1204 keeps track of the elapsed time reading Z. Processor 1208 stores the "last checked" time Y and calculates the time that has elapsed from the time Y to the present time. Processor 1206 stores the activation interval X and compares to the activation interval X to the time that has elapsed from the time Y to the present time. Multiple processors need not be used. In particular, alternate embodiments might use a different number of processors, a single RISC or CISC processor or even other types and/or combinations of hardware that perform appropriate functions to implement an embodiment of the invention.

The hardware that implements the attitude triggers 109 and 209 is illustrated in Fig. 13. The attitude triggers 109 and 209 include five RISC processors 1302, 1304, 1306, 1308 and 1310. These processors are programmed to each perform portions of the operations described with respect to Fig. 10. Processor 1308 stores the "last received" attitude B and calculates the degrees per second rate of attitude change from the time the attitude B was stored to the time the new attitude is stored. Processor 1302 stores the "Degrees per Second" activation limit C and compares this limit C to the degrees per second value calculated by the processor 1308. Processor 1304 stores the steady state attitude reading A and calculates the difference between the last received attitude and A. Processor 1306 stores the "Record New Steady State A" Limit E and compares the degrees per second value calculated by processor 1308 to the limit E. Processor 1310 stores the "Degrees From Steady State" Activation limit E and compares the limit E to difference calculated by processor 1304. Multiple processors need not be used. In particular, alternate embodiments might use a different number of processors, a single RISC or CISC processor or even other types and/or combinations of hardware that perform appropriate functions to implement an embodiment of the invention.

The hardware that implements the position triggers 108 and 208 is illustrated in Fig. 14. The position triggers 108 and 208 include three RISC processors 1402 and 1404 and graphics controller 1406. These processors are programmed to each perform portions of the operations described with respect to Fig. 11. The graphics controller also performs some of the functions described with respect to Fig. 11. Processor 1402 stores the "last stop" position G and calculates the range from the current position to the last stop position G. Processor 1404 stores the set distance F and compare the range calculated by processor 1402 to the distance F. Graphics controller 1406 calculates the range to all areas that a user has specified are of interest and that have associated range activation thresholds. Multiple processors need not be used. In particular, alternate embodiments might use a different number of processors, a single RISC or CISC processor or even other types and/or combinations of hardware that perform appropriate functions to implement an embodiment of the invention.

Figure 21 is a block diagram of a preferred embodiment of the hardware used to implement the graphics limitation due to unit motion subsystem 1516. The subsystem 1516 includes three RISC processors 2102, 2104 and 2106. Each of the RISC processors is programmed to perform a portion of the operation described with respect to Figs. 17 and 18. For example, RISC processor 2102 is programmed to store the vibration limit H and compare the current measured vibration of system 1514 to H. RISC processor 2104 is programmed to store the vibration limit of the stabilization system and compare the current measure vibration of subsystem 1514 to the vibration limit of the stabilization subsystem of system 1514. The RISC processor 2106 stores the slew rate limit J and compares J to the measured slew rate K of the system 1514.

Fig. 22 illustrates the hardware of the AIT 211 of Fig. 2. As shown, the AIT 211 uses 7 RISC processors 2202, 2204, 2206, 2208, 2210, 2212, and 2214. RISC processor 2202 stores the AIT interval value. Processor 2204 stores the time at which the monitor mode of the system 200 was activated. This time is the time that was first read in step 502 of Fig. 5. Processor 2206 calculates the time elapsed from the time stored by processor 2204 to the present time where the present time is the time most recently read by the system 200 in step 502. Processor 2208 compares the elapsed time (DTI) calculated by processor 2206 with the AIT interval value stored in processor 2202. Processor 2210 determines if the user has activated the device 214. If so, the elapsed time calculated in processor 2206 becomes a Down Time Interval (DTI). The processor 2210 stores this DTI in a list of DTI's. If the list is full, the oldest DTI is bumped from the list. Processor 2212 compares each of the DTI's in the list created by processor 2210 with each of the other DTI's in this list to determine if a majority of the DTI's in the list are within a predefined tolerance of each other. Processor 2214 averages the DTI's that are within the predefined tolerance of each other, if any. This average is stored by the processor 2202 as a new value for the AIT interval value. Multiple processors need not be used. Alternate embodiments might use a different number of processors, a single RISC or CISC processor or even other types and/or combinations of hardware that perform appropriate functions to implement an embodiment of the invention.

Fig. 23 illustrates the hardware of the RAT 212 of Fig. 2. As shown, the RAT 212 uses 6 RISC processors 2302, 2304, 2306, 2308, 2310, and 2312. RISC processor 2302 places the present attitude of the device 214 in a list of attitude readings. If the list is full, the oldest attitude reading is bumped from the list. Processor 2304 stores the repetitive action trigger setting. Processor 2306 compares each value of the list generated by processor 2302 with the RAT setting stored by processor 2304. Processor 2308 determines if the user has activated the electronic device 214. If so, the list of attitude readings generated by the processor 2302 is stored at the top of a list of motion routines. If the list of motion routines is full, the oldest motion routine is bumped from the list of motion routines. Processor 2310 compares each of the motion routines in the list to each other to determine if a majority of motion routines are within a predefined tolerance of any other motion routine in the list. Processor 2312 averages the motion routines that are within the predefined tolerance of each other. The processor 2304 stores this average as a new value for the RAT setting. Multiple processors need not be used. Alternate embodiments might use a different number of processors, a single RISC or CISC processor or even other types and/or combinations of hardware that perform appropriate functions to implement an embodiment of the invention. In particular, alternate embodiments might use a different number of processors, a single RISC or CISC processor or even other types and/or combinations of hardware that perform appropriate functions to implement an embodiment of the invention.

Fig. 24 illustrates the hardware of the RDT 213 of Fig. 2. As shown, the RDT 213 uses 7 RISC processors 2402, 2404, 2406, 2408, 2410, 2412, and 2414. RISC processor 2402 stores the RDT repetitive distance value. Processor 2404 stores the position of the system 200 when the monitor mode of the system 200 was first activated. This position is the position that was first read during the first pass through the position trigger operation as illustrated in

Fig. 11. Processor 2406 calculates the distance between the present position and the position stored by processor 2404. Processor 2408 compares the distance calculated by processor 2406 with the RDT repetitive distance value stored by processor 2402. Processor 2410 determines if the user has activated the device 214. If so, the distance calculated in processor 2406 becomes a Down Distance Interval (DDI). The processor 2410 stores this DDI in a list of DDI's. If the list is full, the oldest DDI is bumped from the list. Processor 2412 compares each of the DDI's in the list created by processor 2410 with each of the other DDI's in this list to determine if a majority of the DDI's in the list are within a predefined tolerance of each other. Processor 2214 averages the DDI's that are within the predefined tolerance of each other, if any. This average is stored by the processor 2402 as a new value for the RDT repetitive distance value. Multiple processors need not be used. Alternate embodiments might use a different number of processors, a single RISC or CISC processor or even other types and/or combinations of hardware that perform appropriate functions to implement an embodiment of the invention.

Fig. 25 illustrates the hardware of the graphics limitation due to unit motion (GLDUM) subsystem 1516. As shown, the GLDUM subsytem 1516 uses 8 RISC processors 2502, 2504, 2506, 2508, 2510, 2512, 2514 and 2516. RISC processor 2502-2508 deal with vibration of the electronic device 214. RISC processors 2510-2516 deal with attitude change of the electronic device 214. RISC processor 2502 stores the vibration limit H. Processor 2504 calculates the vibration rate of the vision system 1514. Processor 2506 compares the vibration rate calculated by processor 2504 with the vibration limit stored by processor 2506. Processor 2508 instructs the system 1514 to degrade the complexity of displayed graphics objects according to the result of the comparison by processor 2506. Processor 2510 stores the attitude slew rate limit J of the system 1514. Processor 2512 calculates an actual slew rate of the attitude of the system 1514. Processor 2514 compares the actual slew rate calculated by processor 2514 with the slew rate limit J stored by processor 2510.

Multiple processors need not be used. Alternate embodiments might use a different number of processors, a single RISC or CISC processor or even other types and/or combinations of hardware that perform appropriate functions to implement an embodiment of the invention.

Fig. 26 illustrates the display usage subsystem 1517. As shown, the display usage subsystem 1517 uses a range finder 2602, 3 RISC processors 2604, 2606 and 2608 and a display plane 2610. The range finder 2602 might be an infra-red range finder arranged to detect the range to objects in proximity to the display plane 2610 of the device 1514. In the present embodiment, the range is tested in a direction away from and perpendicular to the display. The display plane 2610 corresponds to a display, such as a video monitor or a heads up display, that presents images to a user. RISC processor 2604 stores the display activation range threshold. Processor 2606 compares the range data from the infra-red range finder 2602 to the display activation threshold stored by processor 2604. If the comparison performed by processor 2606 indicates that an object is within the display activation range threshold, the processor 2608 activates the display, or if already activated allows the display to remain activated. If the comparison performed by processor 2606 indicates that an object is not within the display activation range threshold, the processor 2608 deactivates the display, or if already deactivated allows the display to remain deactivated. Multiple processors need not be used. Alternate embodiments might use a different number of processors, a single RISC or CISC processor or even other types and/or combinations of hardware that perform appropriate functions to implement an embodiment of the invention.

While Applicant has described the invention in terms of specific embodiments, the invention is not limited to or by the disclosed embodiments. The Applicant's invention may be applied beyond the particular systems mentioned as examples in this specification. Although a variety of circuits have been described in this specifications, embodiments of the invention need not use all of the specific circuits described herein. In addition, alternate embodiments might use alternative circuits for some or all of the circuits. For example, the RISC processor of Figs. 12-14 could be replace by a CISC processor, a single RISC processor or alternate circuitry that accomplishes the described functions. In addition, while portions of the embodiments have been disclosed as software, alternate embodiments could implement some or all of the software functions in hardware. Alternate embodiments of the invention might also use alternative sensing methods or devices to accomplish the purposes disclosed herein. Limits and/or thresholds expressed herein as upper (or lower) limits might in alternate embodiments be implemented as lower (or upper) limits. Where the present embodiments discuss activation of an electronic device, alternate embodiments might be used in a similar manner to deactivate electronic devices. Similarly, while the flow charts of the present embodiment are in terms of "activation of the device." Alternate embodiments may be designed to activate (or deactivate) portions of the device to provide a progressive activation or a progressive deactivation, for example.

CLAIMS

What is claimed is:

1. A system for controlling an electronic device, the system comprising:

a sensing subsystem that senses a physical characteristic of the electronic device;

a control subsystem that provides to the electronic device a control signal for switching the electronic device from a first mode to a second mode;

at least one communication coupling between the control subsystem and the sensing subsystem;

wherein the control subsystem provides the control signal to the electronic device in response to receiving at least one physical characteristic signal from the sensing subsystem wherein the at least one physical characteristic signal represents at least one predefined physical characteristic of the electronic device.

2. The system of claim 1, wherein the sensing subsystem comprises:

an attitude sensing device wherein the at least one physical characteristic signal includes an attitude signal and wherein the at least one predefined physical characteristic includes a predefined attitude characteristic of the electronic device.

3. The system of claim 1, wherein the sensing subsystem comprises:

a position sensing device wherein the at least one physical characteristic signal includes a position signal and wherein the at least one predefined physical characteristic includes a predefined position characteristic of the electronic device.

4. The system of claim 1, wherein the sensing subsystem comprises:

a position sensing device wherein the at least one physical characteristic signal includes a position signal and wherein the at least one predefined physical characteristic includes a predefined position characteristic of the electronic device.

5. The system of claim 1, wherein the control signal for switching the electronic device from the first mode to the second mode is for switching the electronic device from a power off mode to a power on mode.

6. The system of claim 1, wherein the control signal for switching the electronic device from the first mode to the second mode is for switching the electronic device from a power on mode to a power off mode.

7. The system of claim 1, wherein the control signal for switching the electronic device from the first mode to the second mode is for switching a portion of the electronic device from a power off mode to a power on mode.

8. The system of claim 1, wherein the control signal for switching the electronic device from the first mode to the second mode is for switching a portion of the electronic device from a power on mode to a power off mode.

9. The system of claim 1, wherein

the control subsystem provides to the electronic device a second control signal for switching the electronic device from the second mode to a third mode;

the control subsystem provides the second control signal to the electronic device in response to receiving a second at least one physical characteristic signal from the sensing subsystem wherein the second at least one physical characteristic signal represents a second at least one predefined physical characteristic.

10. The system of claim 9, wherein

the control signal for switching the electronic device from the first mode to the second mode is for switching a portion of the electronic device from one of a first power off mode and a first power on mode to the other of the first power off mode and the first power on mode; and

the second control signal for switching the electronic device from the second mode to the third mode is for switching a second portion of the electronic device from one of a second power off mode and a second power on mode to the other of the second power off mode and the second power on mode.

11. The system of claim 10, wherein

the control signal for switching the electronic device from the first mode to the second mode is for switching the portion of the electronic device from the first power off mode to the first power on mode; and

the second control signal for switching the electronic device from the second mode to the third mode is for switching the second portion of the electronic device from the second power off mode to the second power on mode.

12. The system of claim 10, wherein

the control signal for switching the electronic device from the first mode to the second mode is for switching the portion of the electronic device from the first power on mode to the first power off mode; and

the second control signal for switching the electronic device from the second mode to the third mode is for switching the second portion of the electronic device from the second power on mode to the second power off mode.

13. The system of claim 2 wherein the predefined attitude characteristic comprises a range of attitudes.

14. The system of claim 2, wherein the predefined attitude characteristic comprises a particular attitude and a predefined tolerance around the particular attitude.

15. The system of claim 2, wherein the predefined attitude characteristic comprises a rate of change of attitude where the rate of change of attitude meets a predefined attitude rate of change threshold.

16. The system of claim 4, wherein the predefined position characteristic comprises a range of positions.

17. The system of claim 4, wherein the predefined position characteristic comprises a particular position and a predefined tolerance around the particular position.

18. The system of claim 4, wherein the predefined position characteristic comprises a rate of change of position where the rate of change of position meets a predefined position rate of change threshold.

19. The system of claim 4, wherein the predefined position characteristic comprises an acceleration where the acceleration meets a predefined acceleration threshold.

20. The system of claim 13 further comprising a user input wherein the control subsystem executes software to provide a user with an option of adjusting the range using the user input.

21. The system of claim 16 further comprising a user input wherein the control subsystem executes software to provide a user with an option of adjusting the range using the user input.

22. The system of claim 14 further comprising a user input wherein the control subsystem executes software to provide a user with an option of adjusting the particular attitude and the predefined tolerance around the particular attitude using the user input.

23. The system of claim 17 further comprising a user input wherein the control subsystem executes software to provide a user with an option of adjusting the particular position and the predefined tolerance around the particular position using the user input.

24. The system of claim 15 further comprising a user input wherein the control subsystem executes software to provide a user with an option of adjusting the rate of change of attitude and the predefined attitude rate of change threshold using the user input.

25. The system of claim 18 further comprising a user input wherein the control subsystem executes software to provide a user with an option of adjusting rate of change of position and the predefined attitude rate of change threshold using the user input.

26. The system of claim 1 wherein control subsystem comprises a clock for generating a timing signals.

27. The system of claim 4 wherein the control subsystem comprises a position trigger that receives position information obtained from the position signal.

28. The system of claim 27, wherein the position trigger provides the control signal in response to the position information.

29. The system of claim 28, wherein the position trigger provides the control signal by executing software.

30. The system of claim 27, wherein the position trigger comprises a RISC processor.

31. The system of claim 30, wherein the RISC processor executes software to provide the control signal.

32. The system of claim 27, wherein the position trigger comprises a CISC processor.

33. The system of claim 32, wherein the CISC processor executes software to provide the control signal.

34. The system of claim 32, wherein the CISC processor provides the control signal in response to the position information.

35. The system of claim 27, wherein the position trigger comprises at least one of digital circuitry and analog circuitry that provides the control signal in response to the position information.

36. The system of claim 35, wherein the at least one of the digital circuitry and the analog circuitry provides the control signal without using software.

37. The system of claim 2 wherein the control subsystem comprises an attitude trigger that receives attitude information obtained from the attitude signal.

38. The system of claim 37, wherein the attitude trigger provides the control signal in response to the attitude information.

39. The system of claim 38, wherein the attitude trigger provides the control signal by executing software.

40. The system of claim 37, wherein the attitude trigger comprises a RISC processor.

41. The system of claim 40, wherein the RISC processor executes software to provide the control signal.

42. The system of claim 40, wherein the RISC processor provides the control signal in response to the attitude information.

43. The system of claim 37, wherein the attitude trigger comprises a CISC processor.

44. The system of claim 43, wherein the CISC processor executes software to provide the control signal.

45. The system of claim 43, wherein the CISC processor provides the control signal in response to the attitude information.

46. The system of claim 37, wherein the attitude trigger comprises at least one of digital circuitry and analog circuitry that provides the control signal in response to the attitude information.

47. The system of claim 46, wherein the at least one of the digital circuitry and the analog circuitry provides the control signal without using software.

48. The system of claim 1 wherein the control subsystem comprises an activation profile subsystem that receives physical characteristic information obtained from the physical characteristic signal wherein the activation profile subsystem provides the control signal in response to the physical characteristic information.

49. The system of claim 48 wherein the activation profile subsystem comprises:

an activation interval trigger wherein the physical characteristic information includes an observed activation interval value.

50. The system of claim 49, wherein the activation interval trigger comprises a processor executing software wherein the processor executing the software provides the control signal in response to a comparison of the observed activation interval value and an AIT interval value.

51. The system of claim 50, wherein the processor comprises a plurality of RISC processors.

52. The system of claim 49, wherein the activation interval trigger learns the AIT interval value from a plurality of observed mode change time interval values.

53. The system of claim 49, wherein the activation interval trigger comprises a plurality of RISC processors that provide the control signal in response to a comparison of the observed activation interval value and an AIT interval value.

54. The system of claim 49, wherein the activation interval trigger comprises a CISC processor that provides the control signal in response to a comparison of the observed activation interval value and an AIT interval value.

55. The system of claim 49, wherein the activation interval trigger comprises at least one of analog circuitry and digital circuitry that provides the control signal in response to a comparison of the observed activation interval and an AIT interval value.

56. The system of claim 55, wherein the at least one of the analog circuitry and the digital circuitry provides the control signal without using software.

57. The system of claim 48 wherein the activation profile subsystem comprises:

a repetitive action trigger wherein the physical characteristic information includes an observed series of attitude readings.

58. The system of claim 57, wherein the repetitive action trigger comprises a processor executing software wherein the processor executing the software provides the control signal in response to a comparison of the observed series of attitude readings and a RAT attitude setting.

59. The system of claim 58, wherein the processor comprises a plurality of RISC processors.

60. The system of claim 57, wherein the repetitive action trigger learns the RAT attitude setting from a plurality of observed series's of attitude readings

61. The system of claim 57, wherein the repetitive action trigger comprises a plurality of RISC processors that provide the control signal in response to a comparison of the observed series of attitude readings and a RAT attitude setting.

62. The system of claim 57, wherein the repetitive action trigger comprises a CISC processor that provides the control signal in response to a comparison of the observed series of attitude readings and a RAT attitude setting.

63. The system of claim 57, wherein the repetitive action trigger comprises at least one of analog circuitry and digital circuitry that provides the control signal in response to a comparison of the observed series of attitude readings and a RAT attitude setting.

64. The system of claim 63, wherein the at least one of the analog circuitry and the digital circuitry provides the control signal without using software.

65. The system of claim 48, wherein the activation profile subsystem comprises a repetitive distance trigger wherein the physical characteristic information includes an observed distance value.

66. The system of claim 65, wherein the repetitive distance trigger comprises a processor executing software wherein the processor executing the software provides the control signal in response to a comparison of the observed distance value and a repetitive distance value.

67. The system of claim 66, wherein the processor comprises a plurality of RISC processors.

68. The system of claim 65, wherein the repetitive distance trigger learns the repetitive distance value from a plurality of prior observed distance values.

69. The system of claim 65, wherein the repetitive distance trigger comprises a plurality of RISC processors that provide the control signal in response to a comparison of the observed distance value and an RDT distance value.

70. The system of claim 65, wherein the repetitive distance trigger comprises a CISC processor that provides the control signal in response to a comparison of the observed distance value and an RDT distance value.

71. The system of claim 65, wherein the repetitive distance trigger comprises at least one of digital circuitry and analog circuitry that provides the control signal in response to a comparison of the observed distance value and an RDT distance value.

72. The system of claim 71, wherein the at least one of the digital circuitry and the analog circuitry provides the control signal without using software.

73. The system of claim 48 wherein the activation profile subsystem is adapted to access a plurality of activation profiles where each activation profile is associated with a different user who may use the system.

74. The system of claim 73 wherein the activation profiles each comprise settings for at least one of an activation interval trigger, a repetitive action trigger and a repetitive distance trigger.

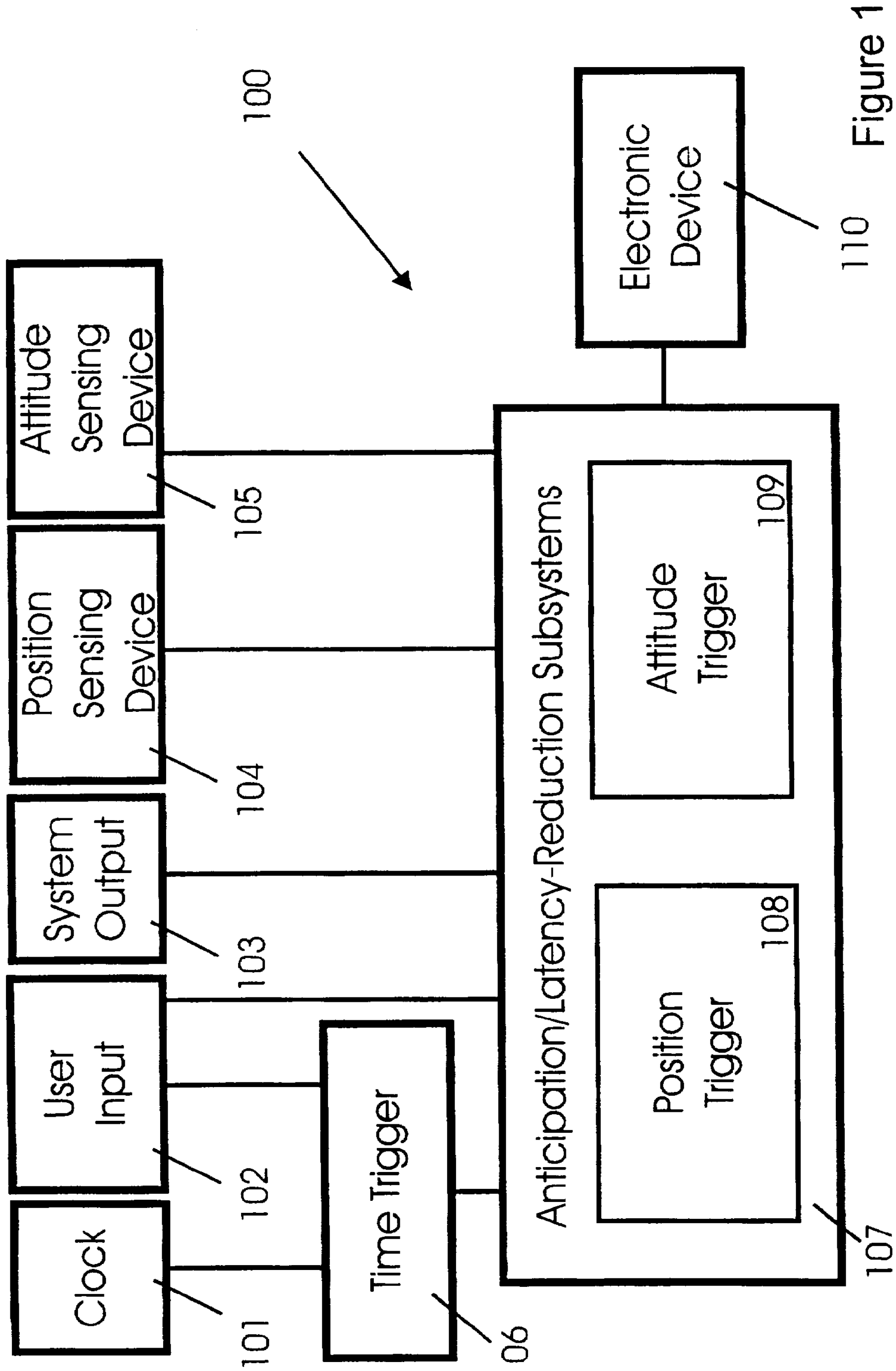


Figure 1

SUBSTITUTE SHEET (RULE 26)

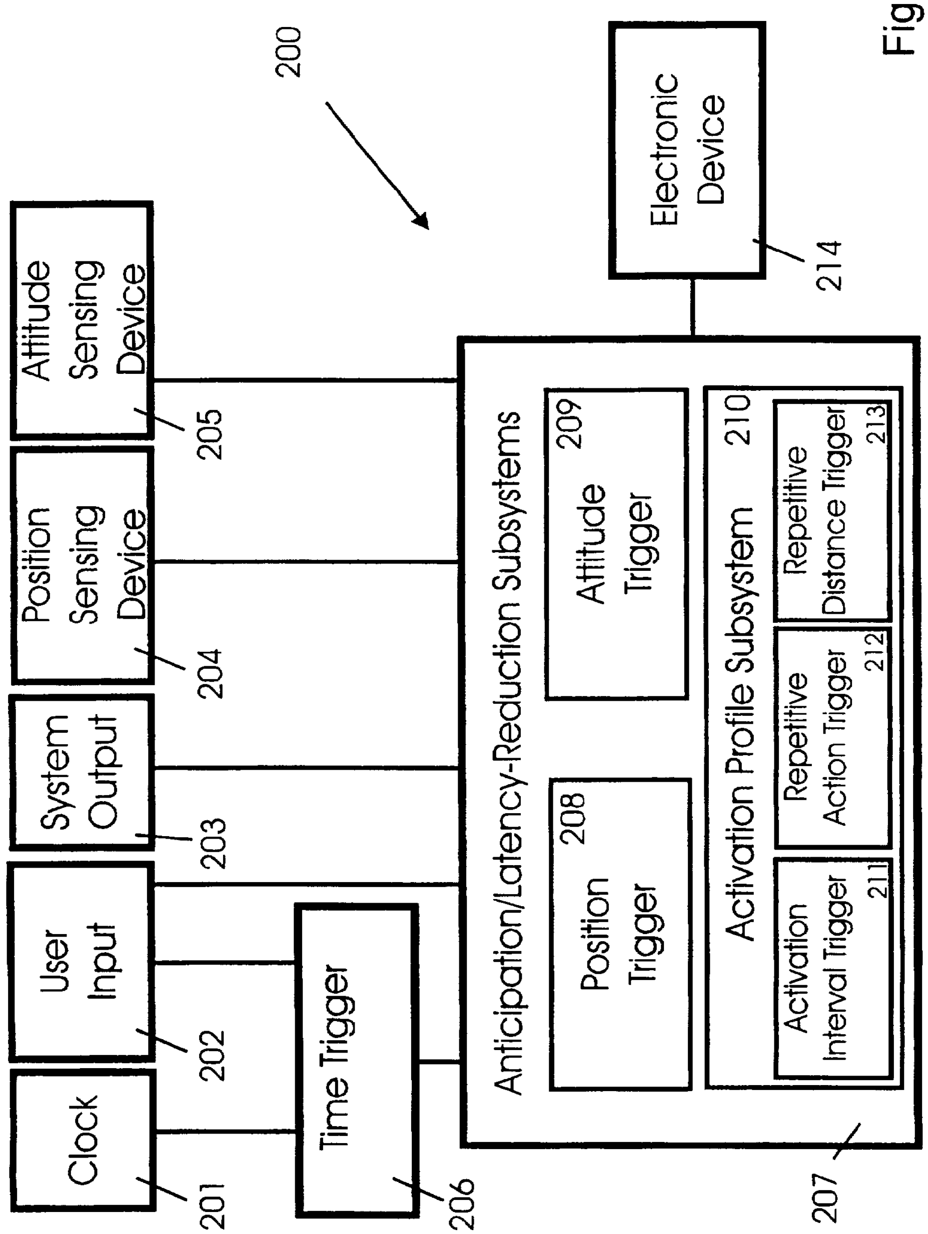

200
Clock
201
User Input
202
System Output
203
Position Sensing Device
204
Attitude Sensing Device
205
Time Trigger
206
Anticipation/Latency-Reduction Subsystems
207
Position Trigger
208
Attitude Trigger
209
Activation Profile Subsystem
210
Activation Interval Trigger
211
Repetitive Action Trigger
212
Repetitive Distance Trigger
213
Electronic Device
214

Figure 2

General Flow 1

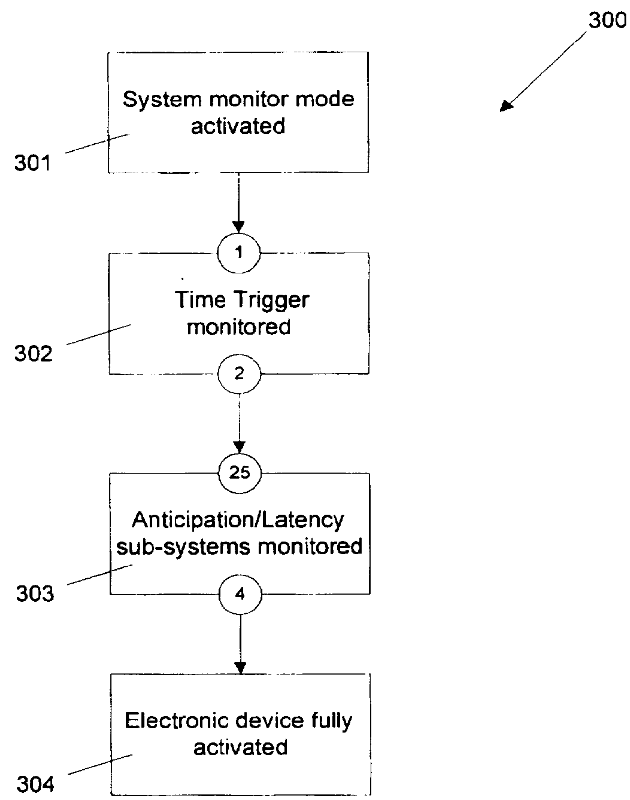


Figure 3

General Flow 2

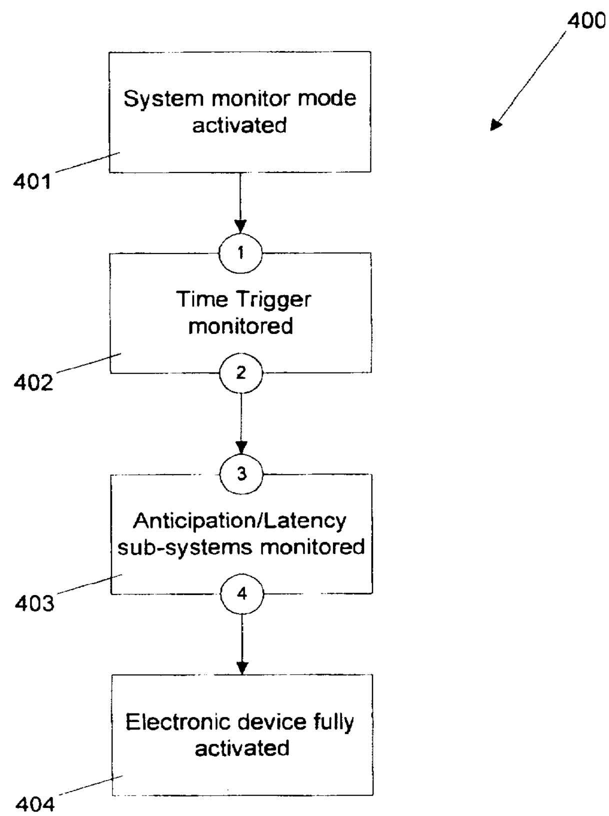


Figure 4

SUBSTITUTE SHEET (RULE 26)

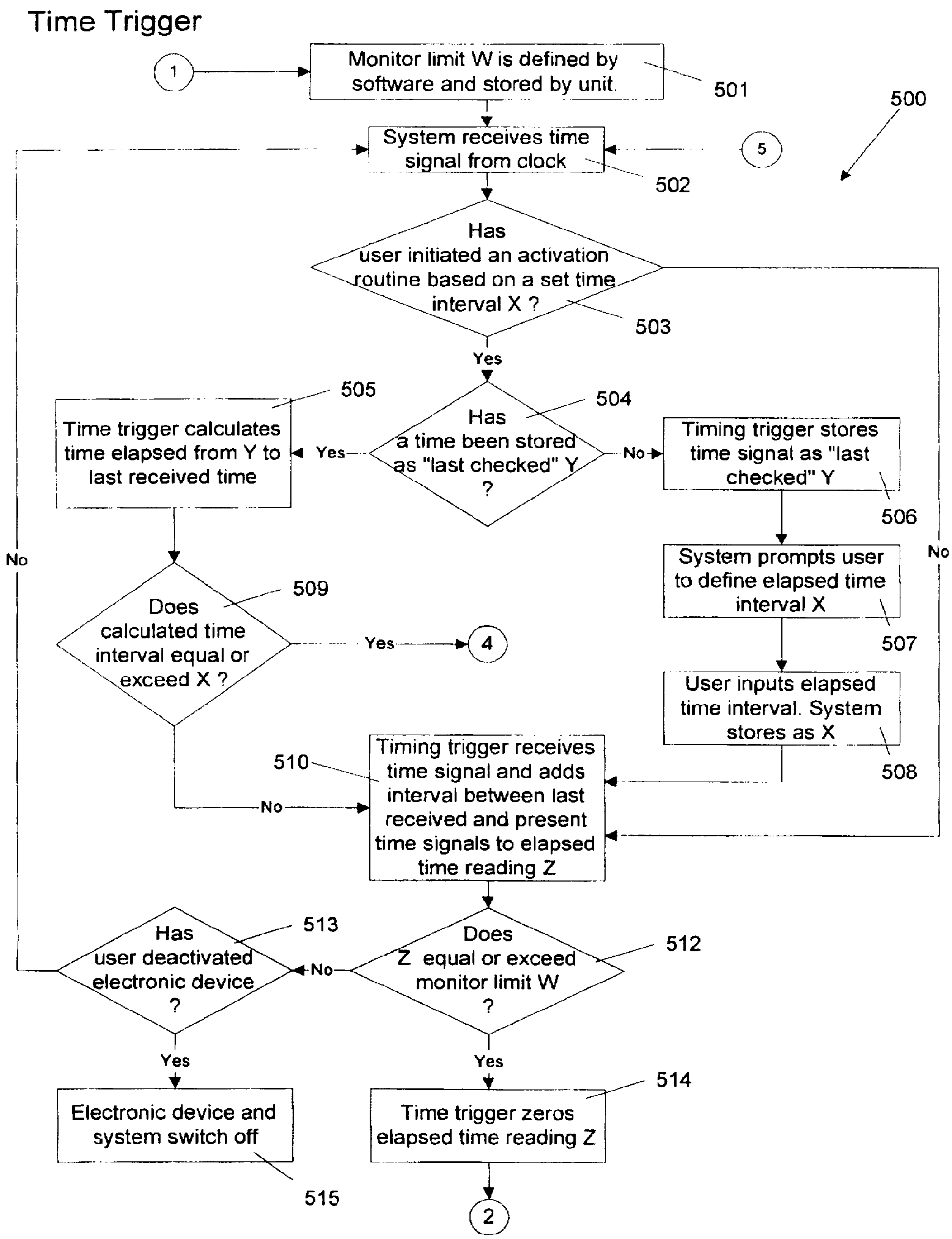


Figure 5

SUBSTITUTE SHEET (RULE 26)

Activation Profile Sub-System 1

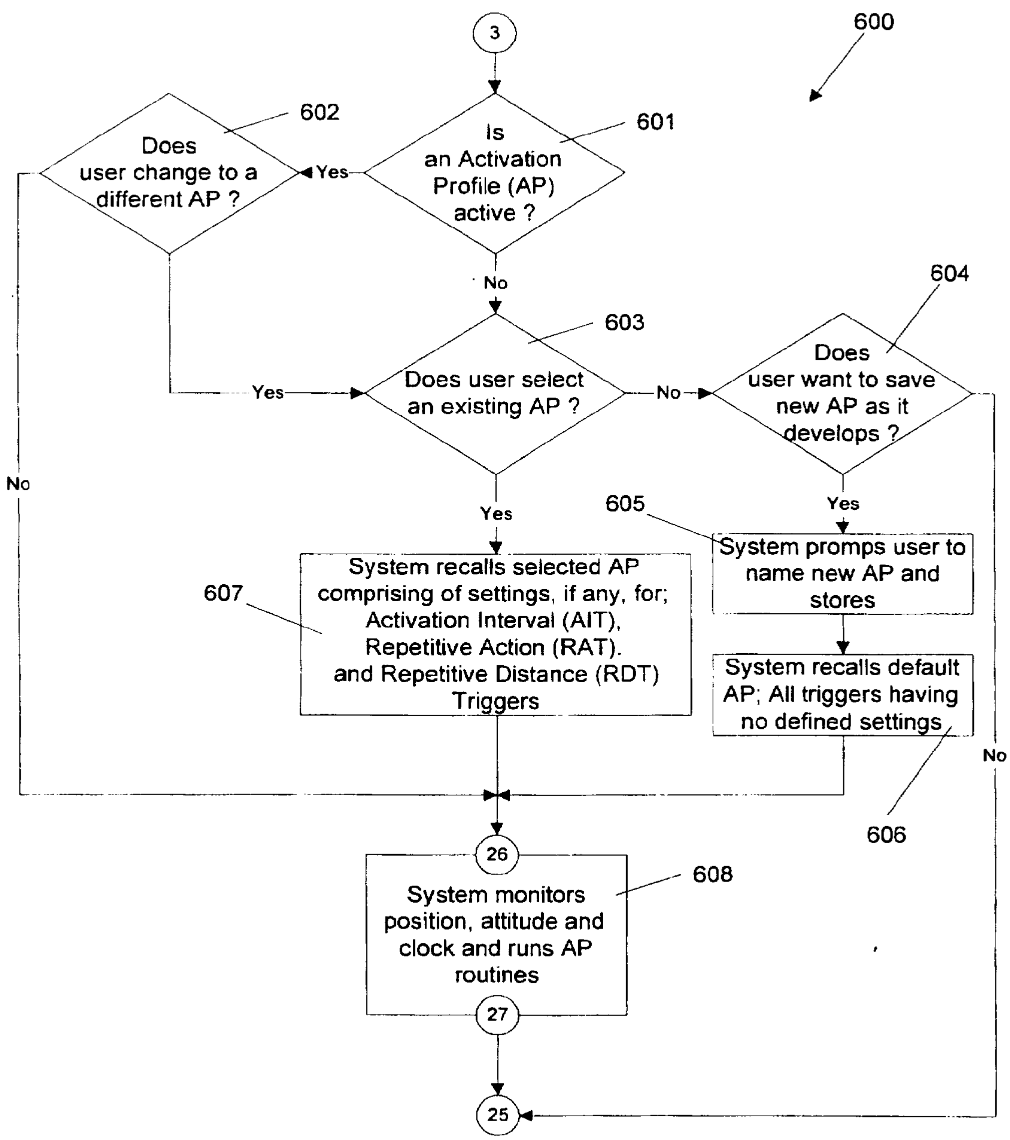


Figure 6

SUBSTITUTE SHEET (RULE 26)

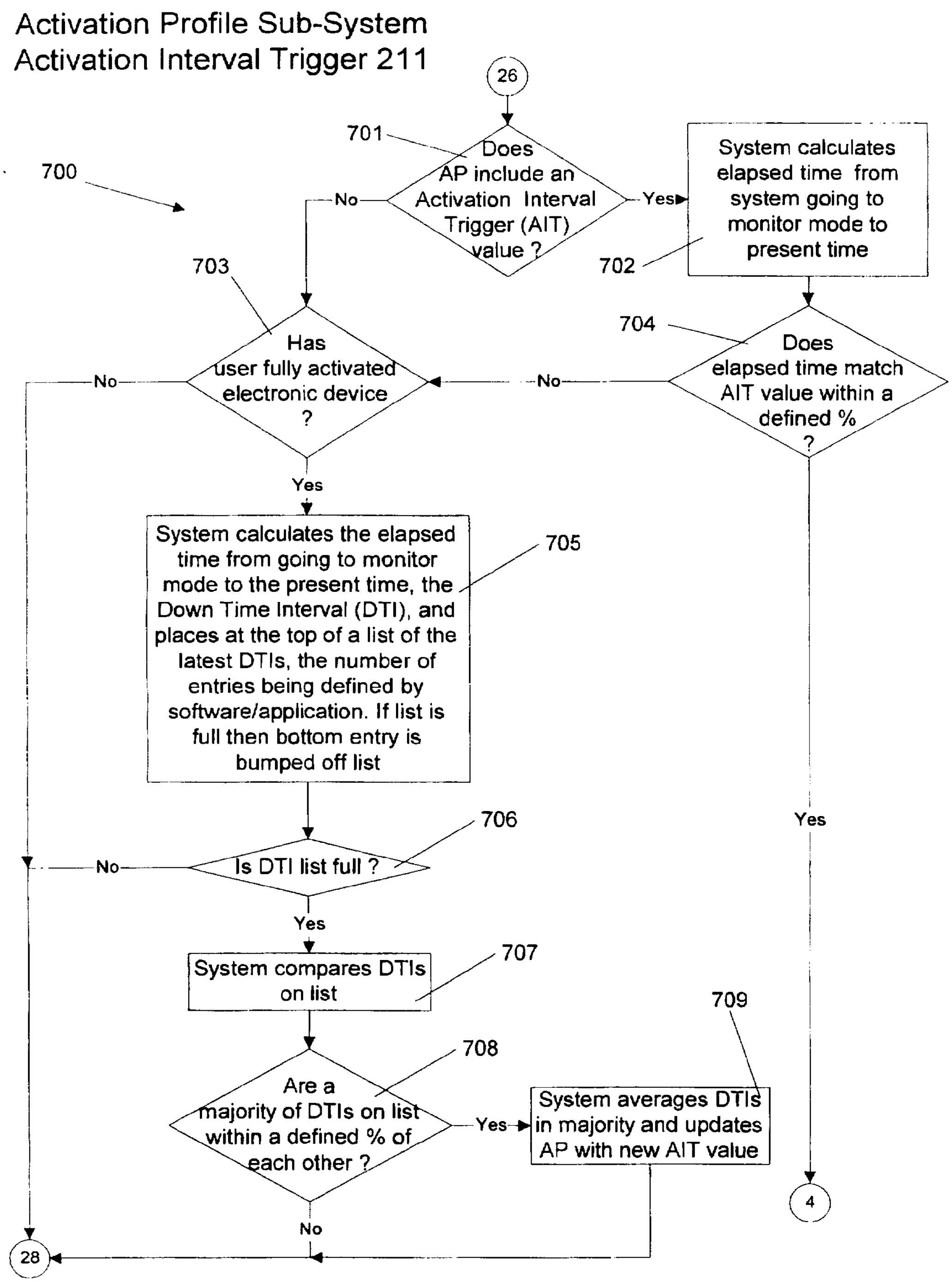

Activation Profile Sub-System
Activation Interval Trigger 211
700
26
701
Does AP include an Activation Interval Trigger (AIT) value ?
No
Yes
System calculates elapsed time from system going to monitor mode to present time
702
703
Has user fully activated electronic device ?
704
Does elapsed time match AIT value within a defined % ?
No
No
Yes
System calculates the elapsed time from going to monitor mode to the present time, the Down Time Interval (DTI), and places at the top of a list of the latest DTIs, the number of entries being defined by software/application. If list is full then bottom entry is bumped off list
705
706
Is DTI list full ?
No
Yes
Yes
System compares DTIs on list
707
709
708
Are a majority of DTIs on list within a defined % of each other ?
Yes
System averages DTIs in majority and updates AP with new AIT value
4
No
28

Figure 7

Activation Profile Sub-System
Repetitive Action Trigger 212

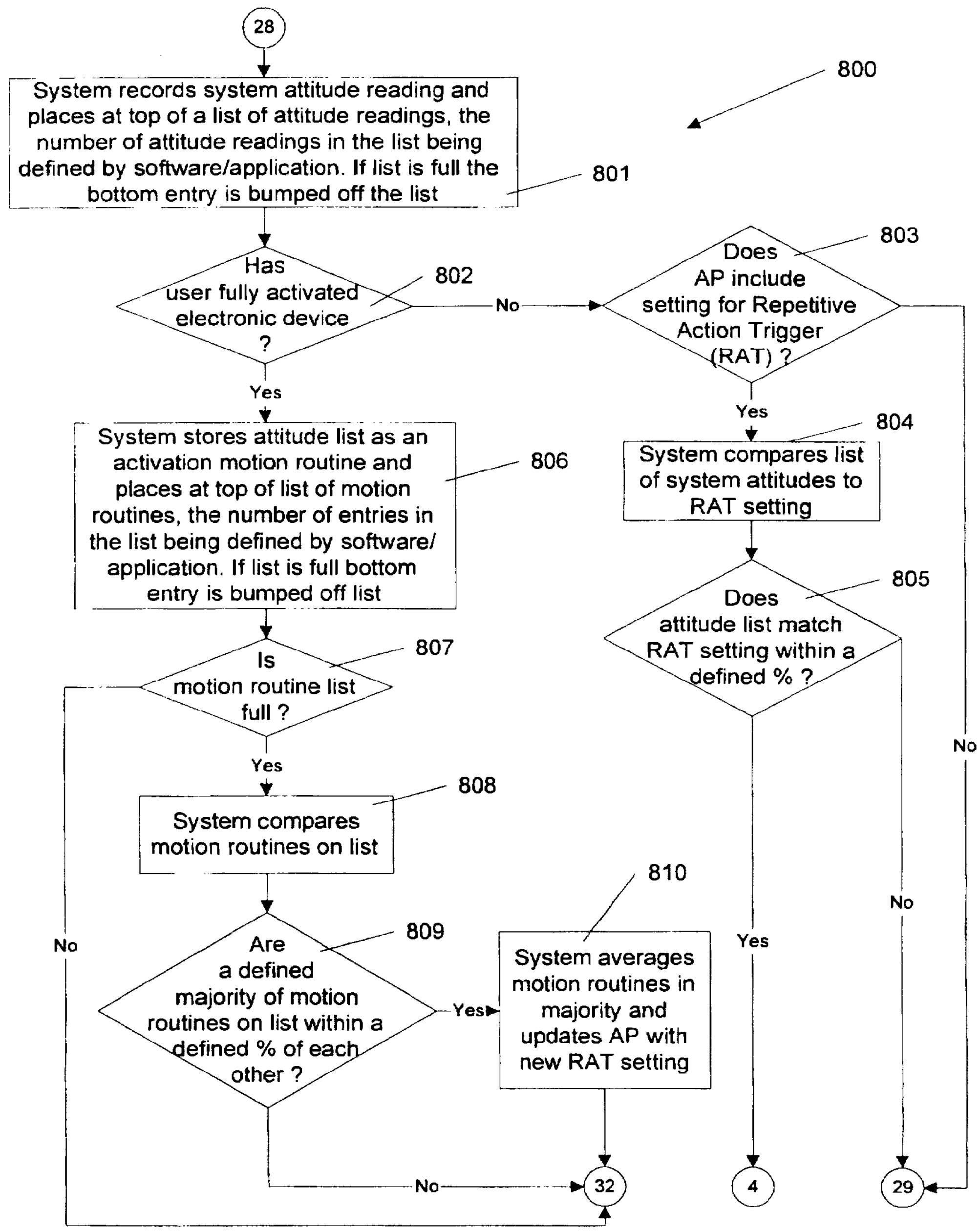


Figure 8

SUBSTITUTE SHEET (RULE 26)

Activation Profile Sub-System
Repetitive Distance Trigger 213

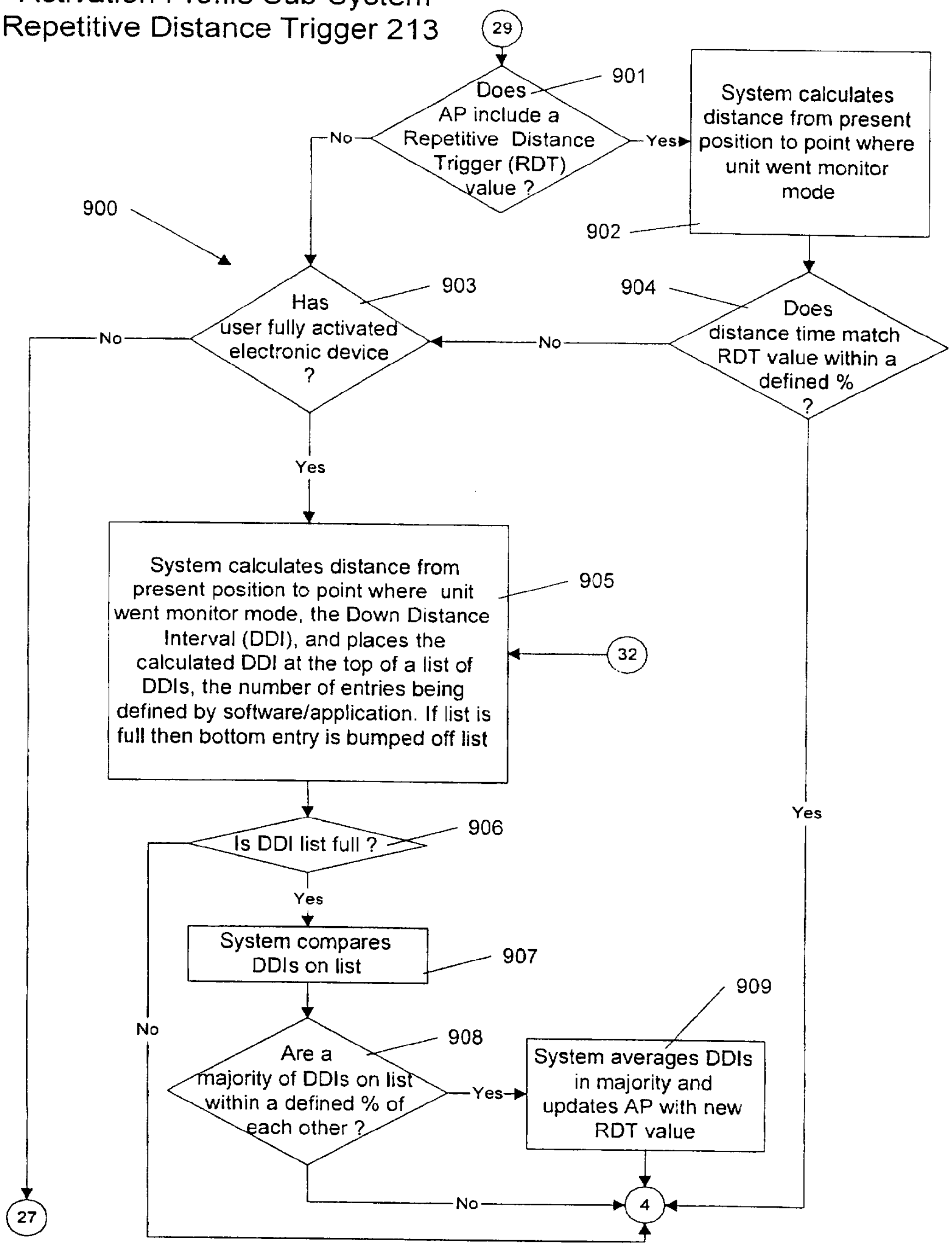
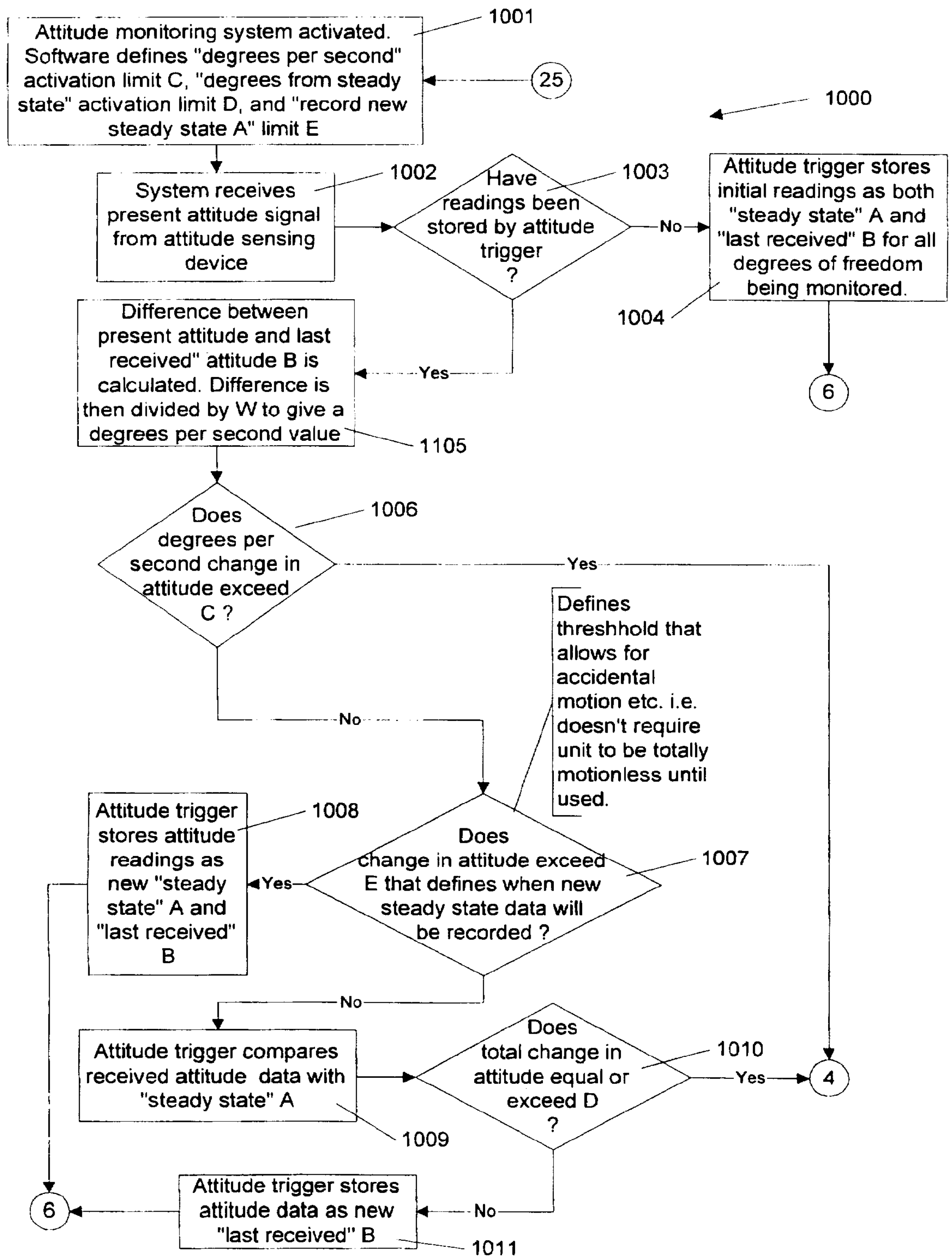


Figure 9

10/26

Attitude Trigger Sub-System



SUBSTITUTE SHEET (RULE 26)

Position trigger Sub-System

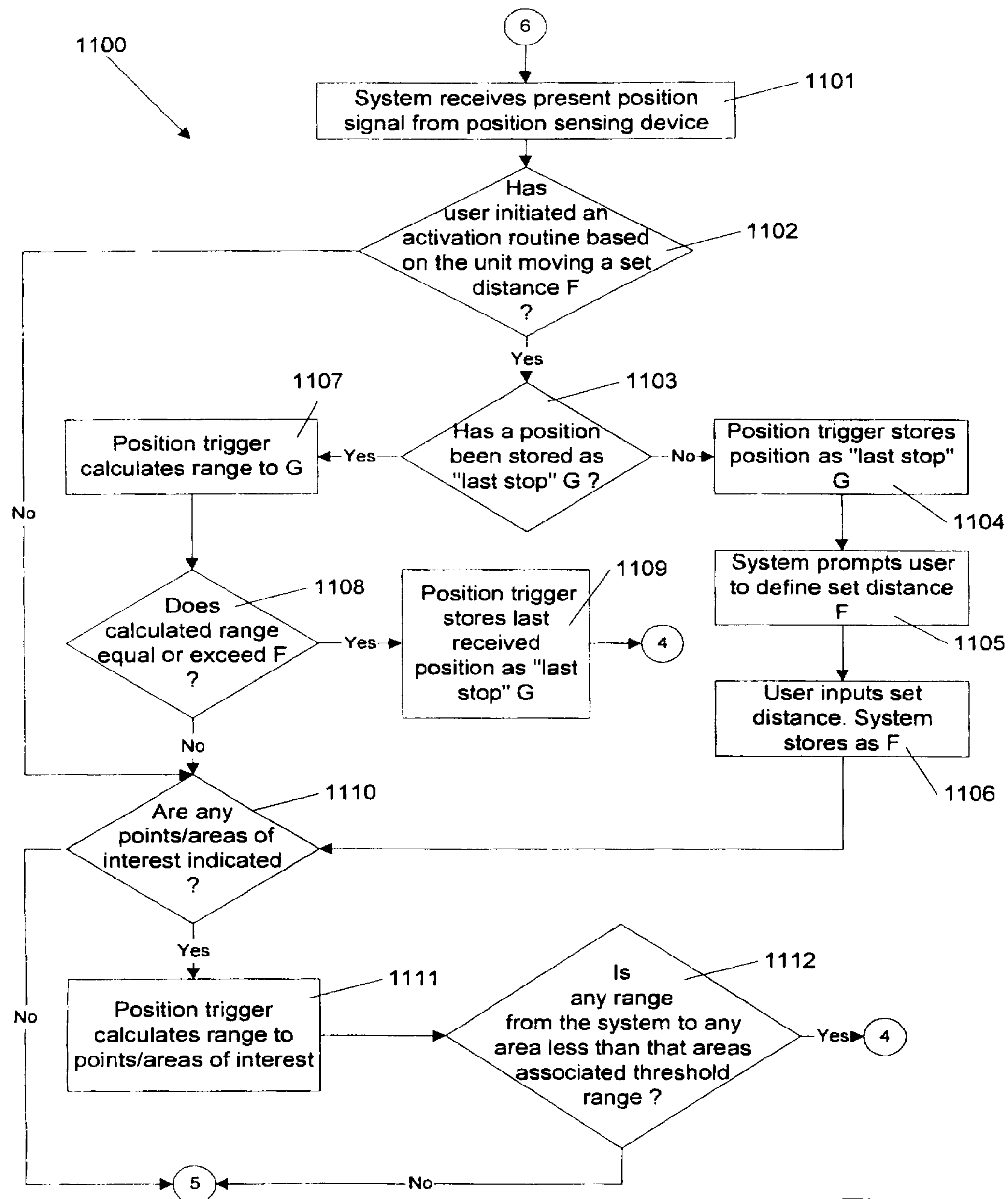


Figure 11

SUBSTITUTE SHEET (RULE 26)

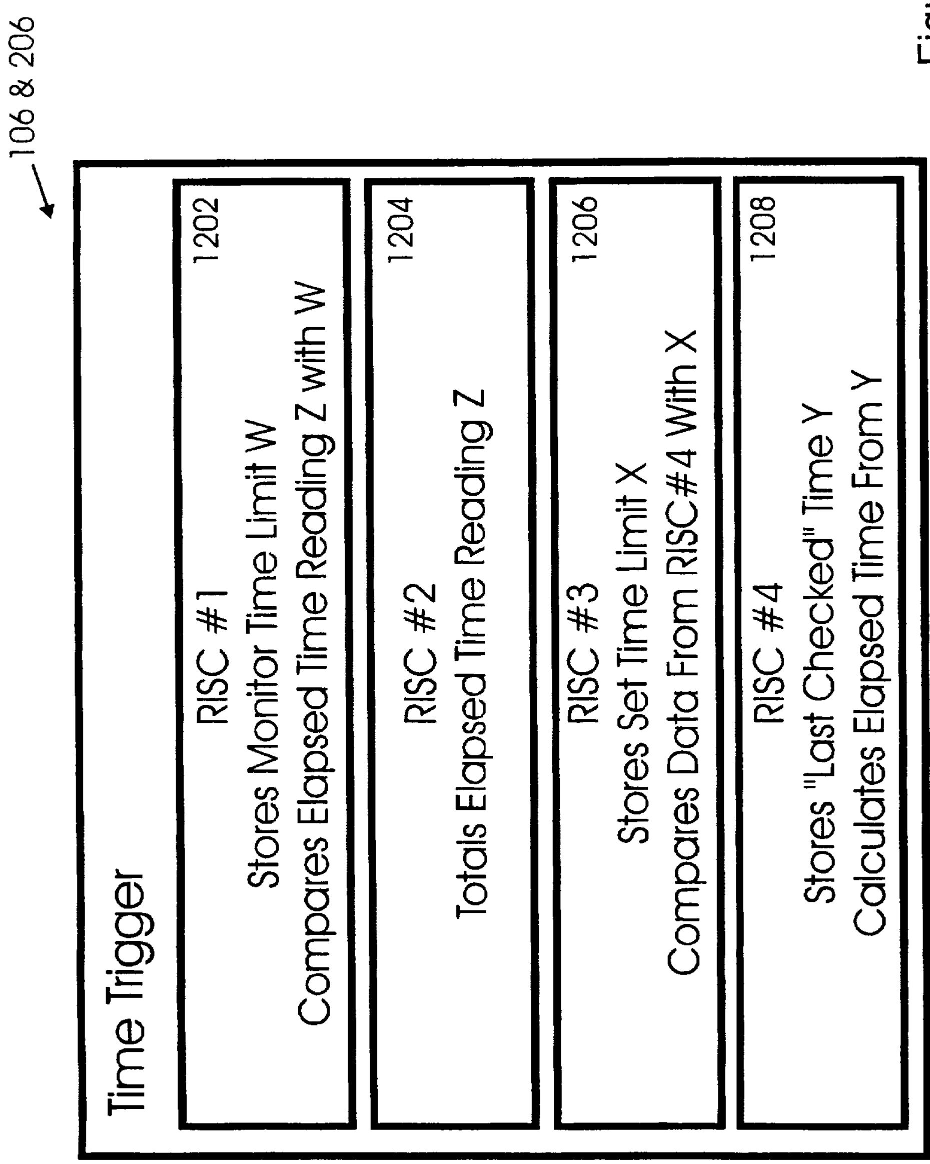

106 & 206
Time Trigger
1202
RISC #1
Stores Monitor Time Limit W
Compares Elapsed Time Reading Z with W
1204
RISC #2
Totals Elapsed Time Reading Z
1206
RISC #3
Stores Set Time Limit X
Compares Data From RISC#4 With X
1208
RISC #4
Stores "Last Checked" Time Y
Calculates Elapsed Time From Y

Figure 12

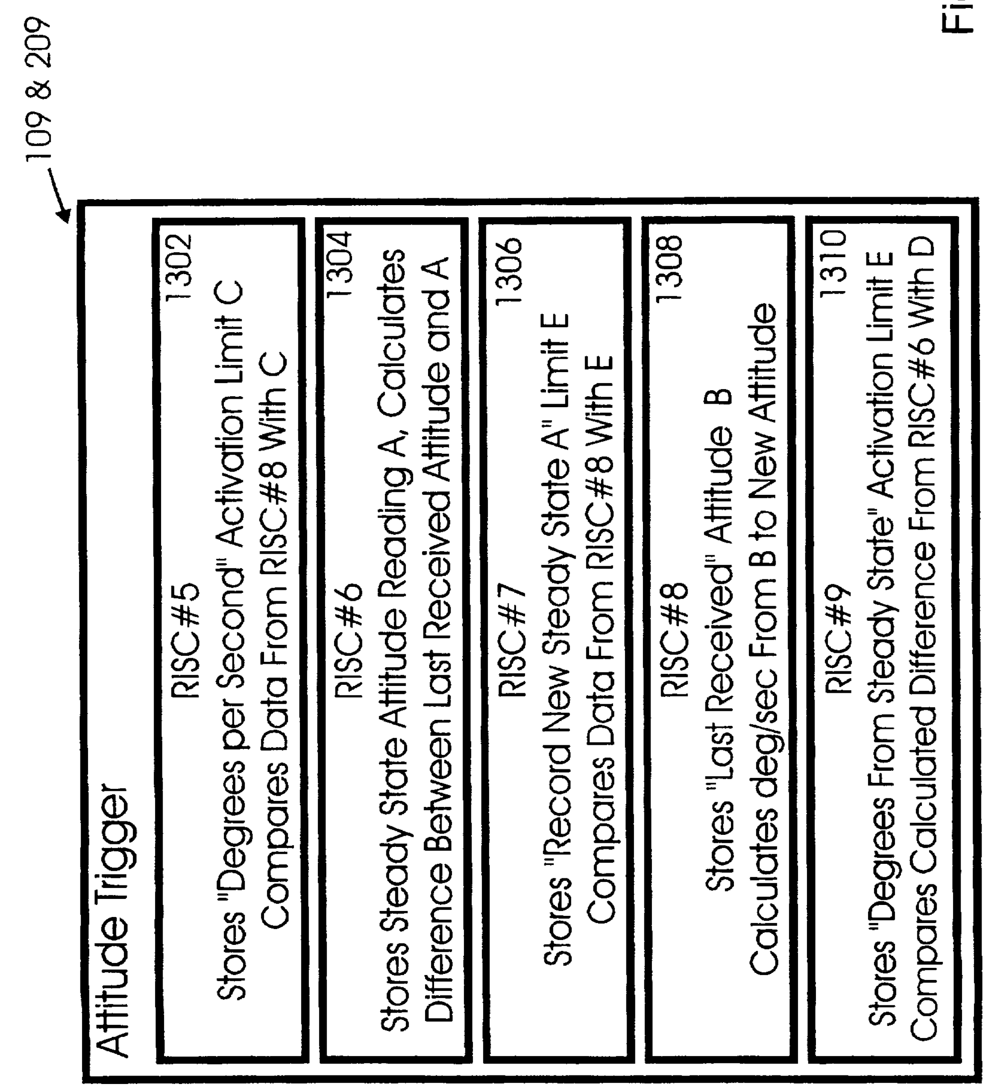

109 & 209
Attitude Trigger
RISC#5 1302
Stores "Degrees per Second" Activation Limit C
Compares Data From RISC#8 With C
RISC#6 1304
Stores Steady State Attitude Reading A, Calculates
Difference Between Last Received Attitude and A
RISC#7 1306
Stores "Record New Steady State A" Limit E
Compares Data From RISC#8 With E
RISC#8 1308
Stores "Last Received" Attitude B
Calculates deg/sec From B to New Attitude
RISC#9 1310
Stores "Degrees From Steady State" Activation Limit E
Compares Calculated Difference From RISC#6 With D

Figure 13

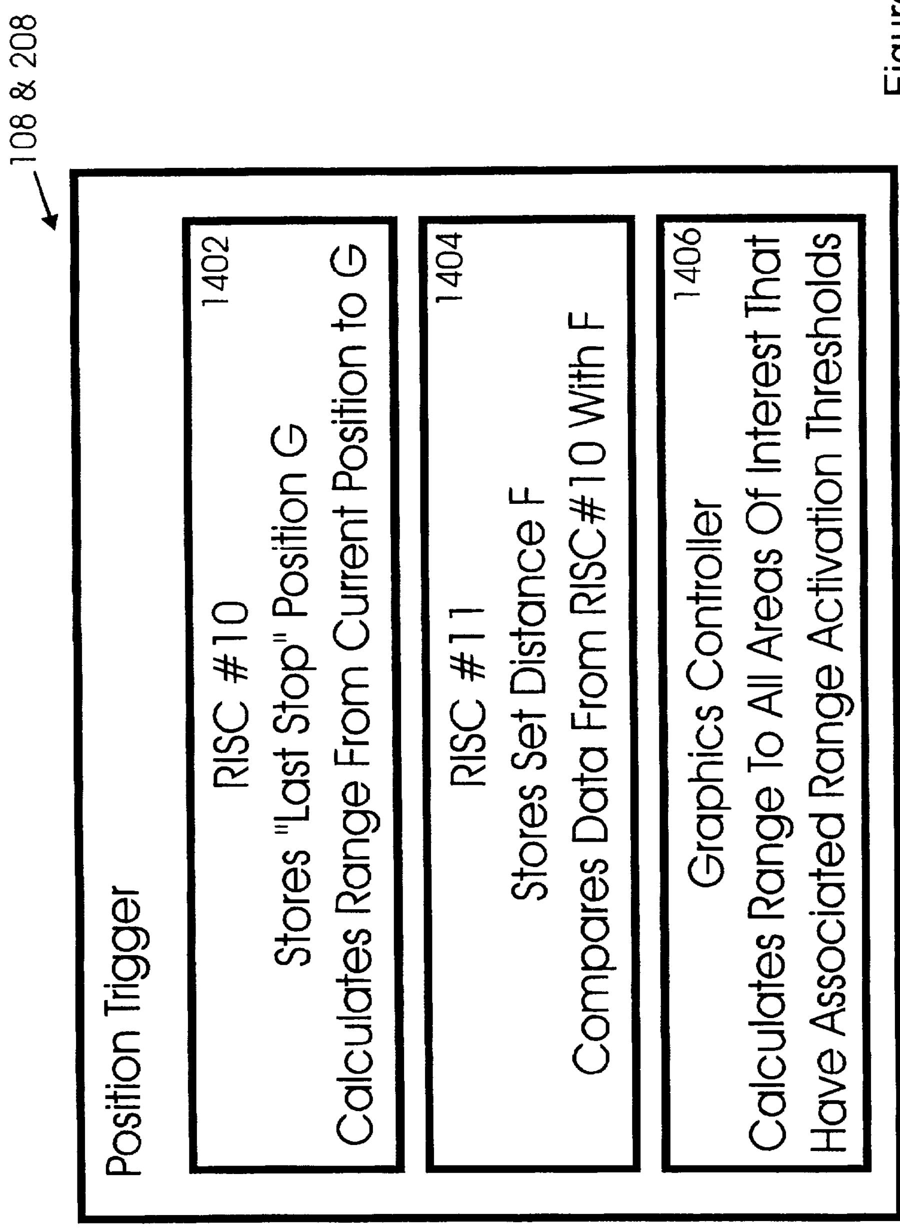

108 & 208
Position Trigger
RISC #10
1402
Stores "Last Stop" Position G
Calculates Range From Current Position to G
RISC #11
1404
Stores Set Distance F
Compares Data From RISC#10 With F
Graphics Controller
1406
Calculates Range To All Areas Of Interest That
Have Associated Range Activation Thresholds

Figure 14

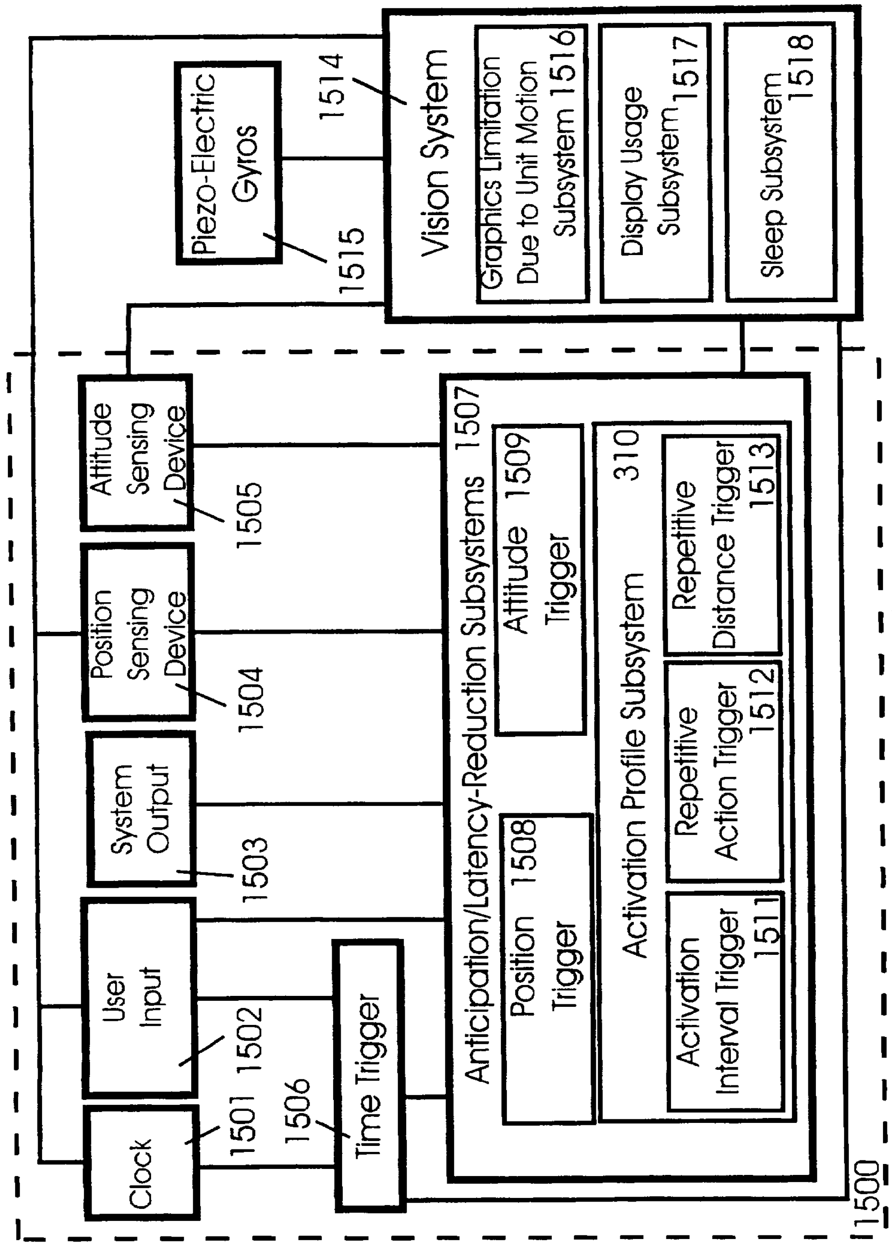

Piezo-Electric Gyros
1515
1514
Vision System
Graphics Limitation Due to Unit Motion Subsystem 1516
Display Usage Subsystem 1517
Sleep Subsystem 1518
Clock
1501
User Input
1502
System Output
1503
Position Sensing Device
1504
Attitude Sensing Device
1505
Time Trigger
1506
Anticipation/Latency-Reduction Subsystems 1507
Position Trigger 1508
Attitude Trigger 1509
Activation Profile Subsystem 310
Activation Interval Trigger 1511
Repetitive Action Trigger 1512
Repetitive Distance Trigger 1513
1500

Figure 15

General Flow 3

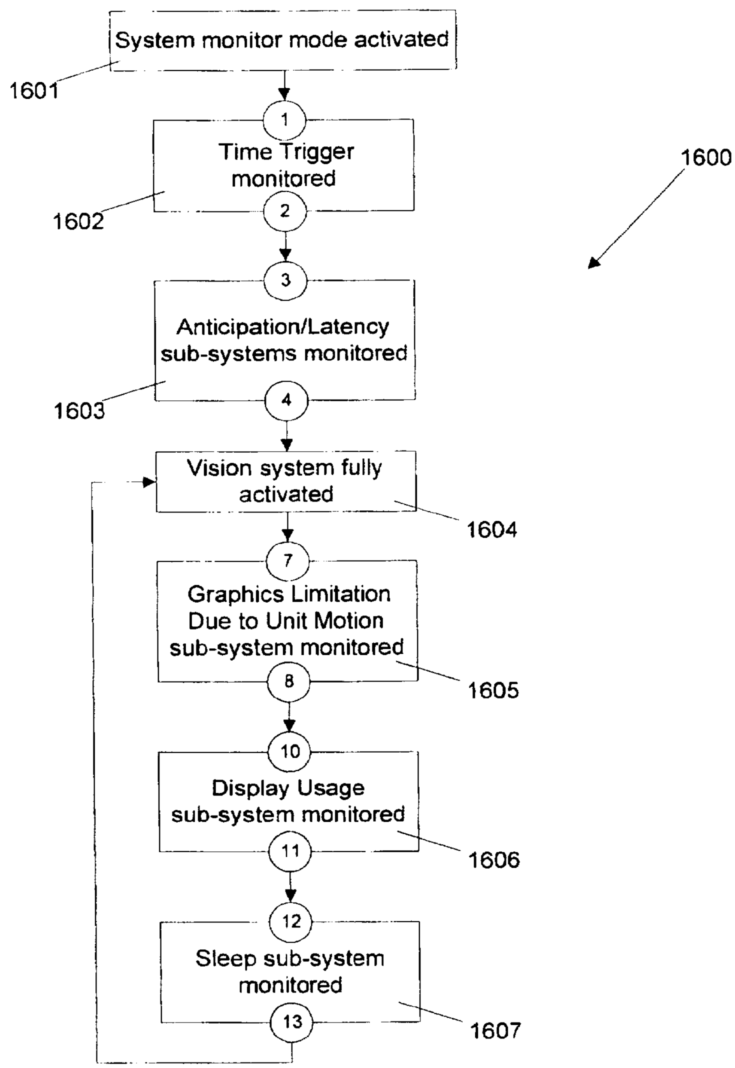
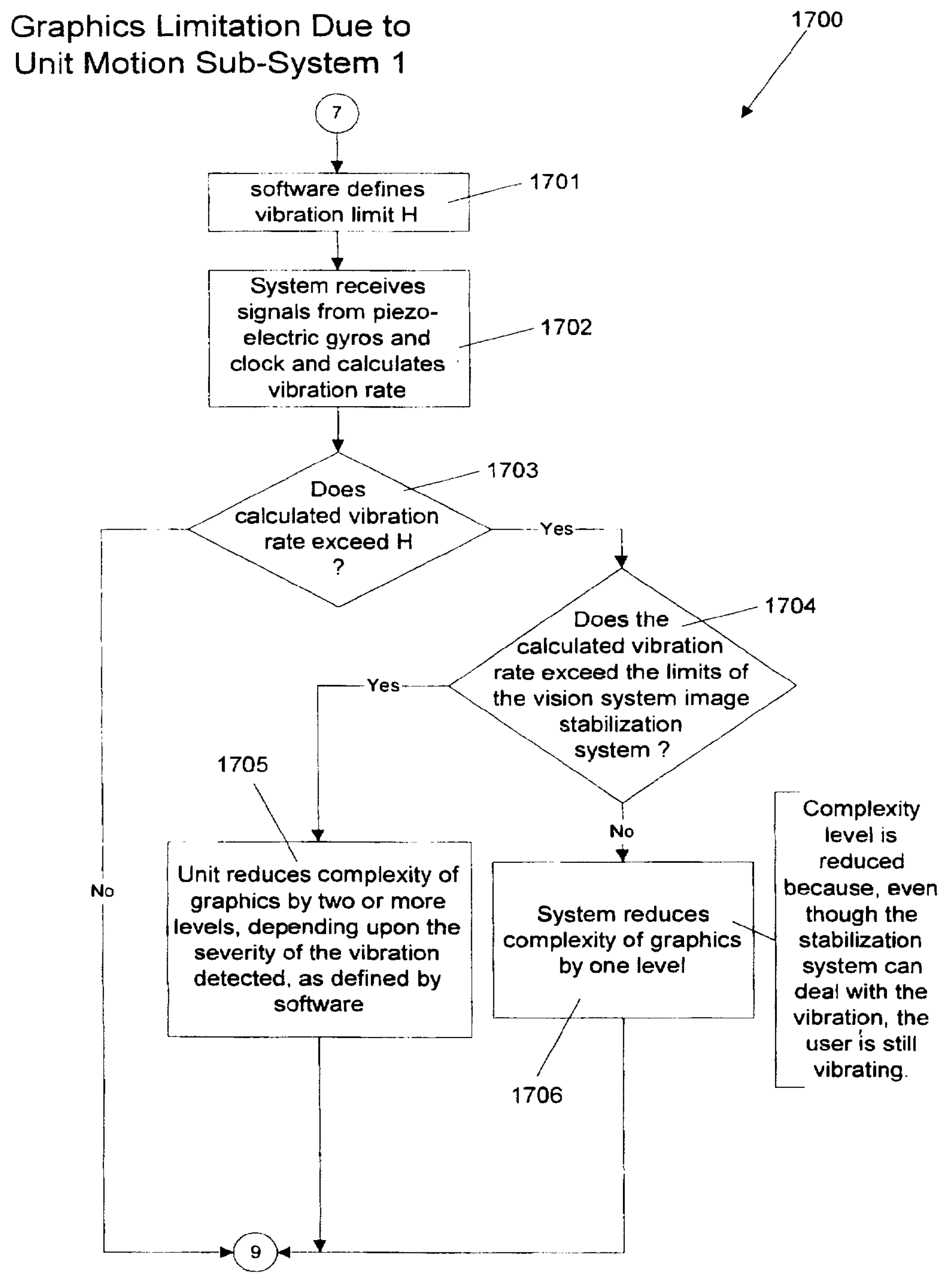


Figure 16



Graphics Limitation Due to Unit Motion Sub-System 1
1700
7
software defines vibration limit H
1701
System receives signals from piezo-electric gyros and clock and calculates vibration rate
1702
Does calculated vibration rate exceed H ?
1703
Yes
No
Does the calculated vibration rate exceed the limits of the vision system image stabilization system ?
1704
Yes
No
1705
Unit reduces complexity of graphics by two or more levels, depending upon the severity of the vibration detected, as defined by software
System reduces complexity of graphics by one level
1706
Complexity level is reduced because, even though the stabilization system can deal with the vibration, the user is still vibrating.
9

Figure 17

Graphics Limitation Due to Unit Motion Sub-System 2

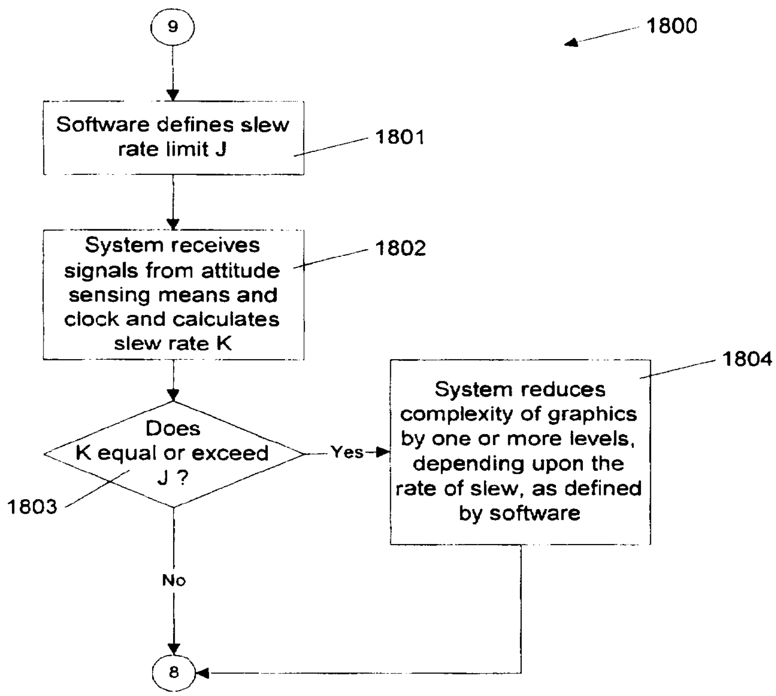


Figure 18

Display Usage Sub-System

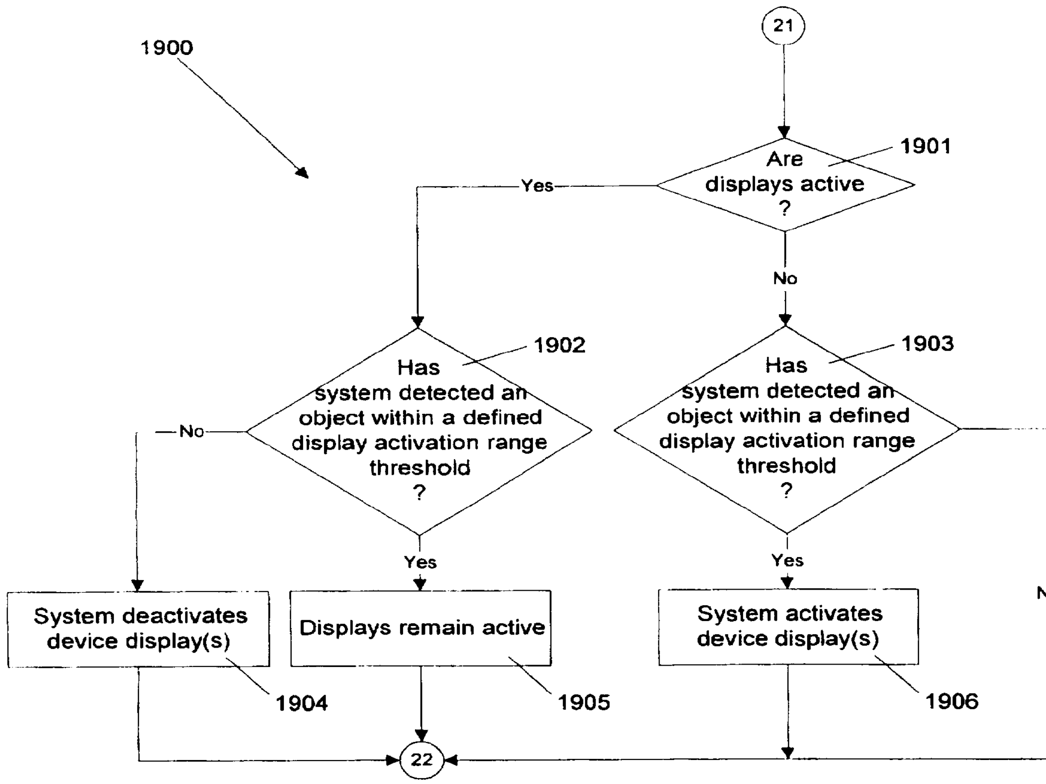


Figure 19

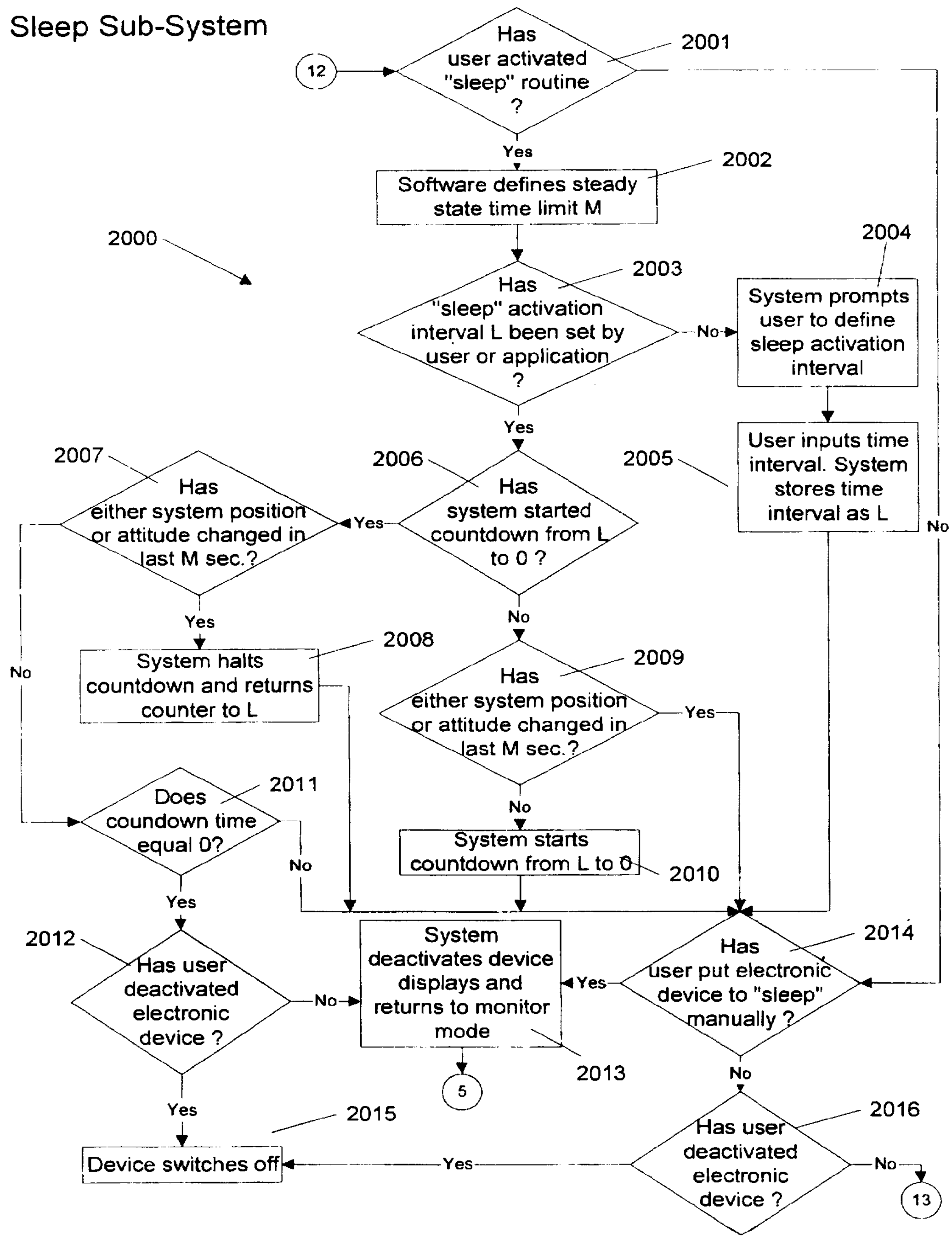

Sleep Sub-System
12
Has user activated "sleep" routine ?
2001
Yes
No
Software defines steady state time limit M
2002
2000
Has "sleep" activation interval L been set by user or application ?
2003
No
System prompts user to define sleep activation interval
2004
Yes
User inputs time interval. System stores time interval as L
2005
Has either system position or attitude changed in last M sec.?
2007
Yes
Has system started countdown from L to 0 ?
2006
No
Yes
System halts countdown and returns counter to L
2008
No
Has either system position or attitude changed in last M sec.?
2009
Yes
No
System starts countdown from L to 0
2010
Does coundown time equal 0?
2011
No
Yes
Has user deactivated electronic device ?
2012
No
System deactivates device displays and returns to monitor mode
2013
5
Yes
Has user put electronic device to "sleep" manually ?
2014
No
Yes
Device switches off
2015
Yes
Has user deactivated electronic device ?
2016
No
13

Figure 20

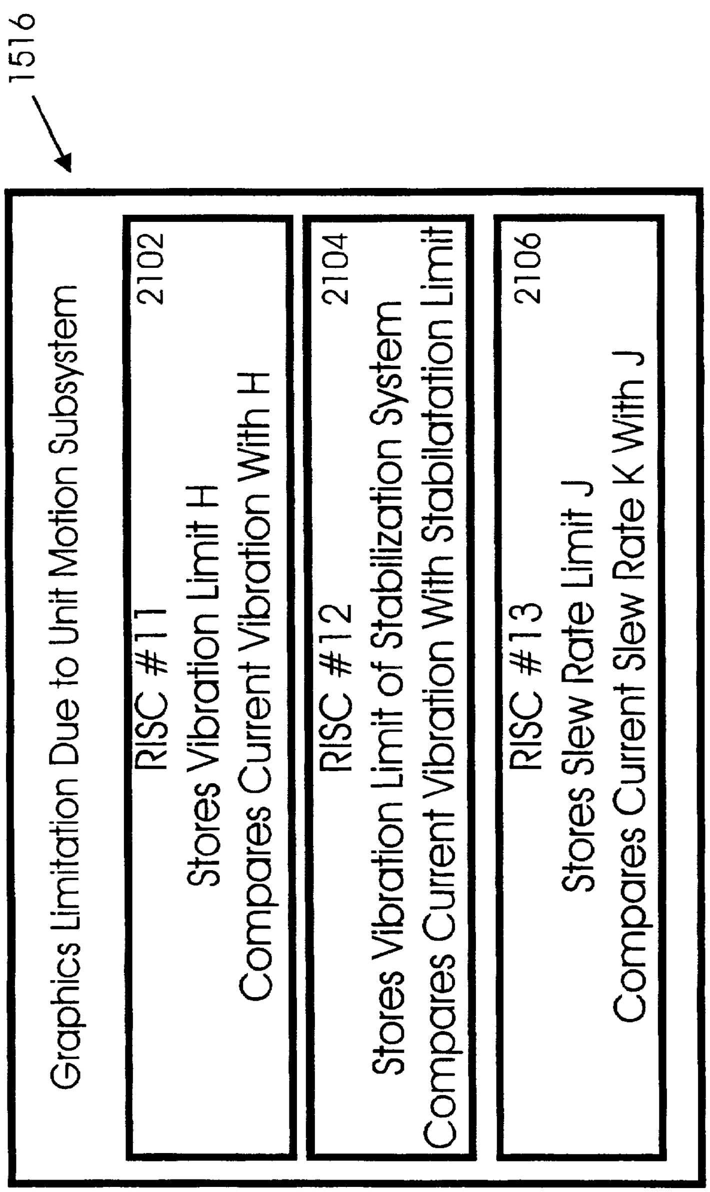

1516
Graphics Limitation Due to Unit Motion Subsystem
2102
RISC #11
Stores Vibration Limit H
Compares Current Vibration With H
2104
RISC #12
Stores Vibration Limit of Stabilization System
Compares Current Vibration With Stabilatation Limit
2106
RISC #13
Stores Slew Rate Limit J
Compares Current Slew Rate K With J

Figure 21

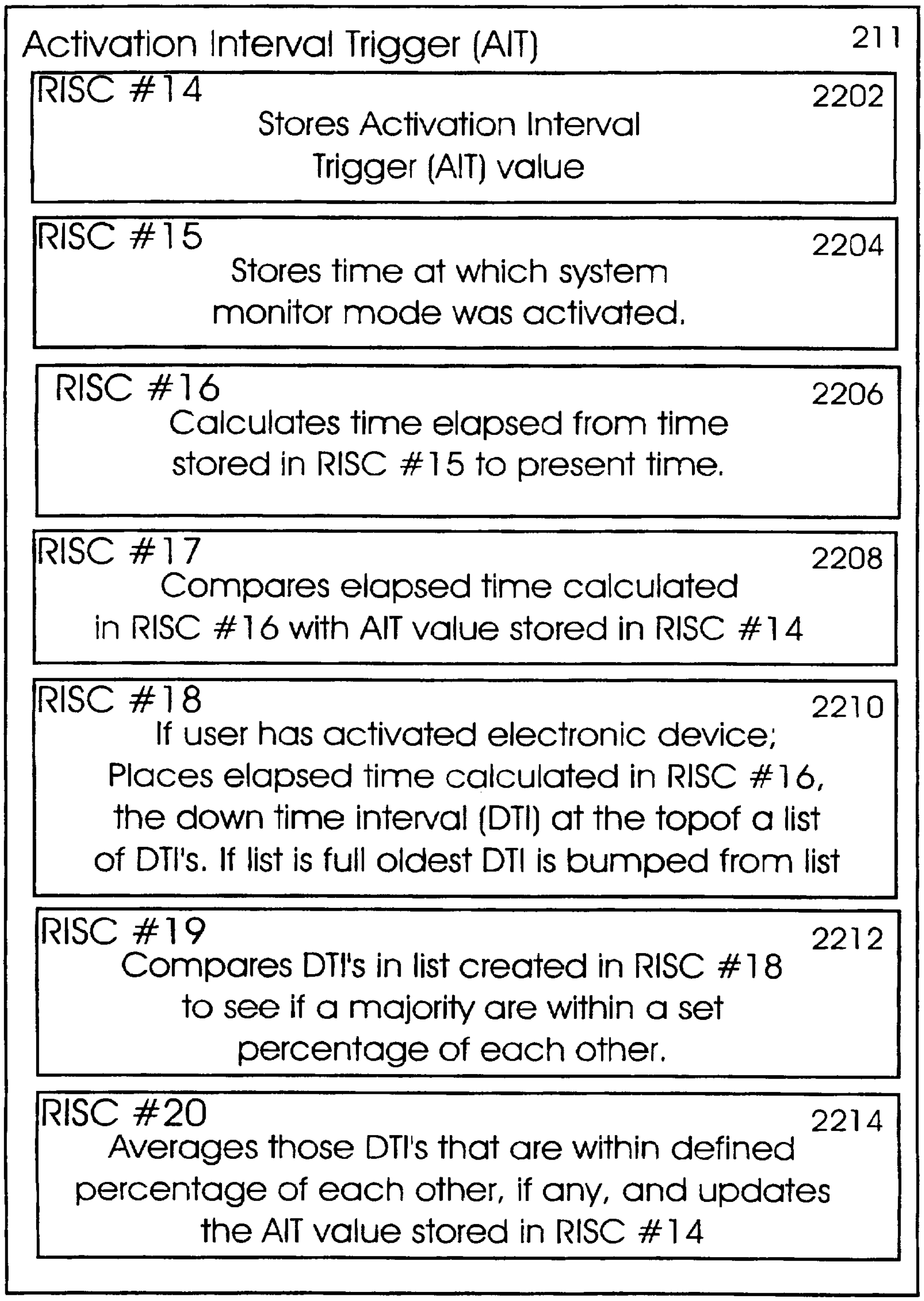


Figure 22

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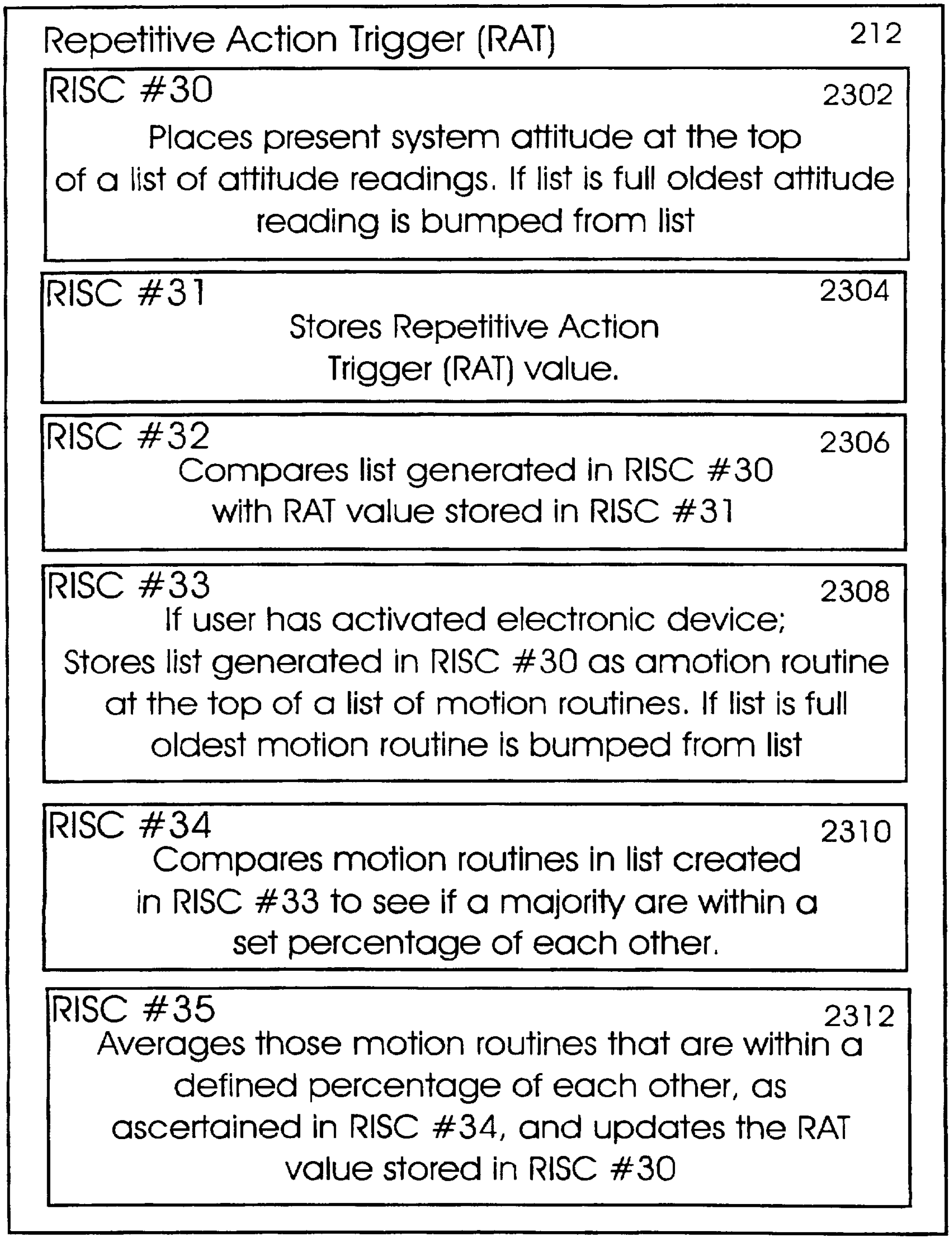
Repetitive Action Trigger (RAT)
212
RISC #30
2302
Places present system attitude at the top of a list of attitude readings. If list is full oldest attitude reading is bumped from list
RISC #31
2304
Stores Repetitive Action Trigger (RAT) value.
RISC #32
2306
Compares list generated in RISC #30 with RAT value stored in RISC #31
RISC #33
2308
If user has activated electronic device; Stores list generated in RISC #30 as amotion routine at the top of a list of motion routines. If list is full oldest motion routine is bumped from list
RISC #34
2310
Compares motion routines in list created in RISC #33 to see if a majority are within a set percentage of each other.
RISC #35
2312
Averages those motion routines that are within a defined percentage of each other, as ascertained in RISC #34, and updates the RAT value stored in RISC #30

Figure 23

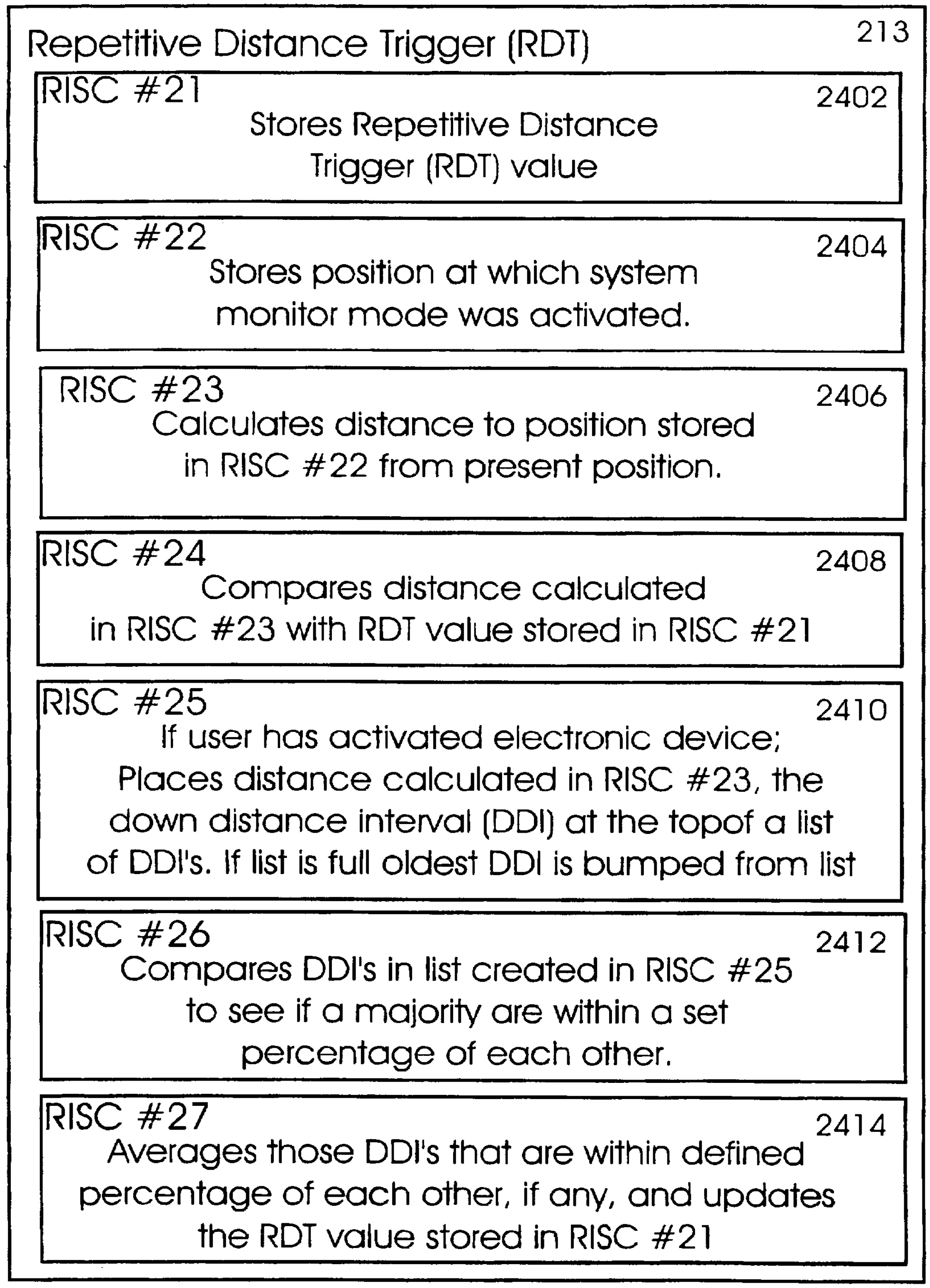
Repetitive Distance Trigger (RDT)
213
RISC #21
2402
Stores Repetitive Distance Trigger (RDT) value
RISC #22
2404
Stores position at which system monitor mode was activated.
RISC #23
2406
Calculates distance to position stored in RISC #22 from present position.
RISC #24
2408
Compares distance calculated in RISC #23 with RDT value stored in RISC #21
RISC #25
2410
If user has activated electronic device; Places distance calculated in RISC #23, the down distance interval (DDI) at the topof a list of DDI's. If list is full oldest DDI is bumped from list
RISC #26
2412
Compares DDI's in list created in RISC #25 to see if a majority are within a set percentage of each other.
RISC #27
2414
Averages those DDI's that are within defined percentage of each other, if any, and updates the RDT value stored in RISC #21

Figure 24

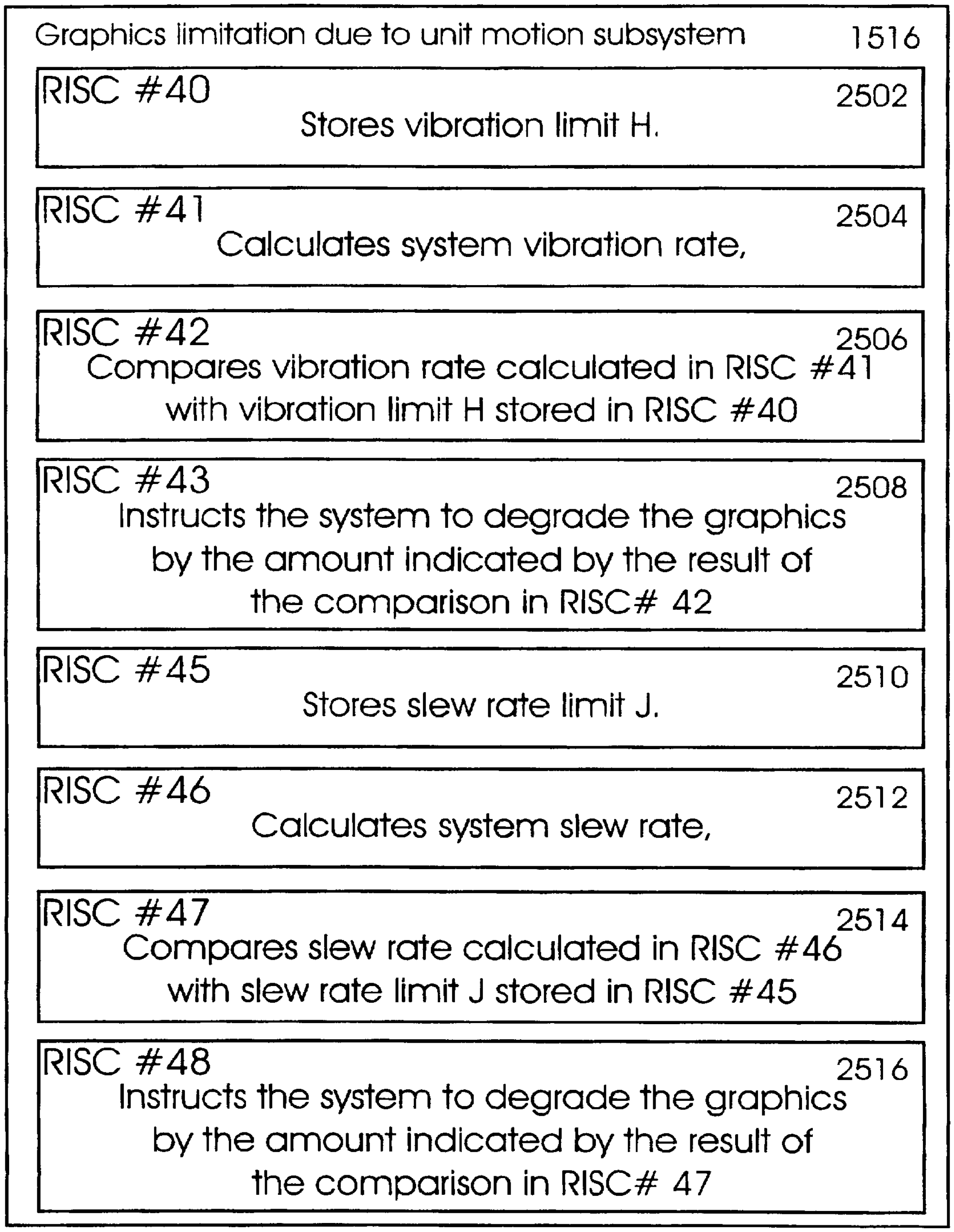
Graphics limitation due to unit motion subsystem 1516
RISC #40 2502
Stores vibration limit H.
RISC #41 2504
Calculates system vibration rate,
RISC #42 2506
Compares vibration rate calculated in RISC #41 with vibration limit H stored in RISC #40
RISC #43 2508
Instructs the system to degrade the graphics by the amount indicated by the result of the comparison in RISC# 42
RISC #45 2510
Stores slew rate limit J.
RISC #46 2512
Calculates system slew rate,
RISC #47 2514
Compares slew rate calculated in RISC #46 with slew rate limit J stored in RISC #45
RISC #48 2516
Instructs the system to degrade the graphics by the amount indicated by the result of the comparison in RISC# 47

Figure 25

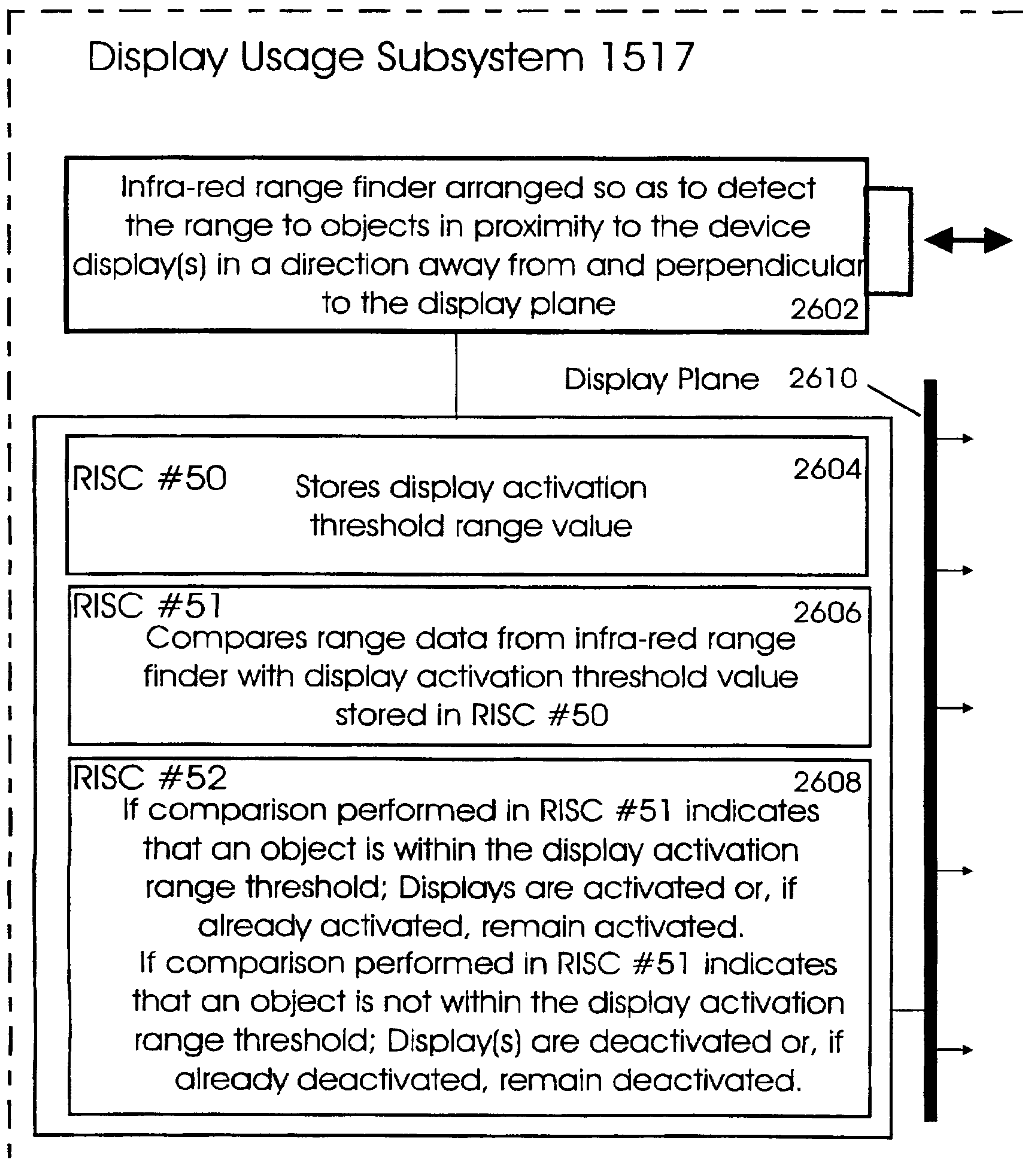
Display Usage Subsystem 1517
Infra-red range finder arranged so as to detect the range to objects in proximity to the device display(s) in a direction away from and perpendicular to the display plane
2602
Display Plane 2610
RISC #50
Stores display activation threshold range value
2604
RISC #51
2606
Compares range data from infra-red range finder with display activation threshold value stored in RISC #50
RISC #52
2608
If comparison performed in RISC #51 indicates that an object is within the display activation range threshold; Displays are activated or, if already activated, remain activated.
If comparison performed in RISC #51 indicates that an object is not within the display activation range threshold; Display(s) are deactivated or, if already deactivated, remain deactivated.

Figure 26

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/08702

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G06F 13/00
US CL :395/750
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/750, 725, 830; 360/69; 340/853.3; 364/571.03; 439/502

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

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

APS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,125,871 A (MARTIN) 14 November 1978, col. 1 lines 57-68, col. 6 line 34 - col. 8 line 53, and claim 1	1-74

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"E" earlier document published on or after the international filing date
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 JULY 1997	24 SEP 1997

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	PO C. HUANG
Facsimile No. (703) 305-3230	Telephone No. (703) 308-5230

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 August 2002 (01.08.2002)

PCT

(10) International Publication Number
WO 02/059716 A3

(51) International Patent Classification[7]: G06F 15/00

(21) International Application Number: PCT/US01/50804

(22) International Filing Date: 29 October 2001 (29.10.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/769,012 24 January 2001 (24.01.2001) US

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(74) Agent: **PAGE, Joseph**; 601 Minnesota Street #212, San Francisco, CA 94107 (US).

(81) Designated States *(national)*: AU, CA, FI, JP, KP, NZ.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *with international search report*

(88) Date of publication of the international search report: 5 June 2003

[Continued on next page]

(54) Title: POINTING SYSTEMS FOR ADDRESSING OBJECTS

(57) Abstract: Systems are arranged to provide a user (521) information (533) which relates to objects of interest (525). A user may point a hand held device (522) toward an object to address it. The device determines which objects are being addressed by making position and attitude measurements and further a reference and search of a database (12) containing preprogrammed information relating to objects. Information relating to objects determined as objects presently being addressed in thereafter presented at a user interface (532). Devices of these systems include a point reference (545), a direction reference (546), a position determining (26) support, attitude (29) determining support, a computer processor (23) and database, and a user interface (532). Methods of systems include the steps of addressing an object (161), determining position and attitude (161) searching a database (221), and presenting information to a user (237).

WO 02/059716 A3

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/50804

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : G06F 15/00
US CL : 702/150
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : Please See Continuation Sheet

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,173,239 B1 (Ellenby) 09 January 2001 (09.01.2001), column 2, lines 34-41 and 55-58; column 3, lines 4-23 and 36-67; column 4, lines 1-18, 20-33, 36-67; column 5, lines1-8, 11-39; column 6, lines 1-24 and 53-61; column 7, lines 49-58; column 8, lines 5-10 and 46-55; column 9, lines 29-33 and 47-57.	1-28, 30-37,108,110-111, 114-115 and 117
Y	US 6,173,239 B1 (Ellenby) 09 January 2001 (09.01.2001), col. 3, lines 26-67 and col. 4, lines 1-49 .	29
Y	US 6,009,629 A (Gnepf et al.) 04 January 2000 (04.01.2000), column 1, lines 23-47.	29
A	US 6,173,239 B1 (Ellenby) 09 January 2001 (09.01.2001), see the entire document.	1-129

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search	Date of mailing of the international search report
01 March 2003 (01.03.2003)	18 MAR 2003
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer John Barlow Sharon S. Hoppe Telephone No. (703)308-0956

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INTERNATIONAL SEARCH REPORT

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/0,171,581 A1 (Sheynblat et al.) 21 November 2002 (21.11.2002), see the entire document.	1-129
A	US 6,381,603 B1 (Chan et al.) 30 April 2002 (30.04.2002), see the entire document.	1-129
A	US 6,396,475 B1 (Ellenby et al.) 28 May 2002 (20.05.2002), see the entire document.	1-129
A	US 5,508,707 A (Le Blanc et al.) 16 April 1996 (16.04.1996), see the entire document.	1-129
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Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

PCT/US01/50804

Continuation of B. FIELDS SEARCHED Item 1:
702/2, 33,150, 185; 33/357,520; 73/865.9; 707/10; 345/156; 342/357.09,418,457,848; 473/407; 700/9; 701/202,207,211; 711/100; 340/988

Continuation of B. FIELDS SEARCHED Item 3:
Searched: USPTO EAST system (Keyword included: Position, measur$5, determin$5, direction$2, attitude, mobile, portable, handheld, hand, held, device$1, unit$1,user$1,cellular, phone, reference, point,location, reference, computer, processor, microprocesso, user, interface, Geographic, information, system, GIS, GPS, database, wireless, telephone, web, webpage$1,html, internet, multimedia, network, data, base, warehouse)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 August 2001 (30.08.2001)

PCT

(10) International Publication Number
WO 01/63487 A1

(51) International Patent Classification[7]: G06F 17/30, 17/40, 17/60, G01S 5/02, G06T 17/00, G09G 5/10, H04B 7/185

(21) International Application Number: PCT/US01/05971

(22) International Filing Date: 22 February 2001 (22.02.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/510,889 23 February 2000 (23.02.2000) US

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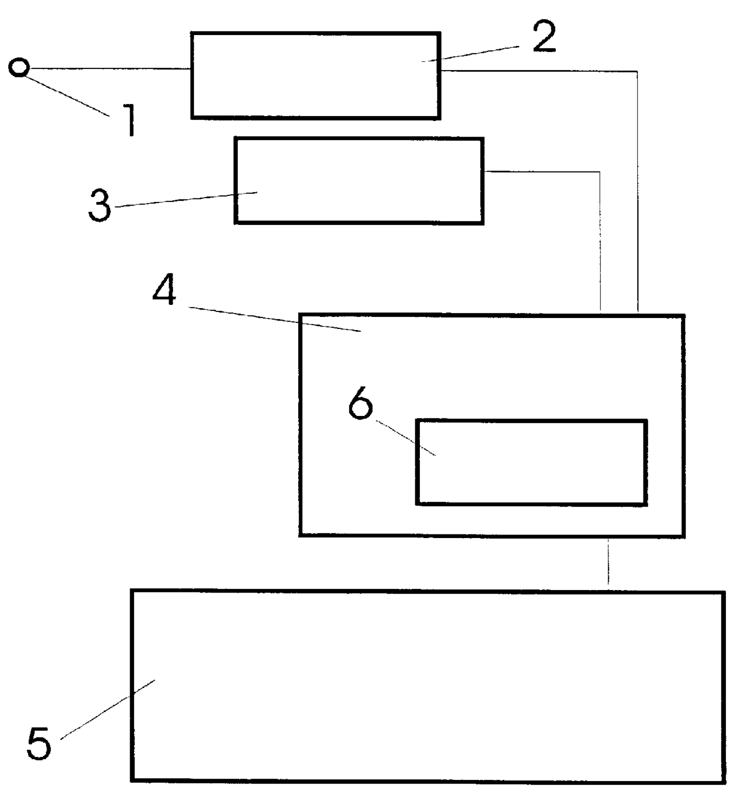
(81) Designated States *(national)*: AU, CA, FI, JP, KP, NZ.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

[Continued on next page]

(54) Title: INFORMATION SYSTEMS HAVING POSITION MEASURING CAPACITY



(57) Abstract: Systems are arranged to provide a user information which relates to objects of interest. A user may provide indication of a directional reference to a device. The device determines which objects are being addressed by searching a database containing preprogrammed information relating to objects. Information relating to objects being addressed can then be presented at a user interface. A device of the system may include a point reference, a position determining means, an input receiving means, a computer processor and database, and a user interface. Methods of the system includes the steps of indicating a direction, determining position, searching a database, and presenting information to a user.

WO 01/63487 A1

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

"Information Systems having Position Measuring Capacity"

Specification for a Letters Patent

BACKGROUND OF THE INVENTION

Field

The field of the inventions described herefollowing may best be characterized as information systems having position measuring capacity combined with attitude indication facility and more particularly by information systems which interact with a database of data elements having geometric descriptors associated therewith.

Prior Art

Applicants' copending U.S. patent applications having serial numbers 09/110,572 and 09/163,746 each relate to information systems which interact with a database of data elements having geometric descriptors associated with the data elements, however, those systems each rely on the devices having a means of determining the pointing direction of a directional reference associated with the device.

While the systems and inventions of the art are designed to achieve particular goals and objectives, some of those being no less than remarkable, these inventions have limitations which prevent their use in new ways now possible. These inventions of the art are not used and cannot be used to realize the advantages and objectives of the present invention.

It should be understood that all of the herein referenced materials provide considerable definition of elements of the present invention. Therefore, those materials are incorporated herein by reference whereby the instant specification can rely upon them for enablement of the particular teachings of each.

SUMMARY OF THE INVENTION

Comes now, Tom Ellenby, Peter Ellenby, and Jeffrey Alan Jay with an invention of information systems having position measuring capacity including devices for and methods of presenting information to a user whereby the information presented relates to the position and directional references.

The present invention includes devices and methods for presenting information relating to objects having an association with a particular geometry and location. A device which determines its position and receives indication of a reference direction, responds by searching a database and determining which objects are being addressed; and further by presenting information which relates to addressed objects.

An address indicator defined by the measured position and indicated attitude is used to search a database. The database being comprised of data elements each having a 'geometric descriptor' or spatial definition may include data elements which have a geometric descriptor which forms an intersection with a particular address indicator. When an object's geometric descriptor forms an intersection with a system's address indicator, the object is said to be 'addressed' by the system. Database search results produces output including information relating to objects being addressed by a device. The information is presented to a user via a user interfaces which may include graphical user interfaces such as a video display device, among others.

Objectives of the Invention

It is a primary objective of the invention to provide systems for presenting information.

It is further an objective to provide systems for addressing an object and presenting information relating to the object.

It is further an objective to provide systems for addressing an object, identifying the object and presenting information relating to the object.

It is further an objective to provide systems for addressing an object, recalling information relating to the object by way of a spatial reference and presenting information relating to the object being addressed.

A better understanding can be had with reference to the detailed description of preferred embodiments and with reference to the appended drawings. These embodiments represent particular ways to realize the invention and are not inclusive of all ways possible. Therefore, there may exist embodiments that do not deviate from the spirit and scope of this disclosure as set forth by the claims, but do not appear here as specific examples. It will be appreciated that a great plurality of alternative versions are possible.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims and drawings where:

Figure 1 is a block diagram illustrating major elements of a device of the invention;

Figure 2 is a block diagram showing the configuration of a database of the invention;

Figure 3 is a geometric construct of interest;

Figure 4 shows a similar geometric construct which illustrates an important geometry;

Figures 5 – 14 similarly show geometries of importance.

PREFERRED EMBODIMENTS OF THE INVENTION

In accordance with each of the preferred embodiments of the invention, there is provided apparatus for and methods of presenting information relating to objects being addressed. It will be appreciated that each of the embodiments described may include both apparatus and methods and that an apparatus or method of one preferred embodiment may be different than an apparatus or method of another embodiment.

Throughout this disclosure, reference is made to some terms which may or may not be defined in popular dictionaries exactly as they are defined here. To provide a more precise disclosure, the following terms are presented with a view to clarity so that the true breadth and scope may be more readily appreciated. Although every attempt is made to be precise and thorough, it is a necessary condition that not all meanings associated with each term can be completely set forth. Accordingly, each term is intended to also include its common meaning which may be derived from general usage within the pertinent arts or by dictionary meaning. For purposes of this disclosure:

A **geometric descriptor** is a mathematical definition of a geometric body. A geometric descriptor of the invention is used in association with an object which may be addressed by systems of the invention.

An **information or data element** is a database record which relates to a particular object of interest. An information element may comprise a plurality of forms of multi-media data including but not limited to: text, audio recordings, video streams, pictures, photographs, icons, Java applets, etc. In addition, each information element has associated therewith a geometric descriptor.

Address is a term used herein as a verb, most commonly with the gerund *-ing*, to indicate a relationship between a device of the invention and an object; the object being the subject of the address. A device of the invention which is pointing at an object is said to be 'addressing' the object.

An **address indicator** may be a geometric construct, examples include vectors and cones, which has a pointing direction associated therewith. In addition to a reference point and reference pointing direction, some address indicators, for example a cone, subtend a solid angle or otherwise have spatial extent.

A **range gate** is a geometric segment which is a subset of an address indicator having a first endpoint or planar region at some minimum distance from a point reference and a second endpoint or planar region at some maximum distance from the same point reference.

Objects refer to any element which may be of interest to a user. An object may be a real tangible object or may be a figurative element in space. The term 'object' should be read in a liberal sense. Although buildings and mountains suggest concrete forms of objects, objects for purposes of this disclosure include abstract forms as well. For example, the region of airspace over an airport which may be restricted is considered an 'object'. Indeed any region of space may be considered an object whether it actually contains a tangible object therein or not.

In simplest versions of the invention, apparatus include the following elements as described herefollowing.

Geometric References

Devices of the invention include a point reference. This may be mere structural construct. The actual point may or may not correspond to any tangible object or element of the device. Alternatively, it may be collocated with an actual physical element of the device. In either case, an important relationship is made between the point and a position determining means which is also included in devices of the invention.

Position Determining Means

A position determining means is arranged to measure the position of the point reference. Since in many embodiments of the invention the position determining means is a global positioning system GPS receiver, the point reference lies at the center of the sphere which is defined by the resolution limits of the positioning system. For practical purposes, a handheld receiver which includes a GPS antenna may be said to have the point reference within the handheld unit. The position determining means therefore measures the position of the handheld unit. Many forms of alternate positioning systems may be used to accomplish the identical task. The particular positioning system employed may be chosen for a specific task at hand, for example a global positioning system would not be appropriate for a small space such as a warehouse so a radio triangulation technique may be preferred. The essence of the invention is not changed by the particular choice of positioning system. Therefore versions of the invention should not be limited to one particular type of positioning system. The limitation described by 'position determining means' is met when the position of the point reference is measured and made available to a computer processor. Therefore, by use of the term "position determining means" it is meant that any conceivable means for determining the position of a point reference and making that position known to a computer is anticipated. Experts will recognize that there are many thousands of possible ways of determining position and it will not serve a further understanding of the invention to attempt to catalogue them here. The reader will appreciate that the broadest possible definition of "positioning determining means" is intended here.

Attitude Determining Means

Systems of the invention also include an input receiving means for receiving an indication of a directional reference. In simple versions, a keypad may be used to indicate a pointing direction. More sophisticated versions may include means for receiving an indication of a directional reference including an inclination parameter as well as direction in a horizontal plane. Although a keypad may be used in certain versions of the invention, it does not improve the description to limit the input receiving means to any particular device. Similar to the position determining means described above, the limitation described as 'input receiving means' is fully met by any device or systems which may be used to input a directional reference and make that information known to a computer processor.

User Interface

A user interface of the invention serves to convey information to a user of the device. A simple speaker driven by computer audio systems is operational for producing audio information and description to a user. Similarly, a display screen driven by video systems of a computer functions to present video or graphic information to a user. Although a display screen and speakers are preferred devices for interfacing with a user, other systems include non-display type visual systems such as simple light emitting diodes, or non-speaker audio systems such as buzzers, tactile outputs such as vibrating systems, et cetera. In all cases, a user interface includes a transducer which is electronically driven by the computer which produces some physical disturbance which can be detected by a user's senses.

Computer Processor

In addition, systems of the invention include a computer programmed to execute specific routines. In particular, a computer is arranged to receive inputs from the position and attitude determining means. From these inputs, the computer defines a geometric body as an address indicator in association with the device reference point and pointing direction. From this geometric body definition, the computer performs a database search and determines if any of the geometric objects described in the information element geometric descriptors intersects the address indicator. Information elements which are determined to intersect said address indicator has data associated therewith which may be recalled and played back to the user interface as appropriate and in agreement with other criteria which may be selected.

Database

In systems of the invention a database is arranged to accommodate data relating to objects of interest. Data relating to objects is prepared and stored in a predetermined and well organized fashion. The data may be stored in many formats and configurations and may be of the nature sometimes referred to as 'multi-media'. A database of the invention is comprised of a plurality of information elements. Each information element relates to a particular object which may be of interest to users of devices of the invention. Each information element contains a descriptor which describes a geometry and location relating to the object for which the stored information pertains.

A geometric descriptor is a definition set for a specific geometry including position. For example, in a Cartesian coordinate system, a sphere may have its center at a point (X, Y, Z) = (2, 5, 9) while having a radius of 7 units. Thus the sphere and all of the points within the sphere's boundary are completely described. A geometric descriptor may describe a geometry which includes: a single point; alternatively, a polygon; which defines a planar region; a solid such as a sphere; or even a three dimensional object of arbitrary shape. Thus the rules which perfectly describe those geometries which are well known in the sciences are used in geometric descriptors of the invention. In all cases, a geometric descriptor includes at least one point and more frequently includes a set of many points.

Methods of the invention are best described as being comprised of the follows steps.

In a first step, a direction reference is indicated by a user and the direction reference is received by the system.

In a step to be performed after the first step, the position of the device reference point is determined. A GPS employed locally at the device operates to measure the global position of the reference point. Although convenient measurement units might be latitude, longitude and altitude, others similarly provide workable solutions. Data from the position determining step is passed to the computer processor.

Data received at the computer processor from the position determining means is used in conjunction with the indicated directional reference to define an address indicator.

A search of database information elements is commenced. A search operation reads database geometric descriptors and performs a coincidence test to see if an address indicator intersects any of the points in a geometry described. Items meeting that criteria are recalled for further processing and presentation at a user interface.

A more complete understanding can be realized in consideration of the drawing figures with reference numerals as follows. Figure 1 illustrates a block diagram of major components of devices of the invention. A point reference 1 is a geometric construct to which measurements of position are directed. The point may correspond to an actual device such as a GPS antenna or may alternatively be merely a point in space having a convenient location within a physical device. A position determining means 2 is in communication with the point reference and is arranged to measure its position. The position determining means is further in communication with a computer. The position measurement is made without regard to any particular coordinate system in various versions of the invention but some versions using GPS devices preferably use a latitude, longitude and altitude scheme which allows one to define position anywhere on or above the Earth's surface. Determination of position within a coordinate system is the essence of the function performed by the device without regard for any coordinate system chosen for convenience.

A directional reference receiving means 3 is arranged to communicate with a computer. The directional reference receiving means reports direction information to a computer processor.

A computer processor 4 is coupled to and receives measurement data from position and attitude determining means. The computer is further connected to a user interface 5 and presents information to a user by way of the interface. The computer includes a database 6 which may contain preprogrammed information.

Now, with reference to Figure 2 the database may be more precisely defined. A database 21 of the invention has a special construction. The database may include a great plurality of basic units each referred herethroughout as an information element 22. An information element may contain stored information in various formats 23. Each information element contains a descriptor 24 which defines a geometric body of interest. Additional information elements 25, each having their own descriptors and stored information, further make up the database. The database is comprised of any number of information elements the last element being the N^{th} element 26.

The above described elements, when assembled as directed, form a device of the invention which is preferably integrated into a small handheld machine. A sturdy case formed of durable plastic operates to contain the assembly and allows a user easy access to functions associated therewith.

In consideration of the above described arrangement and the following procedural description with reference to additional drawings, one will now better appreciate operation of some preferred devices of the invention. Drawing Figure 3 illustrates a simple geometric construction showing a point reference 31, a directional reference 32, a rectangular cylinder 33 and a circular cylinder 34. A portion of space 35 indicated by a dotted line is shared by the rectangular cylinder and an address indicator 36. The address indicator, in this case a simple vector, has an endpoint coincident with the point reference and colinear with the direction reference. Having full geometric definition of the vector, and the cylindrical objects, a computer routine is executed to determine which objects are intersected by the vector and which are not. In the case of Figure 3, the square cylinder is intersected by the vector but the circular cylinder is not. A device having a reference point 31 and directional reference 32 is said to be addressing the square cylinder. A computer having programmed information as to the location and shape of the cylinders can tell when a vector is intersecting the space of interest and when it is not. This fact depends on the condition that the cylinders remain stationary after the computer is programmed. The computer only needs the preprogrammed information and information regarding measurement of the device point reference and indicated directional reference. The computer does not require input from any real object which may be associated with the space of interest and does not need to detect or probe it in any way.

For example if the square cylinder 33 is associated with a hotel known by the computer, the hotel is implicitly addressed whenever the device addresses the square cylindrical space. If a construction crew removes the hotel and the computer is not updated, the computer still assumes the presence of the building because it is a necessity that the space defined by the information element (hotel) geometric descriptor remain despite the actual presence, or lack of presence, of the building therein.

Accordingly, devices of the invention merely determine what space is being addressed and imply that particular objects are being addressed by way of the association of objects to spatial definitions or geometric descriptors. The mere fact that information contained in the database is accurate suggests and implies the presence of the hotel. It is the geometric descriptor which is preprogrammed into the computer which dictates if an intersection exists or not. The actual presence of an object does not affect whether the device is addressing it or not. It is useful to point out that one may generally rely on a hotel remaining in its set position.

One may rely on this technique for most items of interest. For example, the Empire State Building presently occupies a space which is well defined. It is a very reliable fact that the Empire State Building will similarly occupy that same space tomorrow. A device of the invention which is addressing the Empire State Building, the position of the device being measured and a direction indicated by a user defines an address vector, can reasonably deduce that the building is there. In this way, devices of the invention 'know' what they are addressing simply by measuring position and receiving an indication of attitude and comparing that information with information in a database.

For purposes of this disclosure, an intersection of only one point is sufficient to have the address vector be coincident or to have an intersection with the geometric object. Figure 4 illustrates a scheme whereby the vector defined by the reference point 41 and the reference direction 42 is coincident with the square cylinder 43 at a single point 44. The circular cylinder 45 is not intersected by the vector and is not said to be coincident therewith.

It is not a requirement that an object be three dimensional; quite contrarily, a two dimensional or single dimensional object forms perfect basis for an intersection with an address indicator in the form of a vector. Figure 5 illustrates a point reference 51 and a direction reference 52 forming a vector which intersects a plane 53 at a single point 54. One might envisage every advertising billboard as a plane having position information associated with it. When programmed properly, these geometric definitions allow a device of the invention to know of any billboard anywhere. When pointed at a billboard the device can identify the advertiser and be made to respond by playing back information such as a product jingle, text information, video clips, et cetera. The connection between the billboard (object) and the geometric descriptor is made via the database where real objects are associated with geometric descriptors in preprogrammed data storage schemes.

The shape does not necessarily have to be regular or "well-behaved". A geometric description is available for a complexly shaped element as well as those more readily described in simple terms. Figure 6 shows a reference point 61 and reference direction 62 which define an address indicator in the form of a vector having an intersection with a spatial element 63 at line segment 64.

A geometric descriptor used in devices of the invention to associate object data with position and shape may change in time. Although the trains in Japan are moving objects, they move in a highly reliable way in accordance with a rigid schedule. Therefore, a geometric descriptor might include information about changes of position with respect to time. When a device of the invention is pointed at a moving train, inquiry to the database may yield an intersection with a 'moving' spatial element, i.e. an object having a position descriptor which is dynamic with respect to time.

Figure 7 shows an additional construction of interest. Although the term 'vector' implies a line segment with infinite extent in one direction, in some cases only a certain portion of the vector is of interest. Some operations described hereafter will refer to a "range gate". A range gate has two delimiters which define a portion of the vector which is of particular importance. Figure 7 shows a reference point 71, a reference direction 72, a first delimiter 73 a second delimiter 74, a cube body 75, a line segment 76, a circular cylinder 77, and a vector 78. Although the vector 78 intersects and passes through both the cube body and the circular cylinder, only a portion of the vector in the range gate, i.e. that portion between delimiters 73 and 74, forms an intersection with the cube body. Thus, in some instances, a range gate is created to designate which portions of the vector are of greatest interest. Thus a user interface may present information regarding the cylinder and the cube but where information relating to the cube is presented with priority.

Figure 8 shows another important range gate. A range gate may include all the points along a vector from the reference point to a selected maximum distance. For example a user may specify all targets "within fifty meters of the device". Objects which are greater than fifty meters away from the user are not included in any recall effort. Figure 8 illustrates this concept. A reference point 81 and line segment 82 form basis for a system having a range gate starting at the reference point and ending 83 at some predetermined distance from the reference point. A cubic object 84 has a portion 85 of the vector passing through it. Similarly, circular cylindrical object 86 also has a portion of the vector intersecting that object. Of course, the vector 87 continues on without limit. The difference between the cubic object and the circular cylindrical object is that the cubic object lies within the range gate region of the address indicator and the circular cylindrical object does not. A computer search engine arranged to be responsive to criteria describing such a rate gate is useful in restricting objects which are presented.

It is entirely possible that two objects fall within the limits of a particular range gate. Figure 9 illustrates a reference point 91 and a direction vector 92 which passes through 93 a first object, continues through space 94 and passes through a second object 95. In this case, both objects a cubic object 96 and a circular cylindrical object 97 form an intersection with the vector and lie with a range which lies on the address indicator somewhere past the point indicated as 98. A search engine therefore identifies both objects as being addressed by the system. A display can handle this occurrence by listing all objects being addressed simultaneously. A list may include a scheme whereby closer objects are listed first while more distant objects appear nearer the end of the list. A user may select from the list an object of particular interest and request from the computer more information relating to that object.

Although the previous examples primarily use a vector for an address indicator, it is not necessary that an address indicator be in vector form. An address indicator may be any geometric construct including but not limited to: a point; a line; a vector; a line segment; a plane; a planar section; a cone; a conic section; et cetera. To determine intersection with objects of interest, the search criteria may simple determine if any point of an address indicator is shared with any point described in an information elements geometric descriptor.

With reference to drawing Figure 10, one will appreciate an address indicator which is in the shape of a cone. Reference point 100, is joined by a surface 101 which describes a cone having an axis 102. The conic axis may be arranged to be colinear with the system reference pointing direction. Although a cone may extend in space without limit, ellipse 103 is useful to indicate a cross section of the cone. The careful observer might argue that the "cone" shown is not truly a cone in the sense that it is wider in one dimension that in an orthogonal dimension. This loose interpretation of a cone is intended to illustrate that the geometric shape of an address vector may be of complex form.

In some systems of the invention, it is useful to have an address vector which is adjustable. Figure 11 shows a conic shape similar to that of Figure 10 whereby the extent of the limiting surface has been increased. Reference point 110 forms the apex of a cone having a surface 111 which is quite

Figure 10. The conic axis 112 is associated with the system pointing direction. Devices of the invention may include an adjustment setting which can be set by a user to alter the shape and size of an address indicator.

Such adjustment may be used to configure the address indicator to take a shape having a width which is greater in extent than its height. Figure 12 shows a reference point 120 and address indicator surface 121 symmetric about pointing reference 122. One will readily appreciate the aspect ratio is different than those shown in prior figures.

Figure 13 shows how an address vector may be said to be intersecting an object. Reference point 130 is the apex of a conic address indicator having a surface 131 and a reference pointing direction 132 and cross section 133. Cylindrical object 134 contains spatial extent 135 which is shared with the address indicator. In this regard, it is said that a device of the invention having a conic address indicator as shown is addressing the object. One will appreciate that it is not necessary that the reference pointing direction be intersecting the object, but that any portion of the address indicator is sufficient to form an intersection. The database search can be made to be responsive to this condition.

Range gates cooperate with address indicators having spatial extent. Figure 14 shows a reference point 140, conic surface 141, pointing reference 142 and cross section 143. A conic section having cross sections 144 and 145 form a range gate which may be used to limit database searches.

Of course with geometric shapes one might be quite liberal in devising various useful shapes. To be a valid address indicator, a geometric shape must merely have a reference point and reference pointing direction associated therewith.

One will now fully appreciate how a system which measures position receives attitude information via user input may present information relating to objects having an association with a particular geometry and location. Although the present invention has been described in considerable detail with clear and concise language and with reference to certain preferred versions thereof including the best mode anticipated by the inventor, other versions are possible. Therefore, the spirit and scope of the invention should not be limited by the description of the preferred versions contained therein, but rather by the claims appended hereto.

Claims

What is claimed is:

1) An apparatus for the presentation of information relating to an object being addressed, the apparatus comprising:

a point reference;

a position determining means;

an input receiving means;

a computer processor; and

a user interface,

said position determining means being arranged to determine the position of the point reference and convey position information to said computer processor;

said input receiving means being arranged to an indication of a directional reference and convey direction information to said computer processor; and

said user interface being in electronic communication with said computer processor.

2) An apparatus of claim 1, said object being addressed being an object having information relating thereto stored in the computer.

3) An apparatus of claim 2, said object being addressed being an object having associated therewith, a geometric descriptor.

4) An apparatus of claim 3, said geometric descriptor being a definition of a geometric body which may form an intersection with the directional reference.

5) An apparatus of claim 1, said position determining means being a global positioning system receiver.

6) An apparatus of claim 1, said position determining means being a radio signal triangulation position determining system.

7) An apparatus of claim 1, said input receiving means being a keypad.

8) An apparatus of claim 1, said user interface being a transducer electronically driven by signals from the computer to create a physical disturbance which is perceptible via human senses.

9) An apparatus of claim 8, said user interface is a display screen operable for forming images and graphical forms.

10) An apparatus of claim 8, said user interface includes a speaker.

11) An apparatus of claim 8, said user interface includes tactile output.

12) An apparatus of claim 1, the apparatus further comprising a plurality of information elements stored in the computer in a database, each information element comprising stored information relating to an object which may be addressed by the apparatus.

13) An apparatus of claim 12, each of said information elements further comprising a geometric descriptor being a definition of a geometric body which may be associated with an object which may be addressed by the apparatus.

14) An apparatus of claim 12, said apparatus further comprising an address indicator, said address indicator being a definition of a geometric body being associated with said directional reference and point reference, whereby said address indicator may be caused to form an intersection with one or more geometric descriptors.

15) An apparatus of claim 14, said geometric body being a cone.

16) An apparatus of claim 14, said geometric body being a conic section.

17) An apparatus of claim 14, said geometric body being a conic section is arranged in accordance with a range gate definition.

18) A method of presenting information relating to an object being addressed, the method comprising the acts:

receiving a directional reference input;

determining position;

searching a database; and

presenting information,

said receiving a directional reference input being further defined as receiving an indication of a direction;

said determining position further defined as measuring the position of a point reference;

said searching a database further defined as comparing an address indicator against a geometric descriptor of an information element; and

said presenting information further defined as reporting results of a search where correlation is found.

19) A method of claim 18, said presenting information including information relating to an object being addressed in the addressing an object step.

20) A method of claim 18, said geometric descriptor being associated with an object which is an object being addressed in the addressing an object step.

21) A method of claim 18, said address indicator being associated with said reference pointing direction and said point reference.

22) A method of claim 18, said determining position step includes principles used in global positioning systems.

23) A method of claim 18, said determining position step includes principles used in radio signal triangulation systems.

24) A method of claim 18, said presenting information step further including presenting information at a transducer operable for creating a physical disturbance which may be perceived by a human operator.

25) A method of claim 24, said presenting information step further including presenting information on a display screen in image and graphical form.

26) A method of claim 24, said presenting information step further including presenting information on an audio speaker.

27) A method of claim 24, said presenting information step further including presenting information on a transducer which produces a tactile output.

28) A method of claim 18, said searching a database step further comprising recalling information stored in information elements, each information element comprising stored information relating to an object which is the object being addressed.

29) A method of claim 28, said information elements further comprising a geometric descriptor which is a definition of a geometric body and which is associated with an object that is an object being addressed.

30) A method of claim 18 said address indicator being a geometric body which is associated with said directional reference pointing direction and said point reference.

31) A method of claim 30, said geometric body being a cone.

32) A method of claim 30, said geometric body being a conic section.

33) A method of claim 30, said geometric body being a conic section arranged in accordance with a range gate.

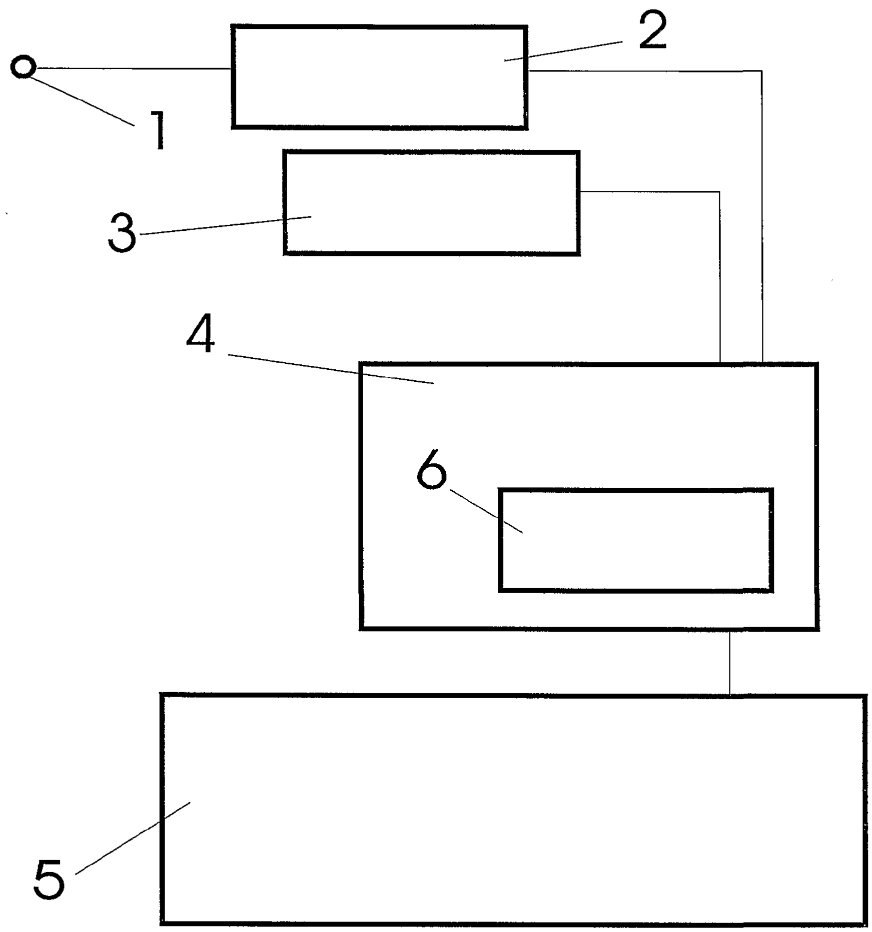


Fig. 1

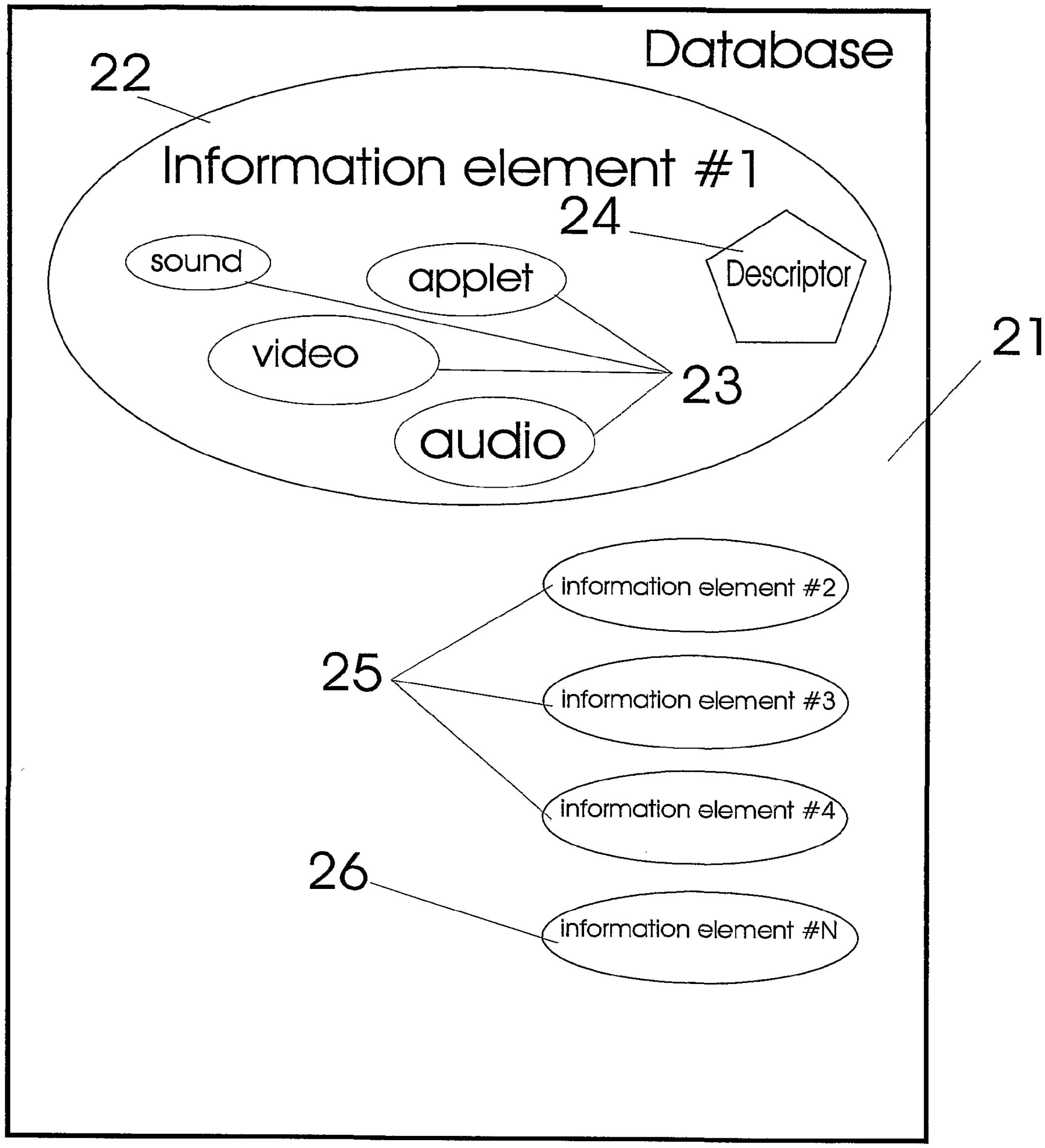

Database
22
Information element #1
24
Descriptor
sound
applet
video
audio
23
21
information element #2
25
information element #3
information element #4
26
information element #N

Fig. 2

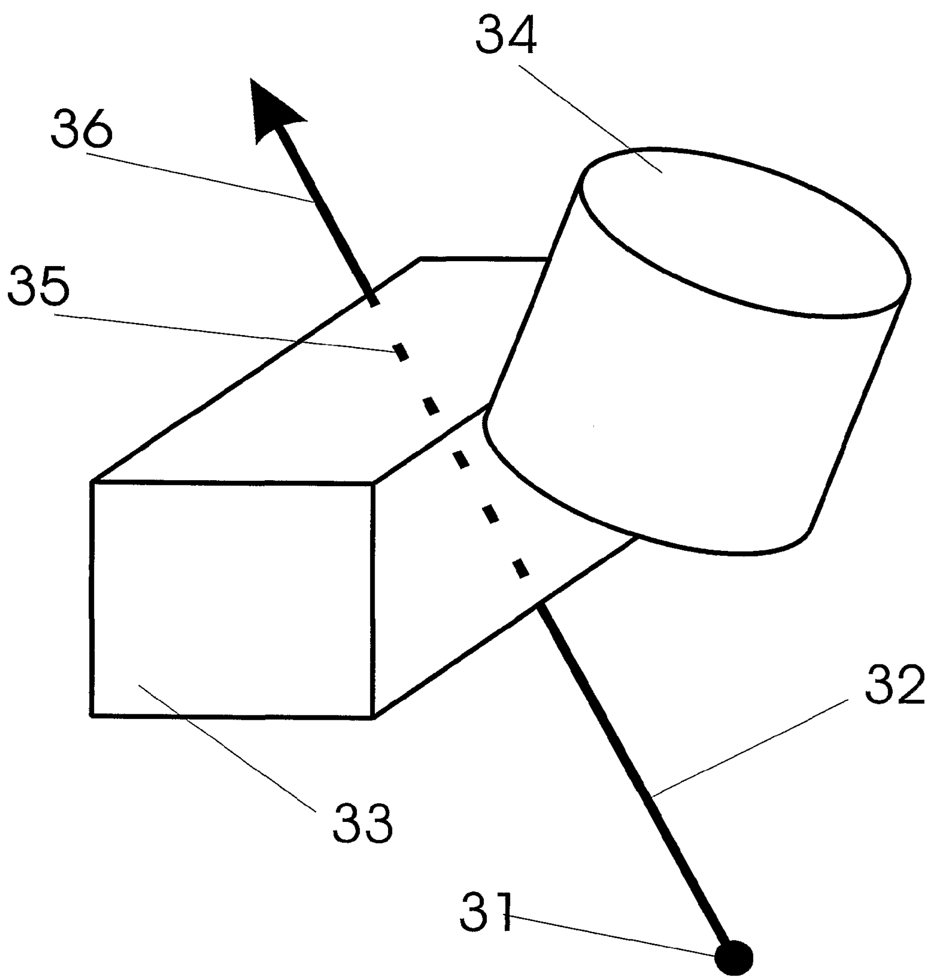


Fig. 3

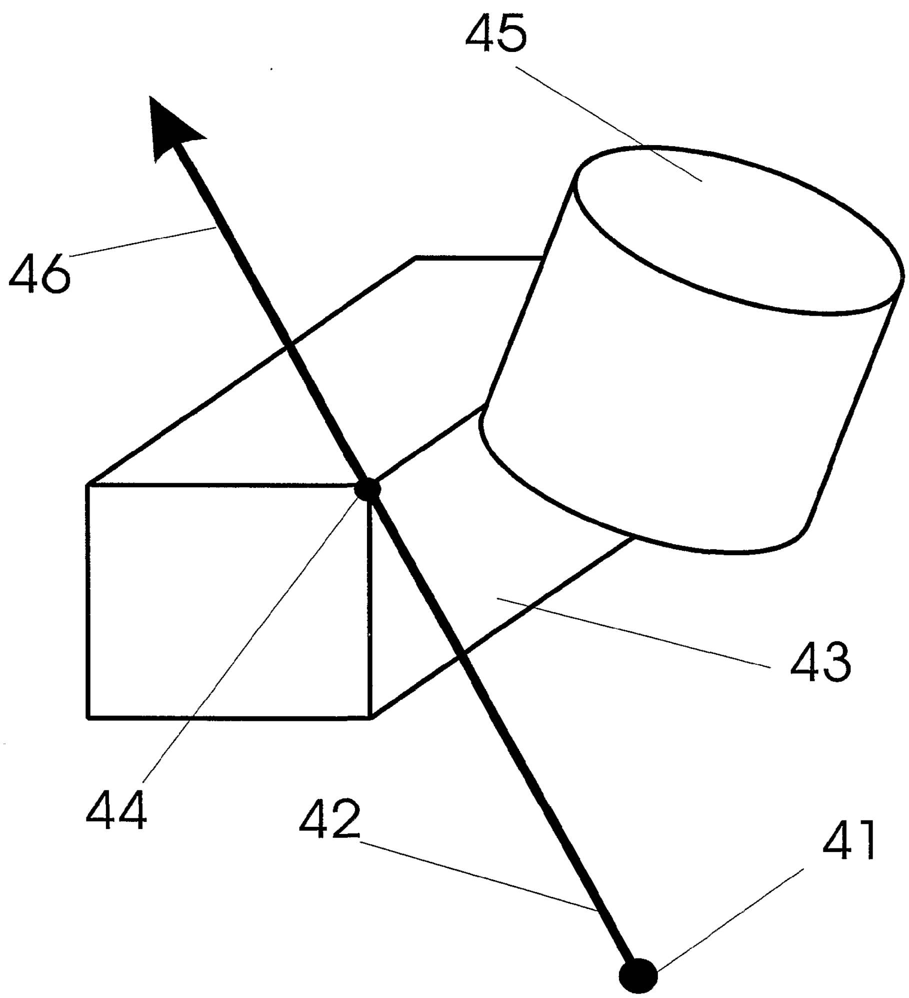


Fig. 4

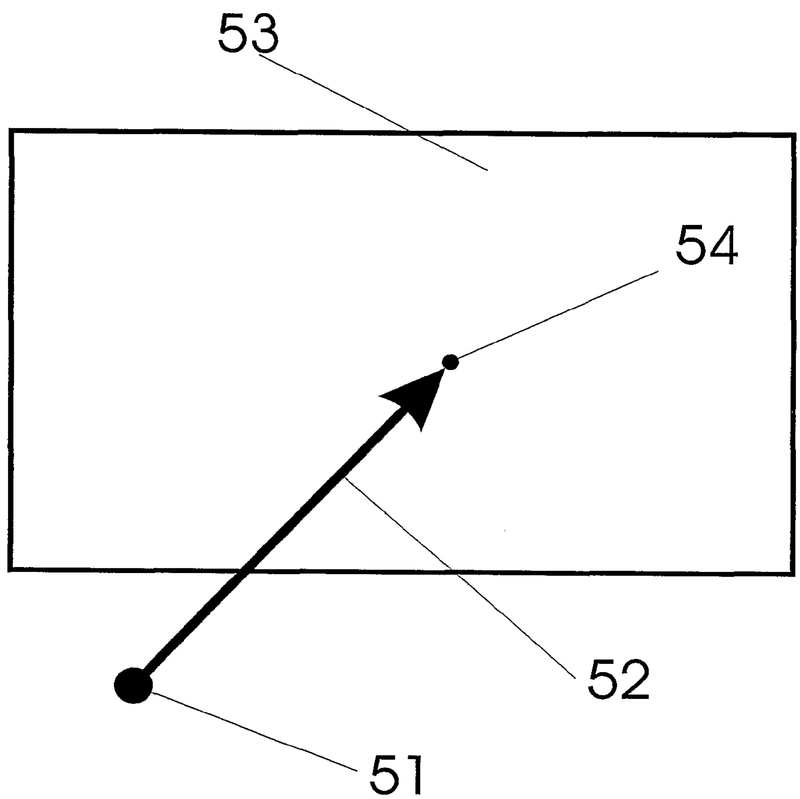


Fig. 5

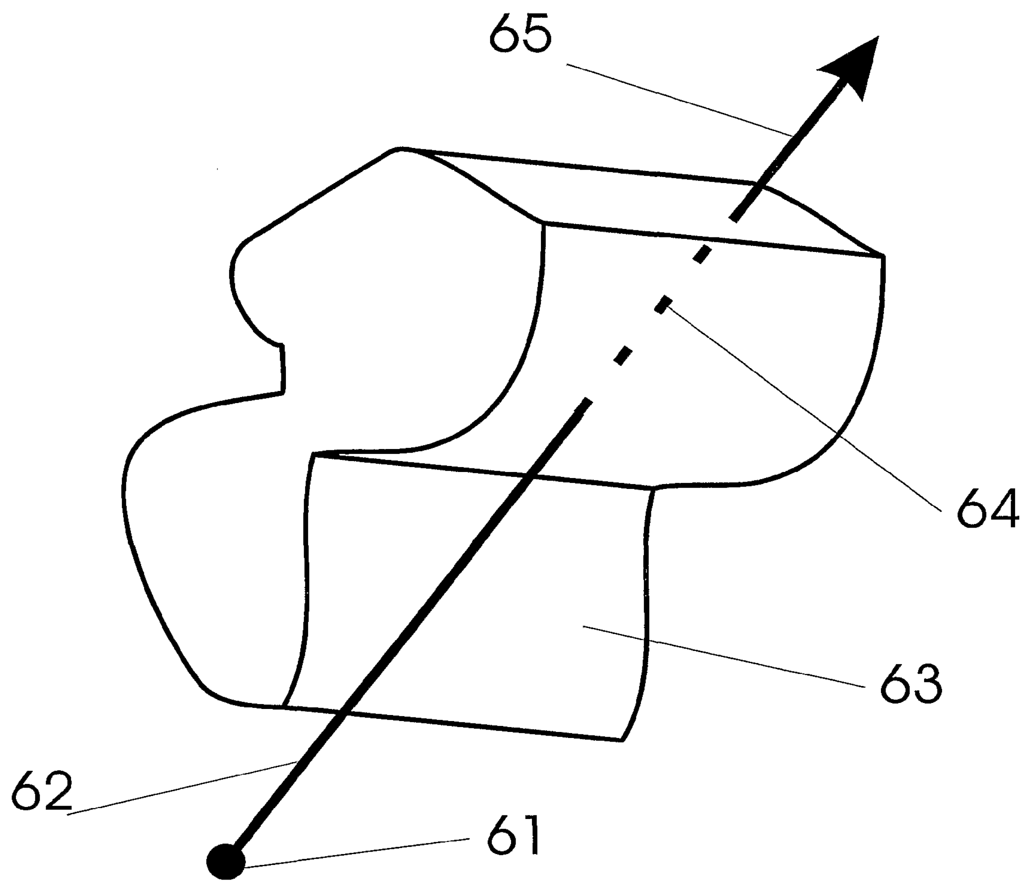


Fig. 6

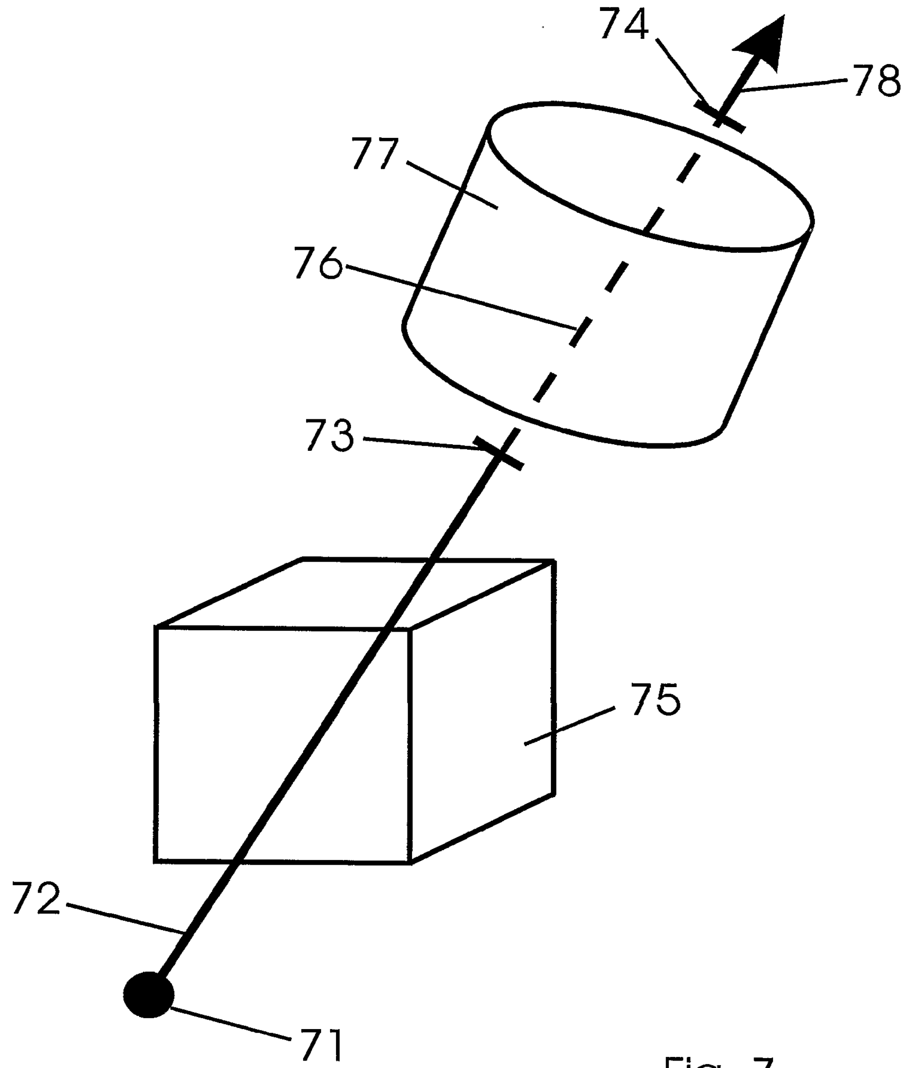


Fig. 7

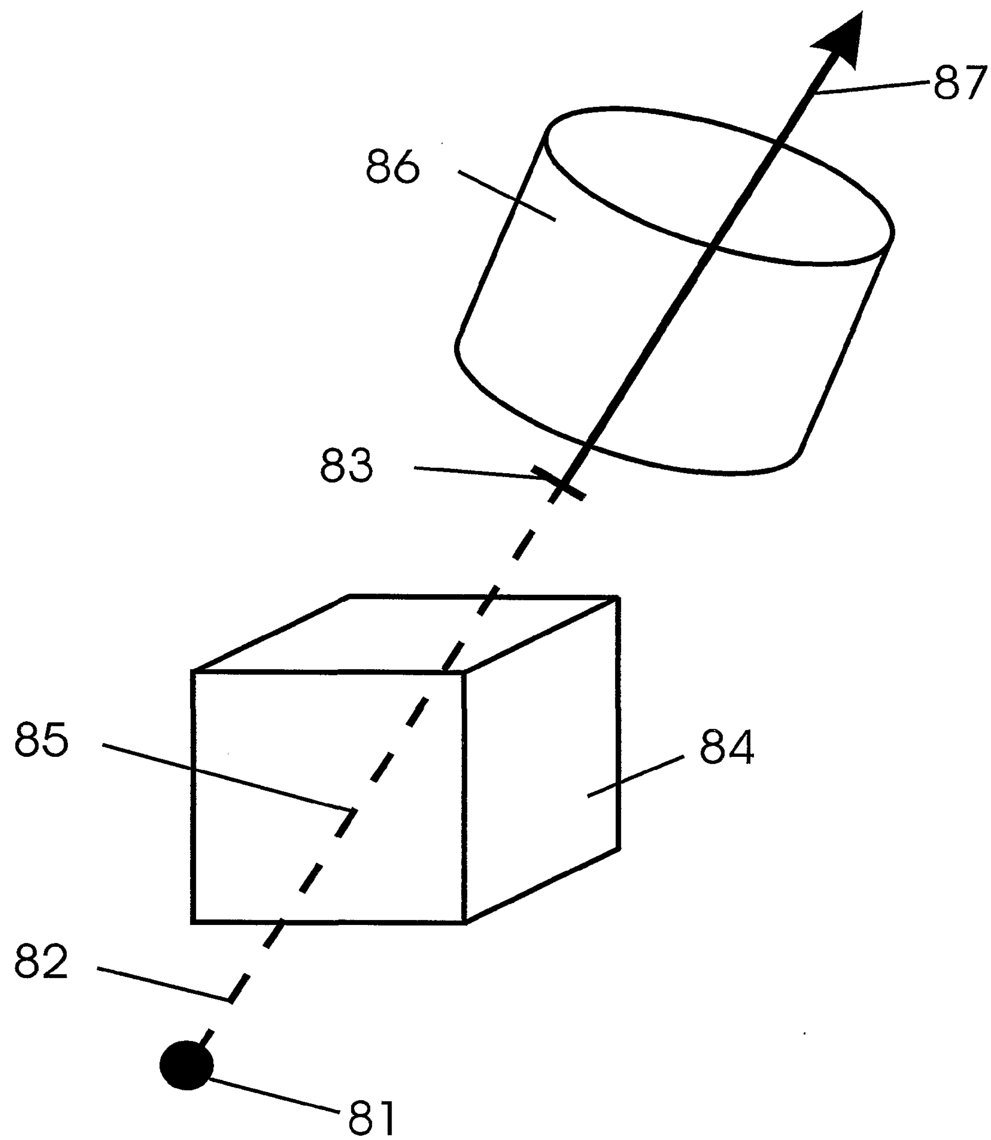


Fig. 8

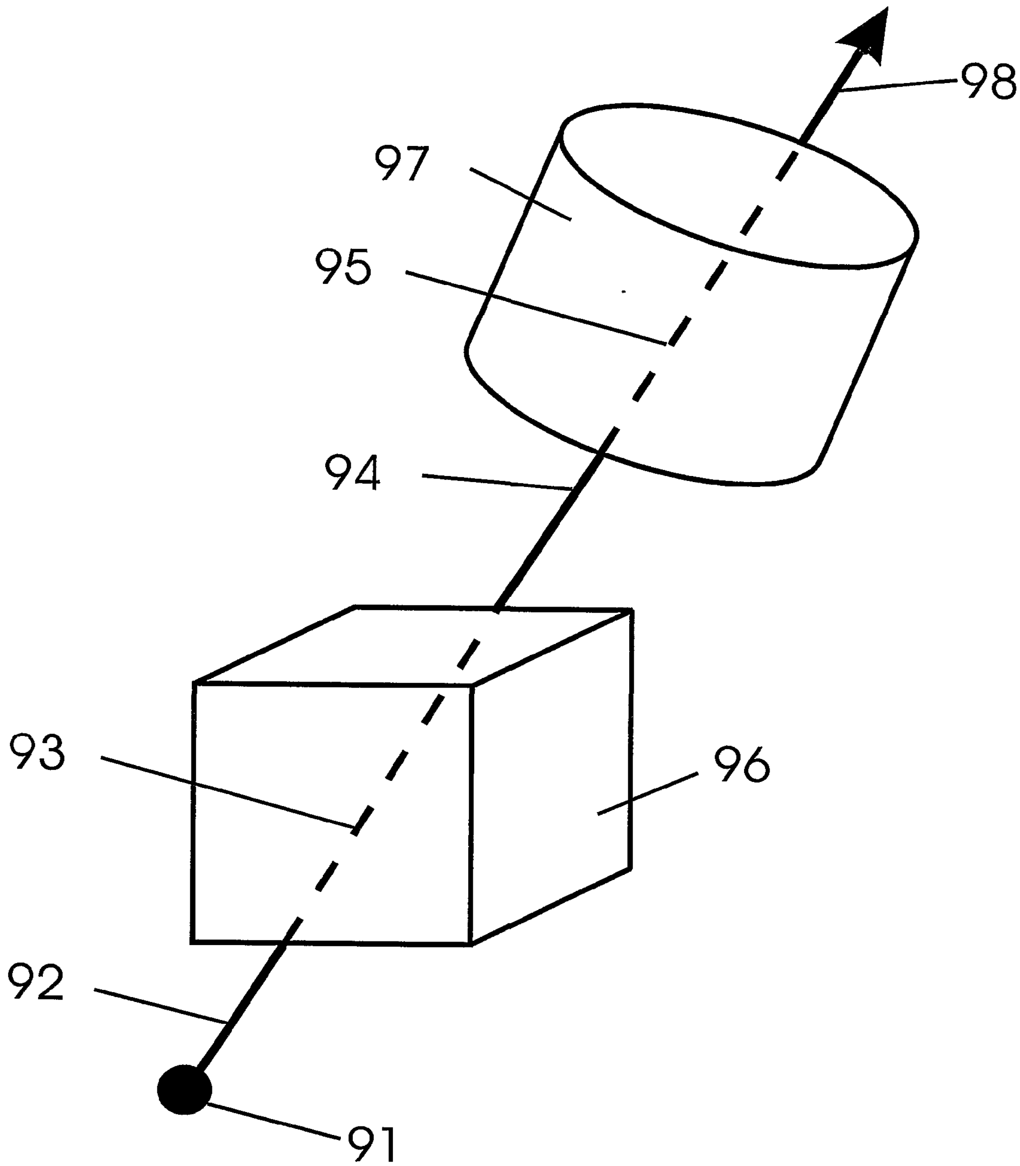


Fig. 9

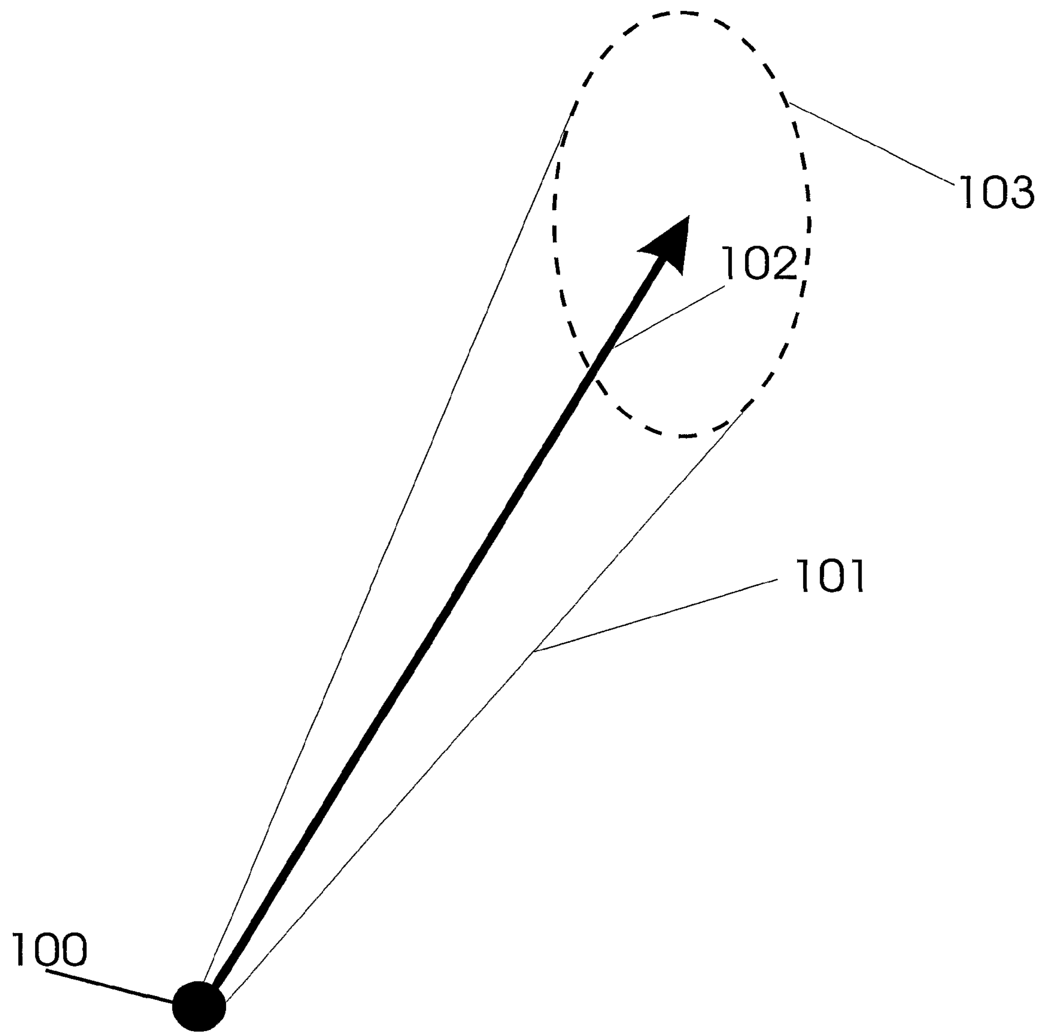


Fig. 10

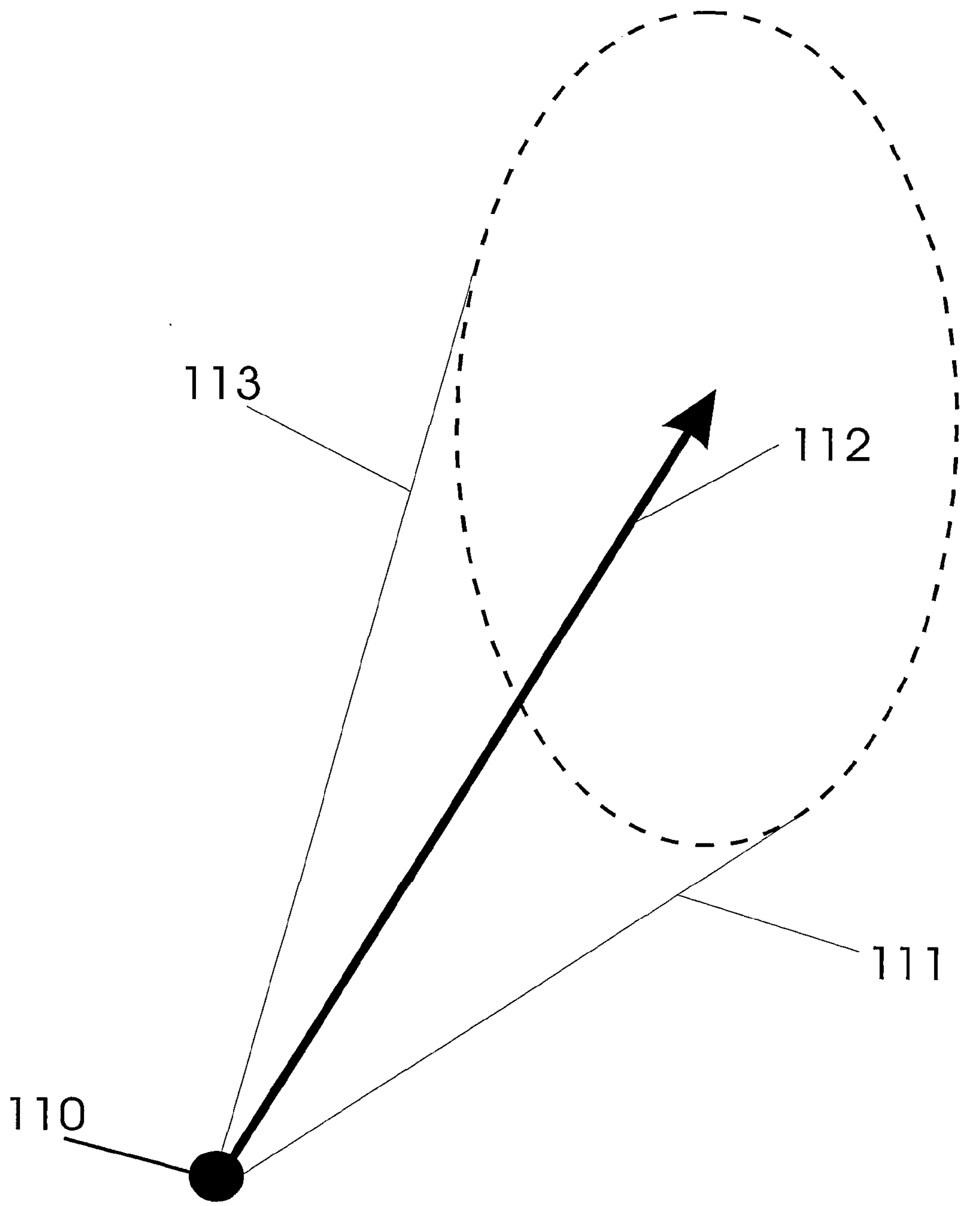


Fig. 11

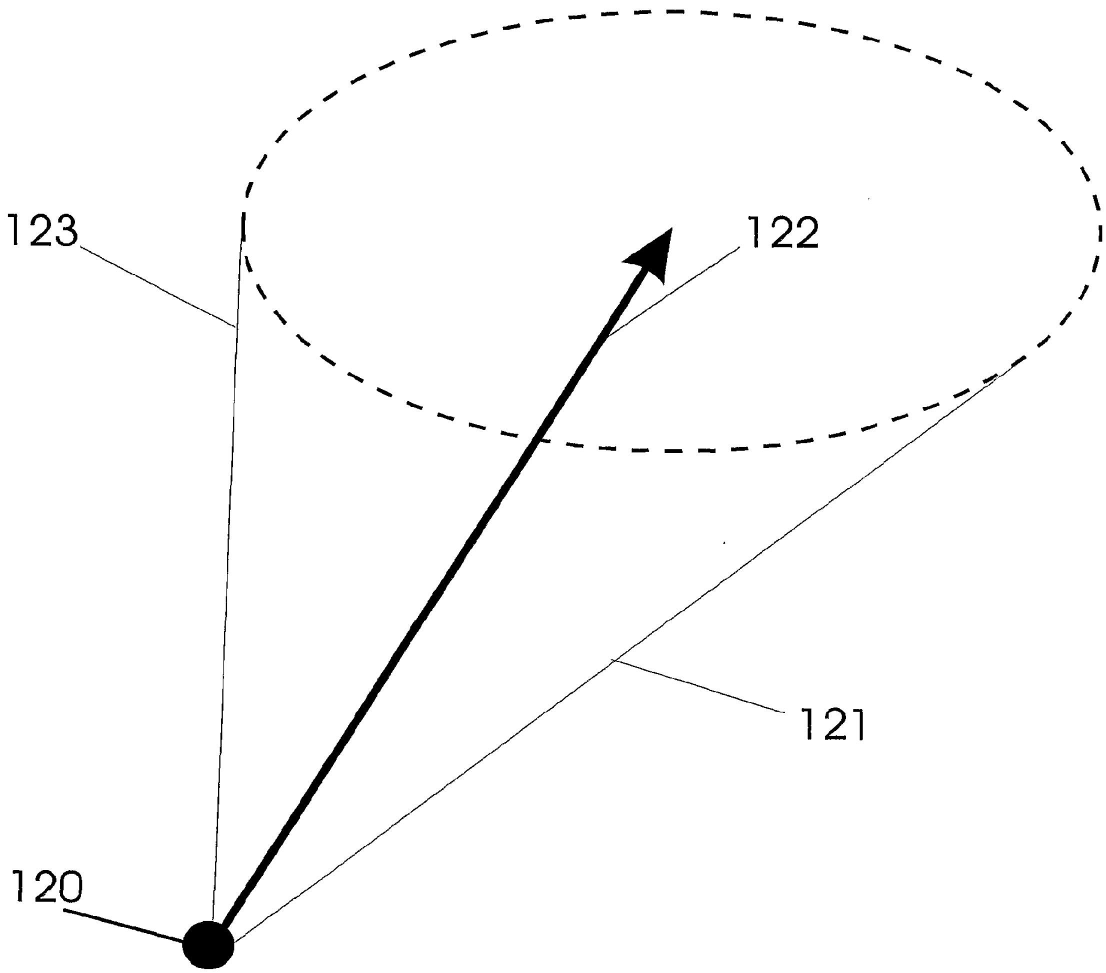


Fig. 12

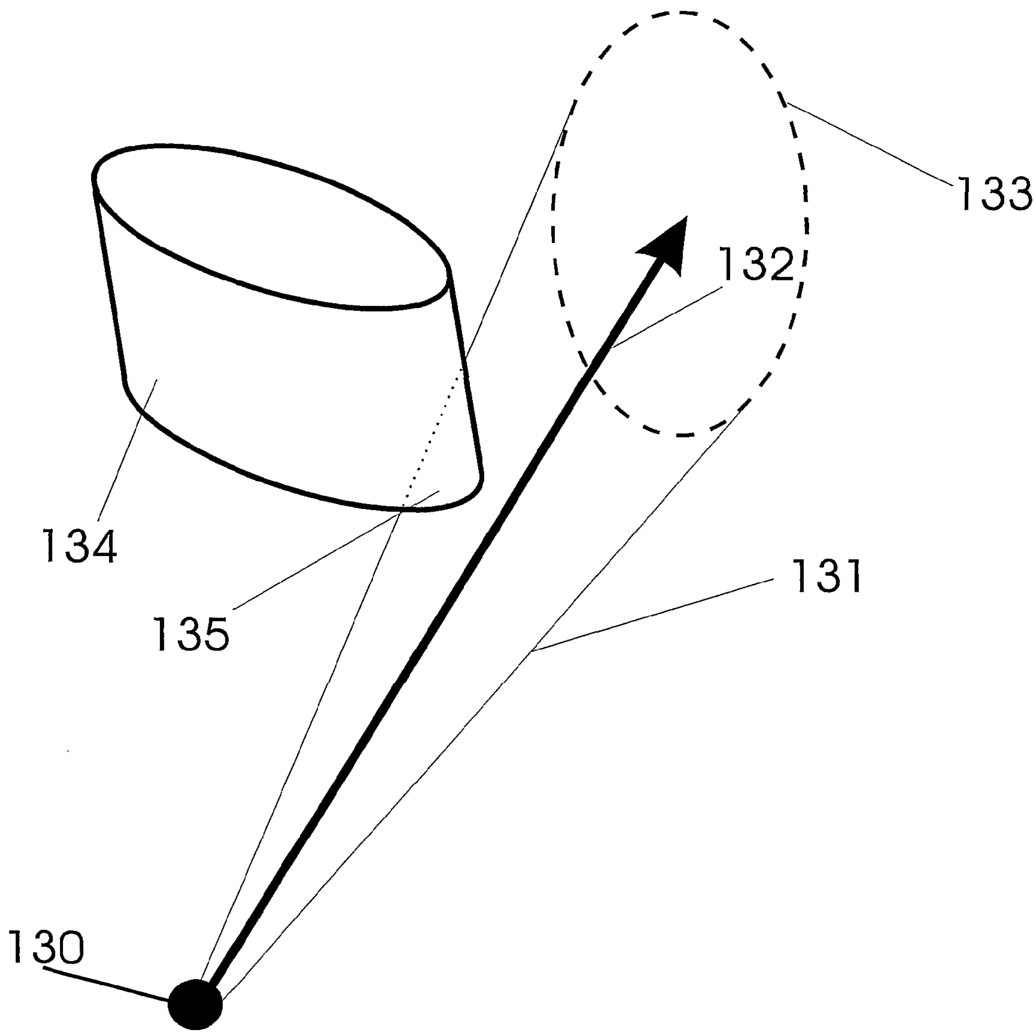


Fig. 13

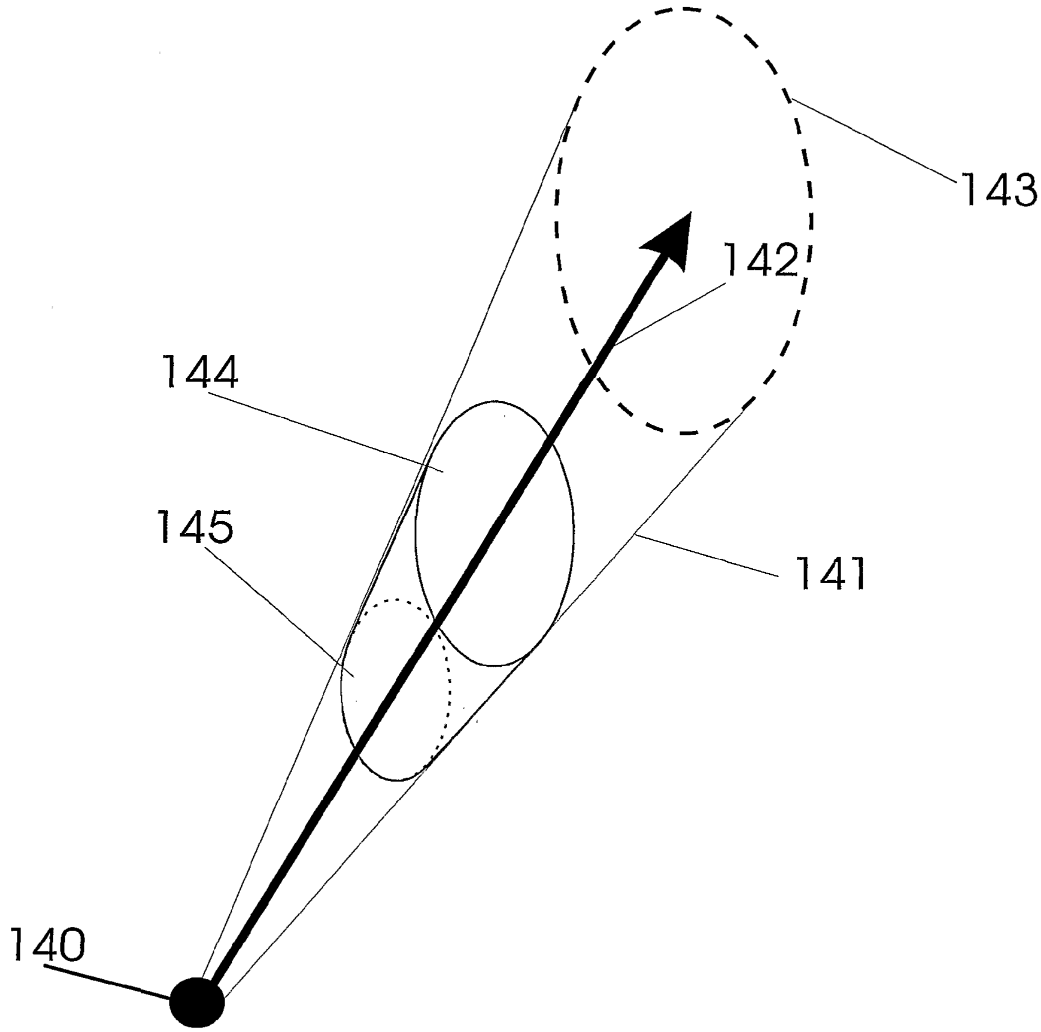


Fig. 14

INTERNATIONAL SEARCH REPORT	International application No. PCT/US01/05971

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 17/30, 17/40, 17/60; G01S 5/02; G06T 17/00; G09G 5/10; H04B 7/185
US CL : 342/357.07; 345/7,435; 702/150,153; 705/28; 707/1

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : Please See Continuation Sheet

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST 1.02.0008

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,682,332 A (ELLENBY et al) 28 October 1997 (28.10.1997).	1-33
X	US 5,815,411 A (ELLENBY et al) 29 September 1998 (29.09.1998).	1-33
X	US 5,961,571 A (GORR et al) 05 October 1999 (05.10.1999).	1-33
X	US 5,960,413 A (AMON et al) 28 September 1999 (28.09.1999).	1-33
Y,E	US 6,215,503 B1 (SNYDER et al) 10 April 2001 (10.04.2001).	1-33

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 May 2001 (31.05.2001)	13 JUL 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Thomas H. Tarcza Telephone No. 703-306-4177

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Continuation of B. FIELDS SEARCHED Item 1: 340/988-995; 342/357.06, 357.07, 357.11, 450, 451, 457; 345/7,435; 382/103, 154, 181, 276; 455/456, 457; 702/150,151,152,153,154; 705/28; 707/1

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 September 2001 (27.09.2001)

PCT

(10) International Publication Number
WO 01/71282 A1

(51) International Patent Classification[7]: G01C 11/26

(21) International Application Number: PCT/US01/05763

(22) International Filing Date: 22 February 2001 (22.02.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/526,801 16 March 2000 (16.03.2000) US

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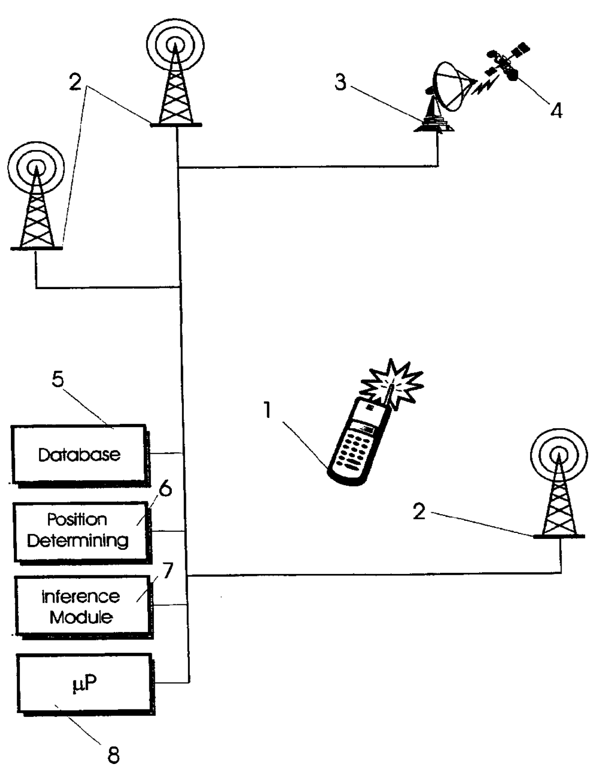
(81) Designated States *(national)*: AU, CA, FI, JP, KP, NZ.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: INFORMATION SYSTEMS HAVING DIRECTIONAL INTERFERENCE FACILITY



(57) Abstract: An information system is arranged to provide information relation to objects at a user interface in response to objects being addressed by the system. An object is addressed by the system whenever a mobile portion of the device (1) is in a location near the object being addressed and an inferred reference direction forms an address vector which intersects a geometric descriptor associated with the object. Reference directions used to arrive at address indicators may be formed by inference rules contained in an inference module (7) which is part of the device. The inference module (7) may also receive hints from outside sources such as clock or via direct user inputs.

WO 01/71282 A1

Title "Information Systems Having Directional Inference Facility"

Specification for a Letters Patent

BACKGROUND OF THE INVENTION

Field

The field of these inventions described herefollowing may be characterized as information systems having position measuring capacity combined with attitude inference facility and more particularly by such information systems which further interact with a database of data elements having geometric descriptors associated therewith.

Prior Art

Applicants' copending U.S. patent applications having serial numbers 09/510,889; 09/110,572; 09/163,746; 09/384,470; 09/384,469; and 08/662,219 and U.S. patents numbered 5,815,411; 5,682,332; each relate to information systems which interact with a database of data elements having geometric descriptors associated with the data elements, however, most of those systems rely on devices having a means of determining the pointing direction of a directional reference associated with the device.

While the systems and inventions of the art are designed to achieve particular goals and objectives, some of those being no less than remarkable, these inventions have limitations which prevent their use in new ways now possible. These inventions of the art are not used and cannot be used to realize the advantages and objectives of the present invention.

It should be understood that all of the herein referenced materials provide considerable definition of elements of the present invention. Therefore, those materials are incorporated herein by reference whereby the instant specification can rely upon them for enablement of the particular teachings of each.

SUMMARY OF THE INVENTION

Comes now, Tom Ellenby, Peter Ellenby, and Jeffrey Alan Jay with inventions of information systems having position measuring capacity including devices for and methods of presenting information to a user whereby the information presented relates to a measured position and an inferred directional reference.

The present inventions include devices and methods for presenting information relating to objects having an association with a particular geometry and location. A device which determines its position and infers a reference direction, responds by searching a database and determining which objects are being addressed; and further by recalling and presenting information which relates to those addressed objects.

A parameter herein referred to as an 'address indicator' is dependent upon a measured position reference and an inferred direction reference. An address indicator may be envisaged as a geometric construct which relates to point and directional references. An example is a vector with an endpoint which corresponds to the point reference and a direction corresponding to the direction reference. An address indicator serves as criteria against which database searches are made. A database comprised of data records each including a 'geometric descriptor' may include records where the geometric descriptor forms an intersection with an address indicator. When an object's geometric descriptor forms an intersection with an address indicator, the object is said to be 'addressed' by the system. Database output for addressed objects may include information relating to addressed objects in many forms such as common multi-media types. The information relating to addressed objects is presented to a user via a user interface which may include graphical user interfaces such as a video display device, among others.

Objectives of the Invention

It is a primary objective of the invention to provide systems for presenting information.

It is further an objective to provide systems for addressing an object and presenting information relating to the object.

It is further an objective to provide systems for addressing an object, identifying the object and presenting information relating to the object.

It is further an objective to provide systems for addressing an object, recalling information relating to the object by way of spatial references and presenting information relating to objects being addressed.

It is further an objective to provide systems for addressing an object via a measured position reference and an inferred direction reference.

A better understanding can be had with reference to the detailed description of preferred embodiments and with reference to the appended drawings. These embodiments represent particular ways to realize the invention and are not inclusive of all ways possible. Therefore, there may exist embodiments that do not deviate from the spirit and scope of this disclosure as set forth by the claims, but do not appear here as specific examples. It will be appreciated that a great plurality of alternative versions are possible.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims and drawings where:

Figure 1 is a schematic diagram of a first version of systems of the inventions;

Figure 2 is a schematic diagram of a second version of the inventions;

Figure 3 illustrates use of a handset in an environment of interest;

Figure 4 is a diagram of an environment in which systems may be used; and

Figures 5 and 6 are a similar diagram of environments in which devices may be used.

PREFERRED EMBODIMENTS OF THE INVENTION

In accordance with each preferred embodiment of these inventions, there is provided apparatus for and methods of presenting information relating to objects being addressed. It will be appreciated that each embodiment described may include both apparatus and methods and that an apparatus or method of one preferred embodiment may be different than an apparatus or method of another embodiment.

Throughout this disclosure, reference is made to some terms which may or may not be defined in popular dictionaries exactly as they are defined here. To provide a more precise disclosure, the following terms are presented with a view to clarity so that the true breadth and scope may be more readily appreciated. Although every attempt is made to be precise and thorough, it is a necessary condition that not all meanings associated with each term can be completely set forth. Accordingly, each term is intended to also include its common meaning which may be derived from general usage within the pertinent arts or by dictionary meaning. For purposes of this disclosure:

A **Geometric Descriptor** is a mathematical definition of a geometric body. A geometric descriptor is used in association with an object which may be addressed by systems of the invention.

An **Information or Data Element** is a database record which relates to a particular object of interest. An information element may comprise a plurality of forms of multi-media data including but not limited to: text, audio recordings, video streams, pictures, photographs, icons, Java applets, etc. In addition, each information element has associated therewith a geometric descriptor.

Address is a term used herein as a verb, most commonly with the gerund *-ing*, to indicate a relationship between a device of the invention and an object; the object being the subject of the address. The physical state of a device of the invention defines a particular address indicator where that address indicator for intersection with the geometric descriptor of an object, the system is said to be 'addressing' the object.

An **Address Indicator** is a geometric construct, examples include vectors and cones, which has a pointing direction associated therewith. In addition to a reference point and reference pointing direction, some address indicators, for example a cone, subtend a solid angle or otherwise have spatial extent.

Objects refer to any element which may be of interest to a user. An object may be a real tangible object or may be a simple element in space. The term 'object' should be read in a liberal sense. Although buildings and mountains suggest concrete forms of objects, objects for purposes of this disclosure include abstract forms as well. For example, the region of airspace over an airport which may be a 'restricted airspace' is considered an 'object'. Indeed any region of space may be considered an object whether it actually contains a tangible object therein or not.

APPARATUS

In simplest terms, apparatus versions of the invention include the elements described herefollowing.

Geometric References

Devices of the inventions include a point reference. A point reference may be merely a structural construct. The actual point may or may not correspond to any tangible object or element of a device. Alternatively, it may be correspond with the position of an actual physical element of a device. In either case, an important relationship is made between the point reference and a position determining means which is also included in systems of the invention. The position determining means is arranged to measure the position of the point reference in some spatial frame of reference.

Devices of the inventions also include a directional reference. A directional reference may be arranged to correspond to a natural axis of a device such as the longitudinal axis of a handheld member. However, the direction reference may also be a mere geometric construct without correspondence to a physical thing.

Position Determining Means

Apparatus of the inventions include a position determining means arranged to determine the position of the point reference. Since in some embodiments of the invention the position determining means is a global positioning system GPS receiver, the point reference lies at the center of a sphere which is defined by the resolution limits of the positioning system. For practical purposes, a handheld receiver which includes a GPS antenna may be said to have the point reference within the handheld unit. Due to the fact that a hand held device is substantially smaller that the minimal resolution of a GPS, the position determining means is said to measure the position of the handheld unit. Many forms of alternate positioning systems may be used to accomplish a similar task. The particular positioning system employed may be chosen for a specific task at hand, for example a global positioning system would not be appropriate for a small space such as a warehouse so a radio triangulation technique may be preferred. The essence of the invention is not changed by the particular choice of positioning system. Therefore versions of the invention should not be limited to one particular type of positioning system. The limitation described by 'position determining means' is met when the position of the point reference is measured and made available to a computer processor. Therefore, by use of the term "position determining means" it is meant that any conceivable means for determining the position of a point reference and making that position known to a computer is anticipated. Experts will recognize that there are many thousands of possible ways of determining position and it will not serve a further understanding of the invention to attempt to catalogue them here. The reader will appreciate that the broadest possible definition of "positioning determining means" is intended.

Reference Direction Inference Module

An Reference Direction Inference Module may best be described as a rule set which is preferably implemented in software or firmware. Although hardware may be configured to provide a directional reference in some versions, software implementations provide considerable flexibility for change, update, low cost. An inference module may have no inputs or minimal inputs. An inference module provides a reference direction as an output. For example, where there are no inputs, a certain rule set may specify that 'North' be the reference direction by mere default. The reference module may receive inputs from system components. For example, direct user input may be received at a system keypad. In addition, generally available parameters such as time of day are available as input to an inference module. Sidereal time is a timing system upon which considerable information relating astronomical bodies may be deduced. For example, for any given position on earth, one may predict with great accuracy the location of the sun or moon in the sky. In addition, the constellations are precisely located in the night sky via sidereal time. Systems of the invention may be arranged to provide sidereal time as an input to the inference module such that time is used in a determination of a reference direction. A detailed example of this use of sidereal time is set forth below.

User Interfaces

User interfaces of the inventions serve to convey information to or receive input from a user of the device. A simple speaker driven by computer audio systems is operational for producing audio information and description to a user. Similarly, a display screen driven by video systems of a computer functions to present video or graphic information to a user. Tactile entry of commands may be received via a keypad or similar devices. Although a display screen and speakers are preferred devices for interfacing with a user, other systems include non-display type visual systems such as simple light emitting diodes, or non-speaker audio systems such as buzzers, tactile outputs such as vibrating systems, et cetera. User interfaces include a transducer which is electronically driven by the computer to produce some physical disturbance which can be detected by a user's senses.

User interfaces are arranged in preferred embodiments as a display in a handheld unit. A device such as a mobile telephone having advance display capacity operates well to support devices of the inventions.

Computer Processor

In addition, systems of the invention include a computer programmed to execute specific routines. In particular, a computer is arranged to receive inputs from the position determining means and reference direction inference module. From these inputs, the computer determines an 'address indicator'. Against this address indicator definition, the computer performs a database search and determines if objects contained in the database have geometric descriptors which intersect the address indicator. Objects having geometric descriptors which are determined to intersect said address indicator have data associated therewith which may be recalled and played back to user interfaces as appropriate and in agreement with other criteria which may be selected.

Although a 'processor' is called out as structure in descriptions of the invention, an expert will recognize that processing is most conveniently done in a distributed fashion where portions of information processing is executed at the handheld unit, in the network nodes, at the database. For purposes of this disclosure, a processor is meant to include all processing components in the entire distributed system in cooperation with each other.

Similarly, an inference module may be physically located in a handheld device or may be part of the distributed processing scheme.

Database

In systems of the invention a database is arranged to accommodate data relating to objects of interest. Data relating to objects is prepared and stored in a predetermined and well organized fashion. The data may be stored in many formats and configurations and may be of the nature sometimes referred to as 'multi-media'. A database of the invention is comprised of a plurality of information elements. Each information element relates to a particular object which may be of interest to users of devices of the inventions. Each information element contains a geometric descriptor which describes a particular geometry and location associated with a certain object for which the stored information pertains.

A geometric descriptor includes a definition set for a specific geometry including position, and sometimes changing position with respect to time. A simple time independent example in a Cartesian coordinate system includes a sphere having its center at a point (X, Y, Z) = (2, 5, 9) and a radius of 7 units. Thus the sphere and all of the points within the sphere's boundary are part of the geometric descriptor. A geometric descriptor may describe a geometry such as: a single point, a polygon which defines a planar region, a solid such as a sphere, or even a three dimensional object of arbitrary shape. Thus the rules which perfectly describe those geometries which are well known in the sciences are used in geometric descriptors of the invention. In all cases, a geometric descriptor includes at least one point and more frequently includes a set of many points.

WIRELESS NETWORKS

A more complete understanding can be realized in consideration of the drawing figures with reference numerals as follows. Figure 1 illustrates major components of certain devices of the inventions. A handheld portable unit 1 which may be in the form of a common mobile telephone is in remote communication with a plurality of stations 2. In addition, the system may include ground stations 3 in communication with one or more satellites 4. In some versions, the handheld unit may communicate with orbiting satellites and omit need for ground based stations; in this case, the drawing of figure 1 reduces to the exclude the ground stations without loss of generality. Ground stations, satellites, and handheld units form a network which is further in communication with information transaction elements as follows.

A database 5 is connected to the network whereby prerecorded information which relates to objects may be stored therein. A handheld portable unit may make requests by passing information relating to an address indicator to the database and receiving object information from the database.

A position determining means may include orbiting satellites such as GPS or alternatively e911 positioning means. In e911 systems, signals may be transmitted from the handheld unit 1 and analyzed for their arrival time at fixed ground stations to triangulate on a present position of the handheld unit. A point reference associated with the handheld device is said to be in the position so measured.

While some versions are implemented where control processing and database management occur at a fixed site connected to the network, as shown in Figure 1, other versions also anticipate having these functions or portions and subsets of these functions taken up at the handheld device. Figure 2 diagrams this alternative. A handheld device 21 may be configured for wireless communication with ground transceivers 2, satellite antennas 23, and satellites 24 in a similar fashion as described previously. However, a computing device 25 may provided to perform database, position, inference and processing functions on board the handheld unit. In instances where speed is a priority, devices may be preferably arranged to execute functions locally at the handset, while in versions which are sensitive to overall cost, an arrangement may be better suited such that the device in merely in communication with the network which handles the bulk of processing. In the latter case, a protocol is worked out for the transfer of information such that a plurality of devices all in communication with the network each would receive information which is particular to those devices.

SELF CONTAINED SYSTEMS

While preferred embodiments may be arranged as described above, alternative architectures are possible which do not deviate from the spirit of the inventions. Although phone networks are well established and provide an excellent basis upon which devices of the invention may be built, a self contained device which does not interact with a wireless network may also be configured as a device of the inventions. Such a device has a complete database, a complete processor, and all position and direction determining means integrated into a single handheld unit. The device, without communication to outside networks is arranged to determine the position of a reference point, infer a direction reference, and provide information recalled from a database at a user interface.

METHODS

Methods of the invention are best described as being comprised of the following steps.

Measure Position

In a first step, the position of the reference point is determined. A GPS may be employed locally at the device and operate to measure the global position of the reference point. Although convenient measurement units might be latitude, longitude and altitude, others similarly provide workable solutions. Alternatively, systems such as those known as '**e911**' where triangulation on radio signals allows a position determination are also useful in systems of the inventions. Data from the position determining step is passed to computer processors.

Infer Reference Direction

A reference direction is determined by inference in agreement with a rule set provided to systems of the invention. In advanced versions, hints such as user activity may be supplied as input to the inference module. Inputs to the inference module are processed in agreement with the rule set to provide as output a reference direction.

Form Address Indicator

In combination, a position value and a reference direction are used to form an address indicator. Although a simple vector may be used in some versions, a cone or other geometric construct having angular extend including solid angle geometries may be used as an address indicator to represent a region of space being addressed by devices of the invention at any time.

Search Database

A database search operation reads database records, more particularly the geometric descriptors of data records and performs a coincidence test to see if a particular address indicator computed in agreement with position and direction references intersects any of the points described by the geometric descriptor. Items meeting that criteria are tagged for recall and further processing including presentation at a user interface.

Prepare and Display Results

Information relating to objects determined to be addressed objects in a database search is recalled and processed for presentation at a user interface.

It is useful to present in detail techniques which may be used to infer a reference direction. These are meant to be a few illustrative examples and not meant to be a comprehensive listing of all possible ways. One will surely appreciate that a great plurality of rule sets may be devised without varying from the spirit of the invention.

ARBITRARY DEFAULT

In devices having no ability to *measure* device attitude and where there are no hints regarding a preferred direction, a reference direction may be placed by arbitrary default. In a most rudimentary version, an arbitrary default may be chosen and set within the inference engine rule base. For example the direction associated with 'North' with respect to any given point on the earth's surface serves as a good starting point. Wherever a user of devices of the inventions carries a handheld unit, the system determines the unit's position and defines an address indicator to be the vector which has as an endpoint the determined position and a direction corresponding to North. From this definition of an address indicator, a database search can be performed. A user of such a simple device is made to understand that the search results do not depend upon the pointing direction of the handheld device or any other physical device but rather the results are set to correspond to the direction of zero degrees on the compass. A list of objects may be presented at a user interface which alerts a user to the objects in his immediate vicinity and more particularly, those near him and North of him.

In example, while standing at latitude N32° 49.649'; longitude W117° 16.513' the device set to have North as a default reference direction determines what database items lie on a line segment starting at the point described and extending in a direction North of that point. The 'Explorer Dive and Travel' scuba diving shop in La Jolla, California is displayed as a object meeting the criteria. Movement of the device to another location causes a new search which produces new results. Other database items lying on the line which begins at a new location and extends North are presented to a user in a list.

While listing objects lying in a line in a direction North of a user may be useful, most applications demand better flexibility. Although the direction North is a good starting point, many occasions require that a reference direction be used where the direction is other than north.

Merely Specifying a Reference Direction

To 'explore' an environment about a user, inference module programming may be arranged to receive user specification of a reference direction between 0 – 360, the conventional divisions about a compass. To get list of objects in any direction a user may simply specify that direction by way of keypad entry. Although a user may have no knowledge of how the direction specified lines up with real objects in the immediate environment, speculation may lead to a 'hit'; a known object. In addition, the user is enabled a way to arrive at a listing of all objects in the vicinity by serially making requests while incrementing the specified reference direction; for example by five degrees increase with each request.

Although specification of a direction of interest is accomplished as described, a simplification includes using the natural spatial distribution of keys on a common keypad. A telephone keypad includes matrix of numerals or symbols in a 3 by 4 arrangement of rows and columns. In a first preferred arrangement, numerals '0' and '5'; and symbols '*'; and '#' are ignored. A convention where North corresponds to the '2' key is adopted. A user having an interest in things lying on a line in the direction east of him, may indicate that interest by stimulation of the keypad, in particular by depressing the '6' key after being prompted by a user interface. In response to the user pressing the '6' key a new database search may be initiated in view of the present position and the specified reference direction which may be deduced from the user input.

For simplicity, an inference engine may be arranged to translate a common mobile telephone keypad into directions about the compass rose where '2' is made to correspond to North. Accordingly, a user indicates a reference direction assignment of West by pressing the '4' key, South by pressing the '8' key, Northeast by pressing the '3' key, et cetera.

The careful observer will note that it remains a difficult task to determine which direction in the real world corresponds to a chosen direction. Accordingly, an arrangement is provided in some inference engines to receive user feedback and re-set a direction reference.

USER FEEDBACK

In some versions of an inference engine, feedback from a user may be used to arrive at a revised reference direction. In particular, where the position of a handheld unit is determined, a list of objects in the immediate vicinity may be presented at a user interface. The user can select from those objects in a list, one which is recognized. By selecting a recognized object and orienting the handheld unit in alignment with that direction the user sets an origin reference direction.

Then, while looking about the environment including objects unknown to the user, a user may have an interest in some object which is off in a direction other than the reference direction. To request information regarding that object, the user may provide indication to the processor by way of the keypad. A inference module rule set may be arranged so that the matrix of keys on the keypad correspond to various directions about the compass with the 'forward' direction corresponding to the '2' key when the keypad is aligned to the origin reference direction. Figure 3 illustrates this scenario. While pointing a handheld device 31 towards a recognized object, schoolhouse 32, the user sets an origin reference direction. The user thereafter makes an inquiry about nearby objects by providing feedback to the inference engine. For example the user may press the '3' key 33 which corresponds to a direction 34 toward a cityscape 35 of interest. In such arrangements, the inference engine determines a direction 34 to be the reference direction and defines an address indicator accordingly. In this way, a user can make requests for information relating to all objects around him by first providing hints to the inference module which is programmed to be initiated with an origin reference direction.

The above technique requires that the user recognize something in the landscape in order to align the device and provide feedback to the device to request information about other things in a direction different than the origin reference direction. It is not always the case that a user could recognize objects in a list of things lying nearby. Therefore alternative means are anticipated for providing a reference direction in an inference module.

SUN POSITION

As many persons find it difficult to determine which direction is North while standing in a common environment, for example a cityscape, it may be useful to provide a technique which aids the user in setting a direction reference via reliance on readily available timing information. A user's position and the precise time of day is well known to systems of the invention via communication with standard clocks. From this, a point on the horizon corresponding to where the sun or moon (or other astrological bodies such as constellations) is located is also within simple calculations.

Therefore, a user may use that point from which an origin directional reference may be formed. A reference direction could be defined by any direction in relation to that origin direction via user input on the keypad which is properly aligned with the origin direction.

Figure 4 illustrates a user pointing a handheld device 41 in a direction different than North 42, a direction which may be completely unknown to him. The direction 43 towards the horizon 44 and immediately below the sun at a single point 45. As the day passes, the position of the sun in its path 46 changes in a precise fashion with respect to sidereal time. Although the user is unaware of which direction is North and further unaware of the identity of objects around him, she can point a natural axis (the longitudinal axis) of the device at the horizon just below the sun to get an origin reference direction. Now with the keypad so aligned, the user may wish to request information about the buildings 47 ahead and to the right of him. Note that the '2' key no longer corresponds to North as an arrangement which uses the sun's position aligns the keypad to a dynamic direction which depends upon the time of day.

To address the buildings, a user simply presses the '3' key on the keypad to provide a hint to the inference module and indicate a direction reference. Figure 5 illustrates a handheld device 51 which is aligned in a direction 52 towards the horizon 53 where the sun is positioned. Buildings 54 are of interest to the user and lie in a direction 55 with respect to the user's present position. To indicate that direction as the direction reference for the purpose of defining an address vector, the user presses the '3' key 56 after first having set the origin direction. Similarly, If a user wishes to address a schoolhouse to the right, handheld unit 61 is pointed along direction 62 at horizon 63. Since schoolhouse 64 lies in a direction 65, a user must press the '6' key 66 to indicate such direction as the selected reference direction.

One will now fully appreciate how a system which measures position and infers a reference direction may present information relating to objects having an association with a particular geometry and location. Although the present invention has been described in considerable detail with clear and concise language and with reference to certain preferred versions thereof including the best mode anticipated by the inventor, other versions are possible. Therefore, the spirit and scope of the invention should not be limited by the description of the preferred versions contained therein, but rather by the claims appended hereto.

Claims

What is claimed is

1) An information system arranged to provide information about known objects in response to those objects being addressed, said system comprising:

a point reference;

a position determining means;

direction reference inference module;

a data store;

a processor; and

a user interface,

said position determining means in communication with said point reference whereby position measurements are made with respect to the point reference and position information is conveyed to the processor,

said direction reference inference module is arranged to provide direction reference output and convey that output to the processor,

said processor is arranged to recall information from the data store in accordance with said measured position of the point reference and the direction reference provided by the direction reference inference module, and

said user interface is in communication with said processor whereby the recalled information may be presented to a system user.

2) A system of claim 1, said point reference being arranged within a handheld mobile unit.

3) A system of claim 2, said handheld mobile unit includes a mobile telephone.

4) A system of claim 1, said position determining means is a global position system having a receiving antenna arranged within a handheld mobile unit.

5) A system of claim 1, said position determining means is a radio triangulation apparatus.

6) A system of claim 1, said direction reference inference module is arranged as a generalized processor with stored programming operable to providing a reference direction.

7) A system of claim 6, said direction reference inference module is arranged with a preset direction as a default whereby the absence of inputs to the direction reference inference module results in an output of a reference direction.

8) A system of claim 1, said direction reference inference module is arranged to receive input signals from a keypad.

9) A system of claim 8, said keypad includes a matrix of keys in rows and columns, a first row having keys labeled: '1', '2', and '3'; a second row having keys labeled: '4', '5', and '6'; and a third row having keys labeled '7', '8', and '9'.

10) A system of claim 9, said keypad is arranged such that the '2' corresponds to the direction north.

11) A system of claim 9, said direction reference inference module is arranged to provide an output which is dependent upon a key press operation.

12) A system of claim 11, said direction reference inference module is arranged to provide an output dependent upon the spatial relationship of the particular key pressed with respect to the matrix of keys.

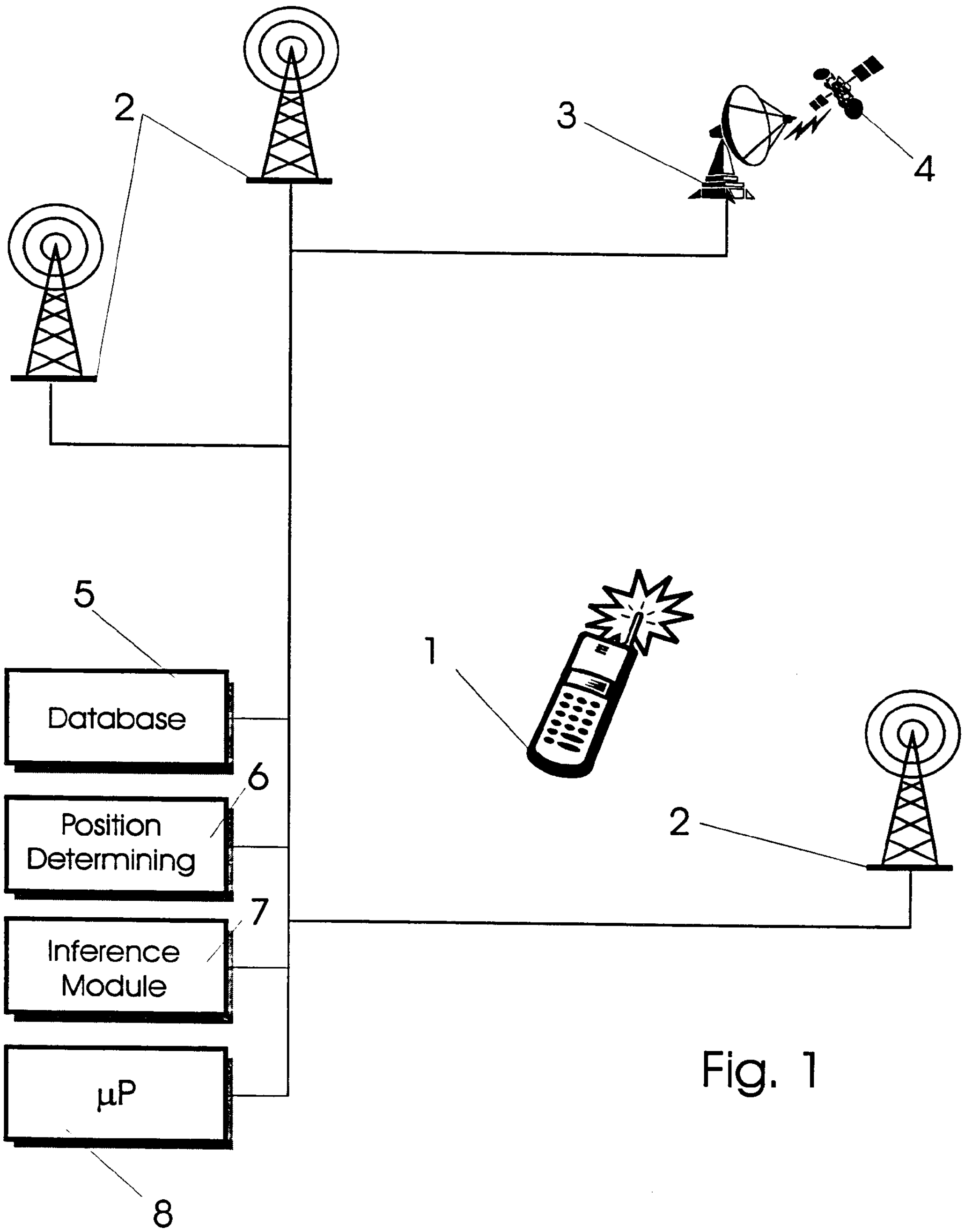

2
3
4
5
Database
6
Position Determining
7
Inference Module
μP
8
1
2

Fig. 1

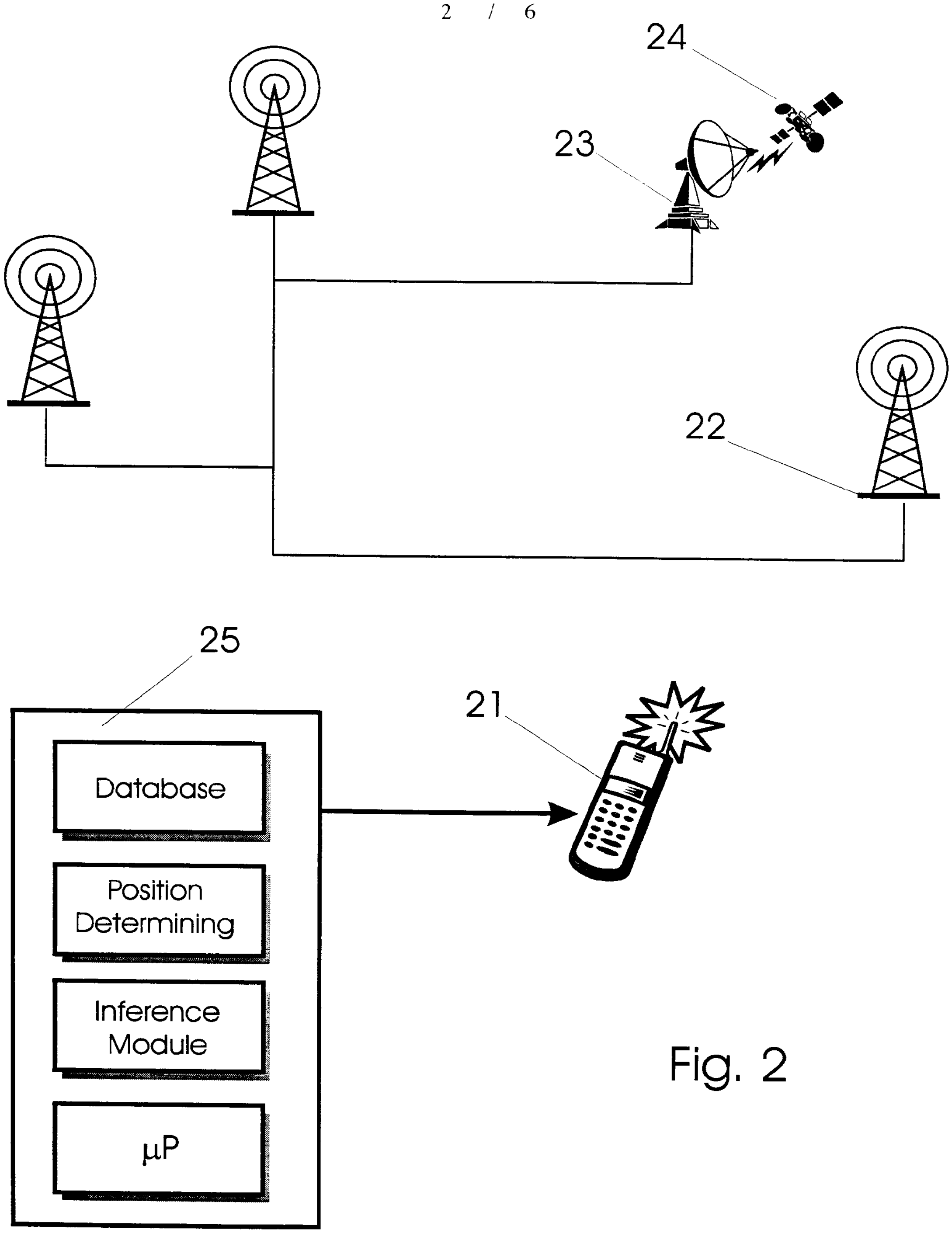

24
23
22
25
21
Database
Position Determining
Inference Module
μP

Fig. 2

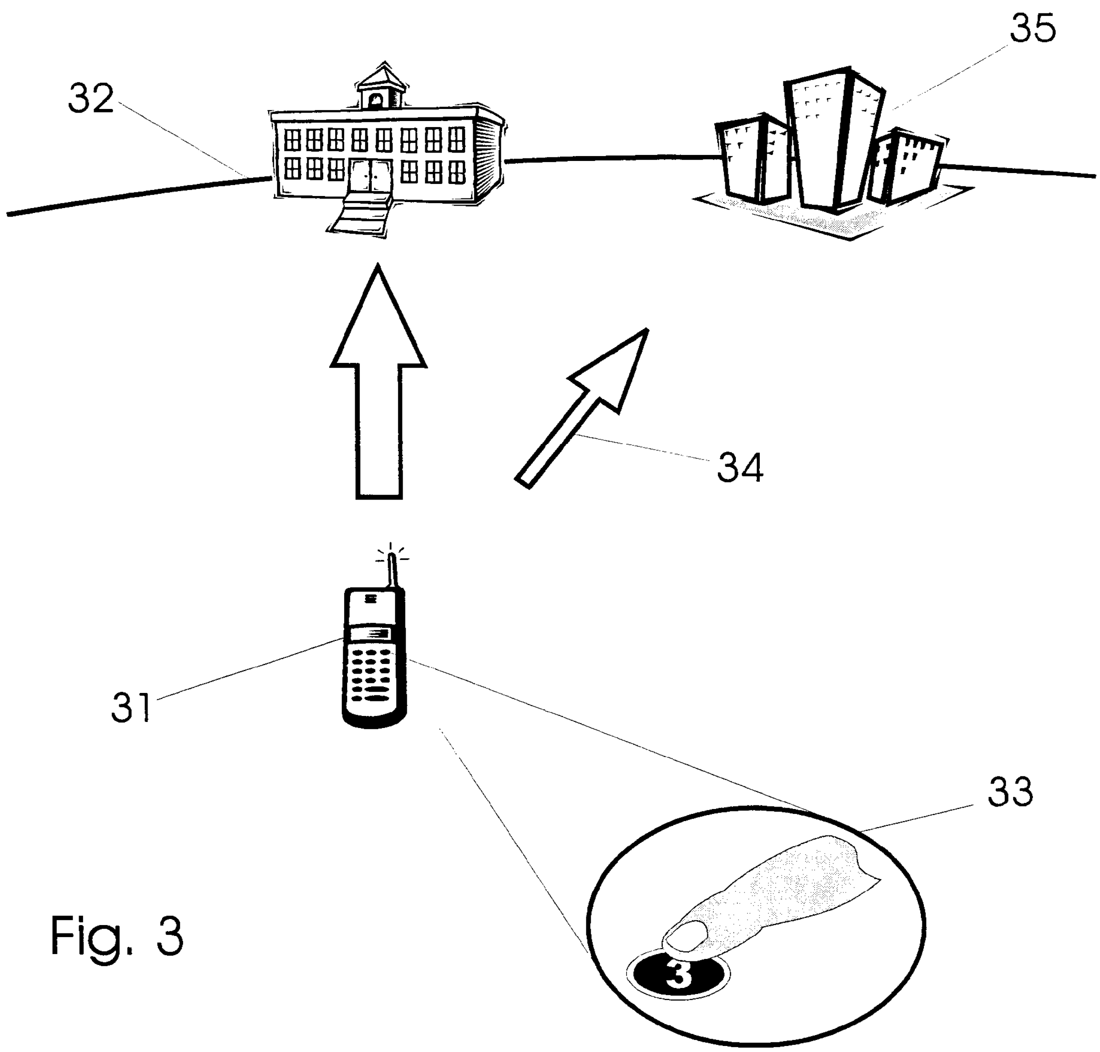


Fig. 3

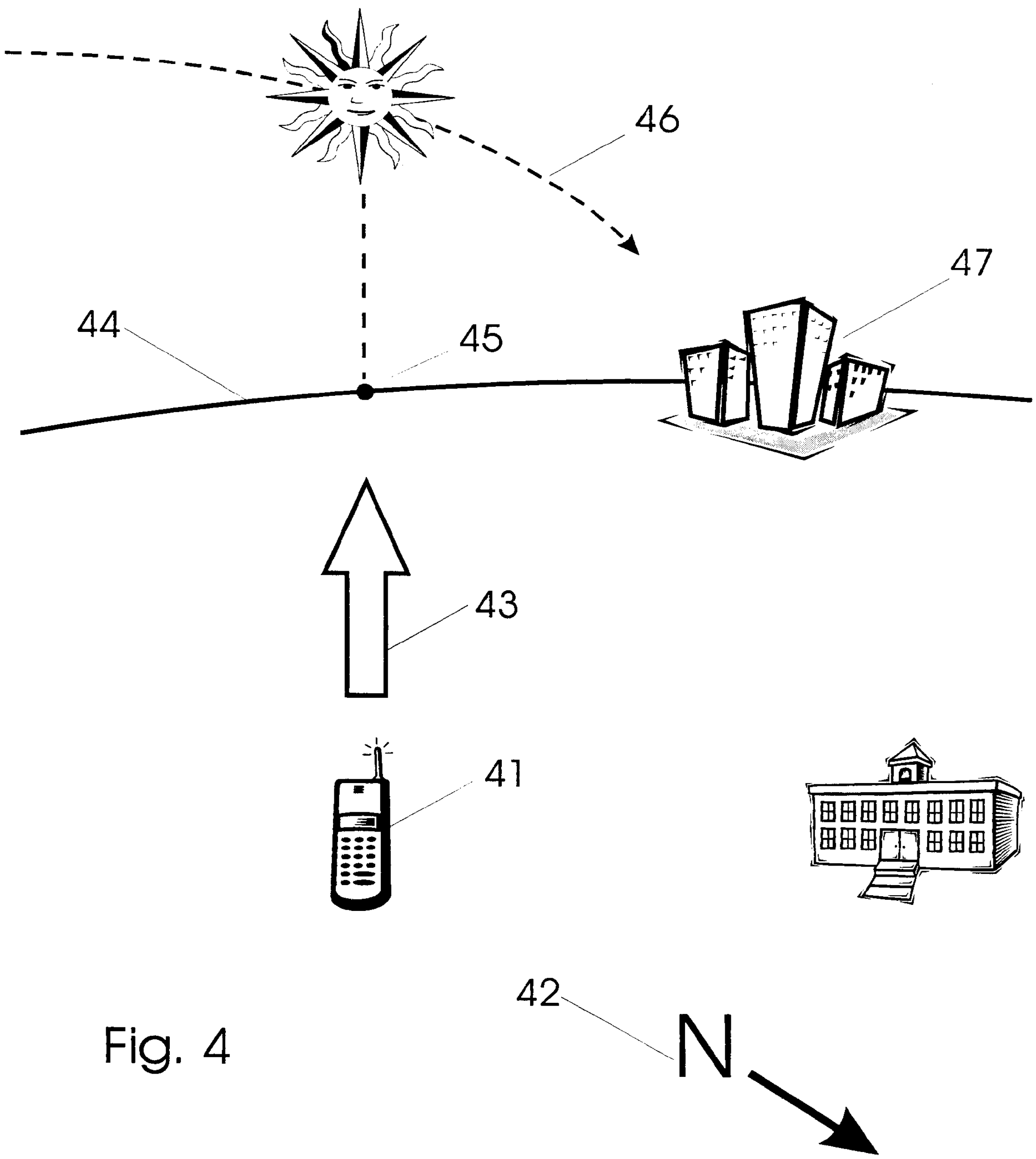


Fig. 4

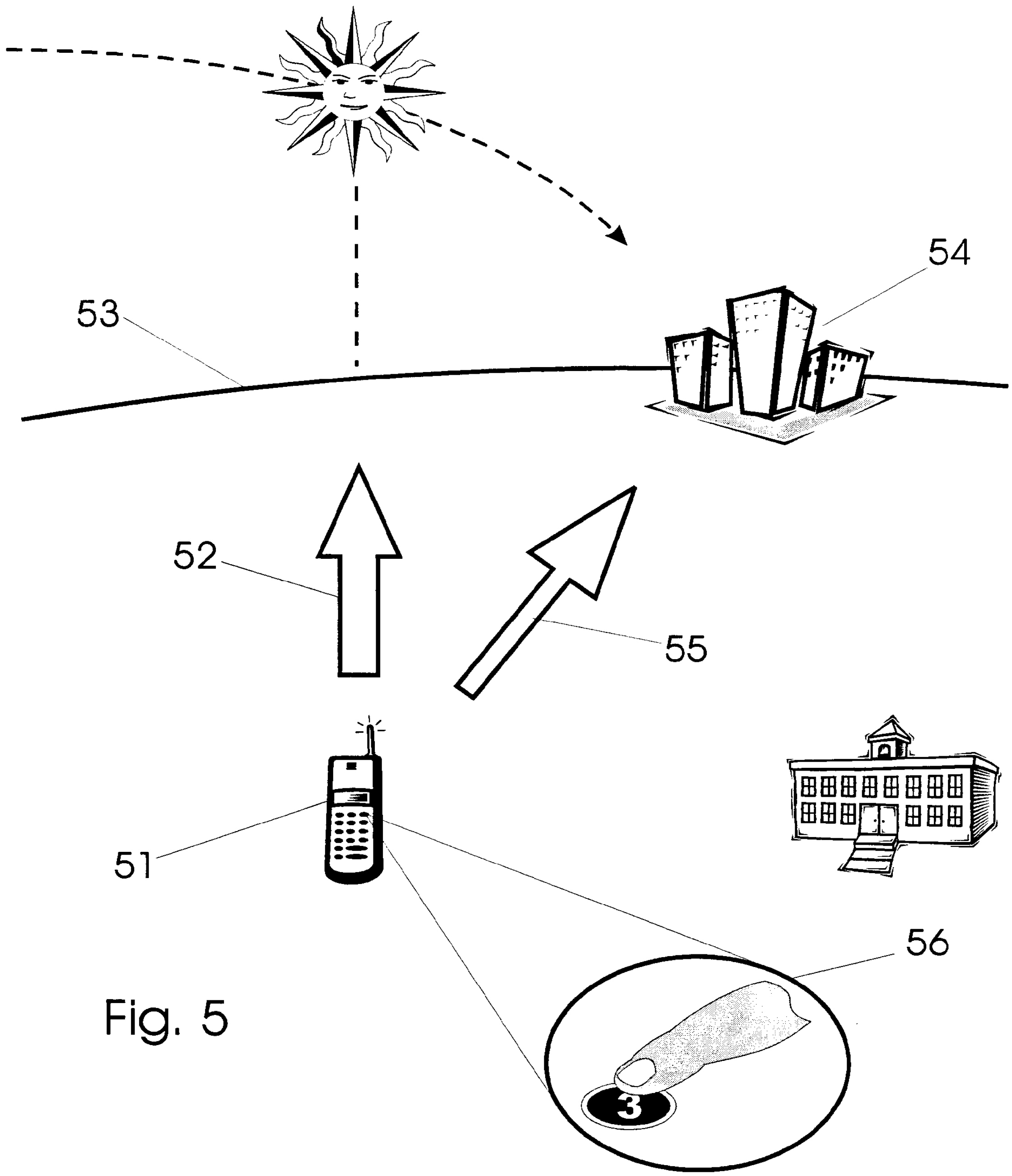


Fig. 5

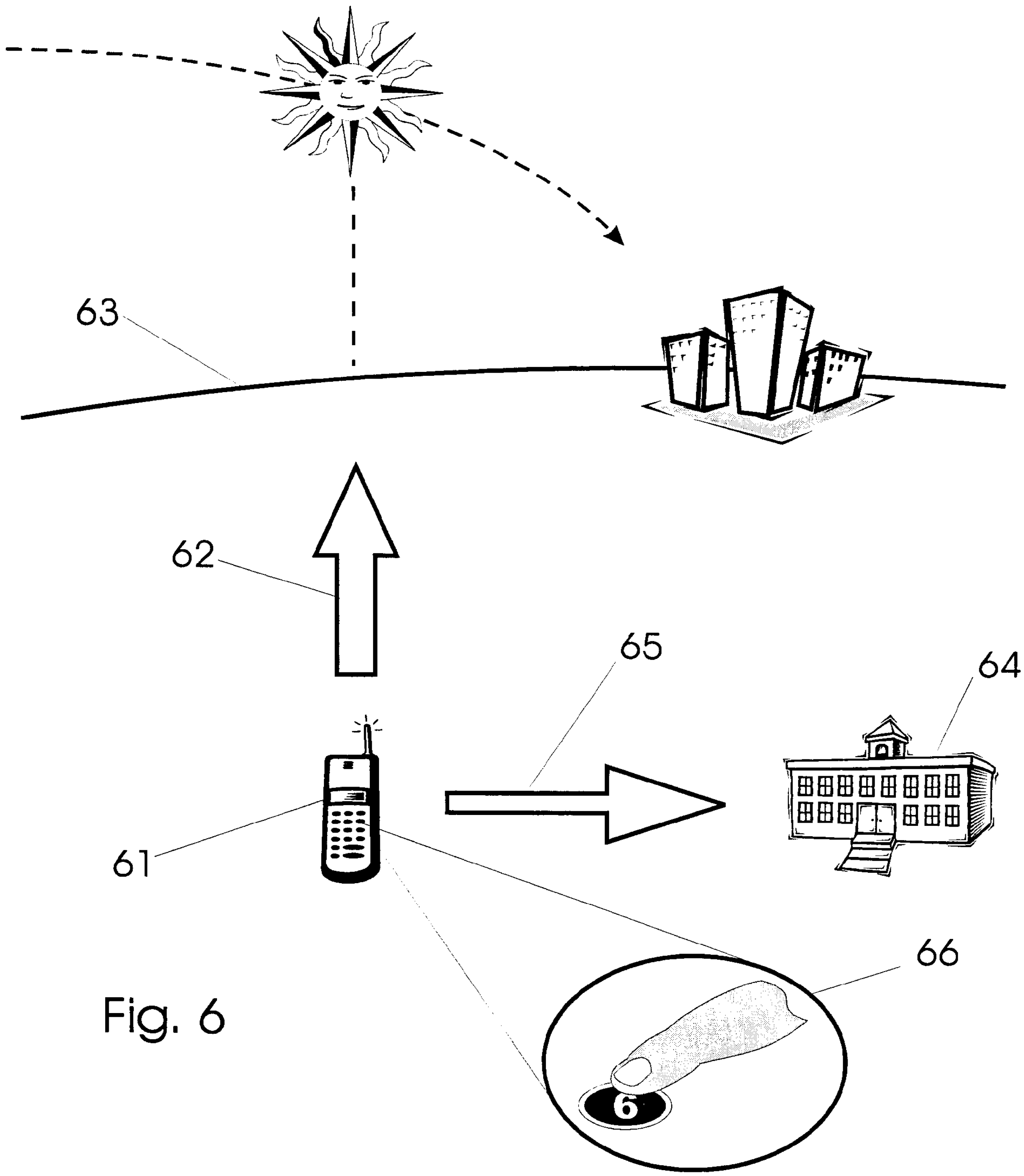


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/05763

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : G01C 11/26
US CL : 702/150
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 702/150, 152; 342/357.06, 451; 701/213

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
USPTO APS EAST, PLUS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A,P	US 6,173,239 B1 (ELLENBY) 09 January 2001 (09.01.2001), whole document.	1-12
A	US 5,815,411 A (ELLENBY et al) 29 September 1998 (29.09.1998), whole document.	1-12
A,P	US 6,127,945 A (MURA-SMITH) 03 October 2000 (03.10.2000), whole document.	1-12

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search 13 April 2001 (13.04.2001)	Date of mailing of the international search report 04 MAY 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer Patrick J. Assouad Telephone No. (703) 308-0956

Form PCT/ISA/210 (second sheet) (July 1998)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 August 2002 (01.08.2002)

PCT

(10) International Publication Number
WO 02/059716 A2

(51) International Patent Classification[7]**:** **G06F**

(21) International Application Number: PCT/US01/50804

(22) International Filing Date: 29 October 2001 (29.10.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/769,012 24 January 2001 (24.01.2001) US

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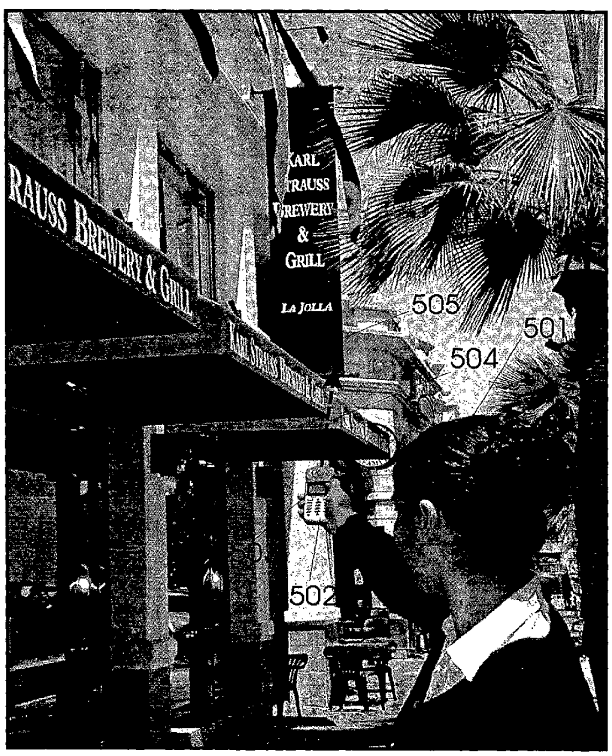
(81) Designated States *(national)***:** AU, CA, FI, JP, KP, NZ.

(84) Designated States *(regional)***:** European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: POINTING SYSTEMS FOR ADDRESSING OBJECTS



(57) Abstract: Systems are arranged to provide a user information which relates to objects of interest. A user may point a hand held device toward an object to address it. The device determines which objects are being addressed by making position and attitude measurements and further a reference and search of a database containing preprogrammed information relating to objects. Information relating to objects determined as objects presently being addressed in thereafter presented at a user interface. Devices of these systems include a point reference, a direction reference, a position determining support, attitude determining support, a computer processor and database, and a user interface. Methods of systems include the steps of addressing an object, determining position and attitude searching a database, and presenting information to a user.

WO 02/059716 A2

Under the Patent Cooperation Treaty

Applicants: Thomas Ellenby, Peter Ellenby, John Ellenby, Jeffrey Alan Jay, and Joseph Page

Title: "Pointing Systems for Addressing Objects"

Specification

BACKGROUND OF THESE INVENTIONS

Field

The field of these inventions is best characterized as pointing systems for addressing objects and is more specifically characterized as computer pointing systems for addressing objects and for manipulating information relating to such objects.

Prior Art

Definition of Pointing Systems

For purposes of this disclosure, 'pointing systems' include apparatus and methods arranged to address objects. A thing is the subject of a pointing system address action when the pointing system is manipulated in a manner which causes it to suggest an alignment or association (generally a spatial relationship) with the thing via pointing and position references of the system. An object can be said to be 'addressed' when a pointing system is pointing thereto.

Examples of Common Pointing Systems

- Finger Pointing

  Perhaps the simplest of pointing systems is the forefinger of the human hand. A common gesture in communication involves the pointing of ones finger toward an object of interest to indicate the object. For example:

"'The bridge on the left' a man says while pointing to the Handford State Bridge distinguishing it from the Overton Bridge which is frequently mistaken as the Handford."

Thus, in communications, a person sometimes arrives at a need to indicate and distinguish one object from another and further to pass that indication in the conveyance of a message.

- Computer Mouse

By the time of this writing, most computer users are familiar with an action described as '***point-and-click***'. Even casual use of a computer requires one to operate a pointing peripheral device, another example of a pointing system, typically a mouse, to cause a cursor to point at a region of a computer display, for example the region occupied by a certain icon image, and to trigger a mouse button whereby a '***click***' event is raised and detected in a computer programming code. A computer is programmed to take appropriate responses to such point-and-click actions in accordance with a program running on a computer. Responses may depend upon the region pointed to, or 'addressed', and sometimes the precise type of '***click***' action, for example a '***double-click***'; or a '***right click***'.

Therefore, we say that a computer has a 'pointing device' which is commonly a mouse type periphery; but may be a track-ball, PowerPoint®, touch screen, et cetera. With a computer pointing device, a user is provided the opportunity to interface with the display of a computer by making 'point-and-click' actions, among others.

In some systems, a cursor position within the display region is driven by tactile inputs from a user's hand. Such is the case with a mouse type periphery where spatial position is driven in two dimensions by the movements of a handheld orb.

- Touch Screen

A 'Touch Screen' type pointing system is interesting because it is not a cursor icon device which is doing the pointing but rather the tip of a physical object, a user's finger. Contact made with the screen as a finger taps the screen's surface causes an event which may be detected and measured by tranduction apparatus, typically a resistive matrix membrane.

- Lecturer's Pointing Stick / Laser Pointer

One will certainly recall a schoolhouse lecture where an elongated stick is used by a lecturer to point to various portions of a chalkboard. Modern lecturers may prefer a high-tech pointing 'stick' comprising a beam of laser light. These pointing systems are interesting in the sense that the pointing stick or laser pointer has a direction reference associated therewith. Thus, two lecturers standing in different positions before a blackboard may both point to and therefore address the identical object. This notion of pointing from various perspectives will be carried forward in the following disclosure. It is important to note that some pointing systems have associated therewith a direction reference while others such as the computer mouse do not.

Limitations of Current Pointing Systems

Because we do not live in the two dimensional world of a computer display sometimes referred to as 'cyberspace', but rather, we live in a three (spatial) dimensional world where objects of interest may be located in well defined spaces distributed about the Earth, the present invention concerns a pointer for addressing real objects anywhere rather than objects represented in two space on a computer's display screen such as an icon.

While the systems and inventions of the art are designed to achieve particular goals and objectives, some of those being no less than remarkable, these inventions have limitations which prevent their use in new ways now possible. These inventions of the art are not used and cannot be used to realize the advantages and objectives of the present invention.

One would be wise to review in detail the inventor's previous patents which relate in part to these inventions taught here as a more full understanding can be realized in view of that information. These patents include U.S. Patents: #6,173,239; #6,098,118; #6,064,398; #6,037,936; #6,031,545; #5,991,827; #5,815,411; #5,742,521; #5,682,332; and #5,625,765.

It should be understood that all of the herein referenced materials provide considerable definition of elements of the present invention. Therefore, those materials are incorporated herein by reference whereby the instant specification can rely upon them for enablement of the particular teachings of each.

SUMMARY OF THESE INVENTIONS

Comes now, Thomas Ellenby, Peter Ellenby, John Ellenby, Jeffrey Alan Jay, and Joseph Page with inventions of pointing systems including devices and methods of addressing objects. It is a primary function of these systems to provide users means of indicating to a computer an object of interest and to further process information relating to addressed objects.

Inventions presented in this disclosure are best characterized as pointing systems which operate in three orthonormal spatial dimensions. These pointing systems may be used to address objects and trigger computer responses relating to or depending upon the objects being addressed. Devices of these inventions may be envisaged as a mouse for the 'real-world'.

A device which is freely movable, a mobile unit, may be manipulated in a fashion to cause it to point towards or address an object of interest. A determination of position and orientation, among other parameters of the mobile unit uniquely defines an instantaneous address state of the device. In view of this instantaneous address state, described by an address indicator, a search of a database is performed to determine which objects are being addressed. Data relating to an object is stored in a database along with a geometric construct which describes a spatial body associated with the object, herein called a 'geometric descriptor'. When a geometric intersection occurs between an address indicator of a mobile unit and the geometric descriptor of an object, the object is said to be addressed by the mobile unit.

Any of an array of events which occur simultaneously while an object is being addressed can be used to cause a computer to take an action where the action relates to the particular objects being addressed. In this way, an extremely useful pointing system is created and may be used in a great plurality of ways.

By way of example, one superior version may be summarized as follows. A mobile telephone equipped with a Global Positioning System and an electronic compass is arranged to pass position and attitude measurement information to a computer. A computer, prepared with pre-programmed operating instruction and data relating to objects including geometric descriptors which define spatial bodies associated with various objects, is set to be responsive to particular address states as determined by the mobile telephone.

The pointing state of the telephone described by an address indicator may become known to the computer periodically upon certain stimuli, for example, expiration of a pre-set time period kept by a timer. In response to receipt of address indicator information, the computer performs a database search to determine which objects have geometric descriptors intersected by the address indicator. A result set is prepared in accordance with a program running on the computer in view of certain filters which may be applied to the recalled object data. The result set may be used as a computer takes an action, which relates to the results and thus the address state of the mobile unit, in agreement with particular programming running thereon.

In the case where a mobile telephone described above is precisely located at -117.201479 longitude, 32.725065 latitude, and is pointing level on the horizon in a direction described as 80 degrees on the compass, the object known as the Sheraton Grand Hotel of Harbor Island in San Diego, California is being addressed. This is so because the address indicator described intersects a geometric description of the space occupied by the hotel building and such was determined in a test for intersection between the address indicator and a group of stored data elements relating to certain objects including the Sheraton Grand. In agreement with a computer program running on the mobile unit (telephone) computing facility, a user presses a special function key to cause the computer to report the telephone number of the Sheraton Grand to the user via a display screen and further to place a call to the hotel. Additional information relating to the hotel may also be available and passed to the mobile telephone user. Information such as vacancy, pricing, preferred room availability, et cetera. One will immediately recognize the utility of such systems because information which sensitive to frequent change is quickly available to users who may be on the move.

A computer action may also include those which do not occur at the telephone but rather at the hotel. For example, a user may cause a dinner reservation to be transmitted to the hotel in response to pointing to the hotel and pressing a certain reservation function key.

A better understanding can be had with reference to detailed description of preferred embodiments and with reference to appended drawings. Embodiments presented are particular ways to realize these inventions and are not inclusive of all ways possible. Therefore, there may exist embodiments that do not deviate from the spirit and scope of this disclosure as set forth by the claims, but do not appear here as specific examples. It will be appreciated that a great plurality of alternative versions are possible.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims and drawings where:

Figure 1 is a block diagram of a system overview;

Figure 2 is also a block diagram which details one element of the overall system;

Figure 3 is a similar block diagram directed to an alternative version of a system where one subsystem is associated with a different element;

Figure 4 is yet another alternative where a subsystem is distributed among two primary system elements;

Figure 5 diagrams a global positioning system in relation to the Earth;

Figure 6 presents a simple representation of the Earth's magnetic field model;

Figure 7 sets forth a coordinate definition for directional references used herein;

Figure 8 is a block diagram directed to components of a direction sensing system;

Figure 9 illustrates a mobile telephone in combination with a compass element;

Figure 10 similarly shows a telephone in use with a compass;

Figure 11 - 13 show similar illustrations of a mobile telephone used in combination with a dipole compass;

Figure 14 graphically describes a server having a database and special data structure;

Figures 15 - 23 are each block diagrams directed to method steps, in particular,

Figure 15 describes the four primary steps of any method of these inventions;

Figure 16 illustrates a 'determine address state' step;

Figure 17 further details the substep 'collect parameters';

Figure 18 illustrates a 'prepare request' step;

Figure 19 further details the substep 'build request';

Figure 20 illustrates a 'transmit request' step;

Figure 21 illustrates a 'process request' step;

Figure 22 further details the substep 'database search';

Figure 23 further details the substep 'take action';

Figure 24 is an illustration of an important object used in examples of this disclosure;

Figure 25 is a similar illustration with a graphical element relating thereto also included;

Figure 26 shows a high contrast version and is presented for extra clarity;

Figure 27 shows a similar version with added detail;

Figure 28 is a halftoned photographic image illustrating a person using a device of the invention;

Figure 29 is a similar image with exaggerated contrast for more perfect clarity;

Figure 30 shows another user in relation to objects being addressed;

Figure 31 is a photo illustration of the same user addressing other objects;

Figure 32 illustrates a plurality of users in a special relationship with a single addressed object;

Figure 33 depicts certain geometry of critical importance;

Figure 34 shows a more detailed geometry of similar importance;

Figures 35 - 44 also show geometries of important elements of these inventions;

Figure 45 shows a mobile unit addressing a restaurant type object;

Figures 46 - 48 illustrate multi-media data being played at a user interface;

Figure 50 shows a user engaging a restaurant via a mobile unit of these inventions;

Figure 51 is a line drawing to show the graphical user interface and element thereon;

Figure 52 illustrates a particular use of the device to manage a switching means;

Figure 53 further demonstrates switching between toolbar icons;

Figures 54 - 61 are line drawings directed to still further techniques of moving a cursor about a graphical display.

GLOSSARY OF SPECIAL TERMS

Throughout this disclosure, reference is made to some terms which may or may not be exactly defined in popular dictionaries as they are defined here. To provide a more precise disclosure, the following terms and their definitions are presented with a view to clarity so that the true breadth and scope may be more readily appreciated. Although every attempt is made to be precise and thorough, it is a necessary condition that not all meanings associated with each term can be completely set forth. Accordingly, each term is intended to also include its common meaning which may be derived from general usage within the pertinent arts or by dictionary meaning. Where the presented definition is in conflict with a dictionary or arts definition, one must use the context of use and liberal discretion to arrive at an intended meaning. One will be well advised to error on the side of attaching broader meanings to terms used in order to fully appreciate the depth of the teaching and to understand all the intended variations.

Application Server

An application server may be a general purpose computer operable for execution of computer code.

Address

'Address' is sometimes herein used as a verb meaning to point towards something or some object.

Address State

'Address state' is a term used to describe a collection of parameters relating to the physical nature of a device.

Address Indicator

An 'address indicator' is a geometric construct used to describe the address state of devices of these inventions.

Attitude

Attitude and orientation may be used as synonyms herein this document. Attitude is a specification of direction in an arbitrary coordinate system. It generally relates to a linear reference which may be incorporated as part of a physical device.

By example, one possible coordinate system includes that where attitude is given as a combination of two angular measures which may be represented by θ and φ. θ representing the directions of a compass, i.e. those in the horizontal plane 0° to 360° where North is 0°, and φ representing an angle measured from a horizontal plane from -90° to +90° to uniquely define any direction which may exist in three space.

Database

For purposes of this disclosure, 'database' means data storage facility without limit to conventional database systems which include considerable amount of data management computer code. Accordingly, a simple common delimited text file may be a data store in some special versions of these inventions.

Geometric Descriptor

A geometric descriptor is a construct having an association with a particular object used to define a region of space which may be similar to the region of space occupied by the associated object. Space described by a geometric descriptor may change as a function of time.

Mobile Unit

Use of the term 'mobile unit' is not meant to limit the scope of these inventions. For example, a unit may be considered mobile if it is operable in changing *either* its position reference *or* its direction reference. Thus devices having a fixed position but variable direction reference are intended as mobile devices. Also, devices having fixed direction reference but a variable position reference is included as a device of these inventions. Although preferred versions have mobile units which are highly mobile, i.e. telephone handsets, 'mobile unit' is not to be applied to constrain less mobile devices from being included in the definition of these inventions. A unit is a 'mobile unit' when its position or direction references.

Object

An 'object' may be a real or virtual entity having some spatial extent associated therewith.

Request

A request is formed in and transmitted from a mobile unit to a server as a request for information and processing services.

Server Computer

A server computer includes a computer which operates to receive requests from and provide services to client computing devices such as mobile units which may be remote from but in communication with such server computer.

Special Function Facility

A special function facility is a module which is arranged to perform application specific function. A special function facility may be physically located in a mobile unit, in a server computer or in a network but is in communication with either a server computer or a mobile unit whereby it may receive instructions or cues therefrom and perform a special function in response thereto.

Wireless Network

The term 'wireless network' is used throughout to promote a better understanding of preferred versions. However, use of 'wireless network' is not meant to exclude a case which is counter intuitive in view of the word 'network'. Although a network is generally comprised of many nodes, the special case where there is but one node is not meant to be excluded. It is entirely possible to configure devices of these inventions, all elements being identical, where the 'wireless network' has but a single node. That is, mobile devices are in communication with a server via a wireless link but there exists only one transmission point in which all mobile units are coupled via the wireless communication link. Therefore, these inventions is meant to include the special case where the wireless network includes only one node. It is interesting to note that these inventions may be complete in a system consisting of exactly one mobile device and a wireless network having one node; although it remains clear that ideal systems will have many thousands of mobile units in a complex wireless network having many thousands of nodes.

Wireless Application Protocol - WAP

Wireless Application Protocol is the name presently used in referring to the standard for wireless communication. By committee, a protocol was designed and agreed upon in order that developers of computer applications and network administers provide products which cooperate together. The protocol, like most others, continues development and is accompanied by changes from time-to-time. Accordingly, it will be recognized that references to WAP herein this document will be broadly interpreted as the standard which prevails at the time of question rather than at the time of this writing.
Thus a reference to 'WAP' includes those versions of wireless application protocols which are sure to come regardless whether they are called 'WAP' or not. What is meant by WAP is the most current and prevailing version of a wireless application protocol.

In addition, terms which are functional in nature like those above may be used throughout this disclosure including the claims. For example, 'means for' or 'step for' followed by a phrase describing a function. One should remain aware that any particular means which may be later provided as an example is not meant to limit the 'means for' to that example but rather the example is provided to further illustrate certain preferred possibilities. Thus the 'means for' or 'step for' should not be limited to any particular structure which may be called out but rather to any conceivable means of causing the function described to be effected. The reader will recognize it is the function to be carried out which is the essence of these inventions and many alternative means for causing the function to occur may exist without detracting from any combination or combinations taught as part of these inventions.

PREFERRED EMBODIMENTS OF THESE INVENTIONS

In accordance with each of the preferred embodiments of these inventions, there is provided apparatus for and methods of addressing objects. It will be appreciated that each of the embodiments described may include both apparatus and methods and that an apparatus or method of one preferred embodiment may be different than an apparatus or method of another embodiment.

A complete outline of the preferred embodiments portion of the disclosure is included as follows to help navigate the document and provide a most complete understanding.

BRIEF SYSTEM OVERVIEW

It is useful to consider a system overview prior to a presentation of more specific details regarding elements from which a system is comprised. With reference to drawing Figure 1, a mobile unit 1 which may be in the form of a handheld computing appliance such as a mobile telephone 2, is in wireless communication 3 with a network of receiving station(s) 4 to which are connected computers 5 arranged to direct data traffic via a gateway 6. A 'request' initiated in the mobile telephone depends on the physical nature (address state) of the telephone. The request 7 is passed to an application server 8 arranged to receive such requests which may contain parameters and values as inputs to general and application specific computer programming. A content assembler 10 receives data 11 from a database 12 of information relating to objects which might be addressed by mobile units from time to time. Assembled content 13 is then passed back to the gateway where encoders 14 may be used to prepare data for wireless transmission as encoded content 15 back to the mobile unit.

Figure 2 illustrates some important details regarding the elements of a mobile unit 21 in preferred versions. Embodied as a handheld wireless telephone 22, mobile units of preferred versions of these inventions have seven critical elements. A computer processing facility 23, a point reference 24 in communication 25 with a position determining means 26, and a direction reference 27 in communication 28 with an attitude determining means 29.

Although point and direction references are merely geometric constructs and do not correspond to physical elements, they are important structure essential to systems of the invention and cannot be discounted as unimportant elements due to their lack of physical being. That these elements are abstract in nature shall not detract from their important role as structureal components of a mobile unit.

It is important for readers to remain aware that a great many alternatives are possible when assembling systems over largely distributed subsystems. Although best modes are described herein, it should be stated explicitly from the outset that alternatives will not deviate from the spirit of the invention. For example, it is not essential that the position determining means be *phyiscally contained* within a mobile unit. Indeed, since a GPS actually includes a plurality of satellites in orbit, it is clear that a position determining devices of perferred versions *cannot* be contained within the physical case of any handheld devices. Thus although a simple diagram used herein may seem to imply that a position determining means is physically contained within the mobile unit, this is generally not the case. A few examples herefollowing will cleary advance this point.

Figure 3 suggests that hardware of a position determining means may physically be incorporated within a wireless network apparatus. A mobile telephone 31 sends radio signals 32 to receiving stations 33 having special devices 34 to measure the time of arrival of such radio signals. Timing of received signals contains implied information about the location of the transmitting devices. Thus, position determining hardware 34 may be said to be in mathematical communication 35 with a point reference 36, the point reference being within the mobile device, the position determining hardware being in a wireless network. From this presentation, one will be reminded throughout the remainder of this disclosure that the phyical location of specified elements is not to be implied with strict limitations.

To emphasize the point, an example may be drawn to the case where another component is distributed rather than physically confined to the mobile unit. Figure 4 suggests that alternative relationships may occur in other versions with regard to attitude determining means. Where a system is configured with a radio direction finding technique of attitude determination, parts of the attitude determining means lie in the mobile unit 41 while other elements lie in the wireless network. Thus it can be said that the attitude determining means 43 is physically located in both places. This presentation is intended to alert one to the fact that a great deal of possibilities exist when considering the physical location of elements. Thus, the reader will be well positioned to resist temptation of attaching limitation relating to an element's physical location when considering the whole of these inventions. With this primer in mind, the following details will be well received.

PREFERRED EMBODIMENTS IN DETAIL

A complete outline of the preferred embodiments portion of the disclosure is included as follows to help navigate the document and provide a most complete understanding.

A) APPARATUS

I. SYSTEM HARDWARE - PRIMARY ELEMENTS

1. **Mobile Unit**
2. **A Wireless Network**
3. **The Internet**
4. **The Wireless Application Protocol WAP Gateway**
5. **Server Computer**
6. **Preprogrammed Database**

II. SYSTEM HARDWARE - OTHER ELEMENTS

1. **MOBILE UNIT**
   - A. Point reference
   - B. Direction reference
   - C. Position Determining Means
     - i) Global Positioning System GPS
     - ii) e-911
   - D. Attitude Determining Means
     - i) Solid State Magnetoresistive Sensors
     - ii) Simple Magnetic Dipole Compass
   - E. Computer Processing Facility
     - i) Input / Output for sensors
     - ii) A Wireless Application Protocol browser
     - iii) Code in Read Only Memory
   - F. Local Database
   - G. User Interfaces
     - i) Inputs
       - a) tactile switches
       - b) wheels/trackballs
       - c) touch pad
       - d) DeltaTheta detection
       - e) Voice recognition
       - f) other sensors
     - ii) Outputs
       - a) audio
       - b) visual

2. **WIRELESS NETWORK**
   - A. Components of a Wireless Network
   - B. Special Function Facility
     - i) Remote Machine Operation
     - ii) Point-to-call Facility

3. **SERVER COMPUTER**
   - A. Special Function Facility

4. **DATABASE**
   - A. Geometric Descriptors
   - B. Multi-Media Data
   - C. Hierarchical Datasets

B) METHODS

I. OPERATIONAL MODES

II. SYSTEM METHODS - PRIMARY STEPS

1. **Determining Address State**
2. **Preparing a Request**
3. **Transmitting the Request**
4. **Processing Request**

III. SYSTEM METHODS - FURTHER DETAILS INCLUDED IN SOME VERSIONS

1 User action to cause address of an object
2 User action to cause a trigger event
3 Determine an Address State of a Mobile Unit
  A. Application specific address indicator template
    i) initialize with defaults
    ii) user set-up
  B. Take Action
    i) Action at Server
    ii) Action at Wireless network
    iii) Action at Mobile Unit
    iv) Action at Addressed Object
    v) Action at another place

C) SPECIAL TOPICS

1 Geometric Descriptors
2 Address Indicators
3 Multi-media Type Data
4 Objects
5 Database Filtering

D) ILLUSTRATIVE EXAMPLES

1 Cursor Driver
2 Point to Call
3 Friends and Family
4 Shopping
5 Challenge Games
6 Surveying

A) APPARATUS

I. SYSTEM HARDWARE - PRIMARY ELEMENTS

1. Mobile Unit

In accordance with preferred embodiments, a 'mobile unit' is a portable computing appliance. Some industry experts refer to portable computing devices as wireless communications devices, wireless devices, hand-held mobile computers, et cetera. The term 'wireless' refers to the device's ability to communicate with other computers connected to a network of fixed or orbiting transceiving stations via electromagnetic communication. Devices such as a 'personal digital assistant' PDA, a mobile telephone, a personal navigation aid, are examples of mobile units into which devices of these inventions may be integrated. As functionality of some of these devices begins to overlap the functionality of the others, it becomes difficult to drawn distinction between them. For example, personal mobile telephones are commonly enabled with a programmable telephone directory. Personal digital assistants also incorporate identical function of storing telephone numbers. Since the concepts taught herein can be incorporated into a plurality of types of devices, no attempt is made to describe further the class of product in which these concepts are best placed. Accordingly, the term 'mobile unit' is used to indicate any portable computing platform and the reader will appreciate that restriction to one type or another should not be made. Further, examples presented herein may be drawn to one or another type of mobile unit without the implication that restriction to that type is intended.

Mobile units of these inventions have the following essential elements. Mobile units have a point reference and have a direction reference. Although these elements are sometimes merely geometric constructs without association to physical objects, they serve as important structural elements to which other system elements have a strong and concrete relationship. In best versions, a point reference lies roughly in the geometric center of a physical case or enclosure from which a mobile unit is comprised. Similarly, a direction reference may be arranged to correspond to a longitudinal axis of the body of a mobile unit case. As mobile unit enclosure can be formed of a hard plastic or similar material suitable for containing electronic components therein, sometimes the point and direction references are arranged with relationships to the mobile unit enclosure. In some preferred versions, an enclosure is an elongated member having a longitudinal axis suggesting the enclosure has a natural "pointing" direction. For example, a telephone handset typically has a length which is significantly longer than its width and thickness. Accordingly, a longitudinal axis is said to run along telephone handset length at the geometric center of the phone cross section. When naturally held in a single hand, the telephone handset serves as a good pointing device. Sometimes a mobile telephone handset includes a protruding antenna. The antenna further suggests a pointing direction as it is typically an elongated member which also runs along the direction of a longitudinal axis, albeit sometimes with a slight offset to the edge of the enclosure.

Mobile units of these inventions also may have computing or computer processing facility. The computer processing facility is arranged to receive input signals from specially arranged devices in communication with the computer processing facility. In particular, these input signals include those which yield information relating to the position of the point reference and the pointing attitude of the direction reference of the mobile unit. Thus it is said that the computer processor facility is in communication with or coupled to position determining means and attitude determining means. These position and attitude determining means are described in more detail below. It is important to note that in addition to position and attitude determining means, other systems which measure the physical state of the mobile unit may also be coupled to a computing facility.

Finally, mobile units of these inventions have at least one user interface. An output type user interface enables the computing facility to present information to a user. An input type allows a user to interrupt code and send signals to processor.

Mobile units of these inventions may be in communication with one or more databases of stored information. 'Communication' may be described as a chain of links including communication via a wireless network, through the Internet, to a server computer, and finally to a database; a return path being similar but in an reverse order. Thus a mobile unit can be best visualized as being coupled to the communication chain via a wireless network such as those presently used for mobile telecommunications. Accordingly, best versions of mobile units of these inventions include the same transceivers used in modern mobile telephones; for example, those developed by Qualcomm Corporation as CDMA technologies.

2. A Wireless Network

Wireless networks have been established worldwide with great success and have enabled amazing new technologies. In brief, a wireless network includes electronic means for communication with mobile devices which operate within a network's coverage. A mobile device may exchange information with surrounding fixed sites via electromagnetic communication without hardwire connections to the network. Thus, small computing devices are free to move while remaining connected to powerful information and communication systems.

A wireless network is generally comprised of a plurality of fixed transceiving stations where one station 'hands-off' a signal to an adjacent station as a mobile device moves from one coverage region, sometimes called 'cells', to another. Each of the fixed transceiving stations may be in communication with the others or a central processing whereby messages and handling instructions are passed therebetween. In addition, wireless networks may also be directly in communication with wireline networks; for example telephone wireline networks and the network of computers known as the Internet.

Examples of wireless networks include GSM, Cellular, and PCS type networks. Continuous improvements have resulted in very sophisticated systems which are being installed presently. These include the new ability to handle packet type data traffic to support interaction with other digital systems. Advance networks known as Universal Mobile Telecommunications System or "UMTS" is the European member of the family of third generation 3G mobile standards. The goal of UMTS is to enable networks that offer true global roaming and can support a wide range of voice, data and multimedia services. Proposed data rates offered by UMTS are: fast moving (vehicular) 144 kbit/s; slow moving (pedestrian) 384 kbit/s; fixed (in-building) 2Mb/s. Commercial UMTS networks are expected from May 2001 (Japan).

Wireless networks can be coupled to the Internet to provide mobile devices with an extensive, perhaps unlimited, source of information and computing power. Information stored at a great plurality of web servers, sometimes referred to as 'content' becomes readily accessible to users of mobile devices. In addition, powerful remote computers are accessible by mobile devices which tend to be limited in their computing ability because of size and power limitations. Wireless is therefore the connection which allows small wireless devices to achieve unlimited storage and computing facility.

3. The Internet

The Internet is a network of computers in a continuous conversation unlikely to end soon. Although any single computer may terminate its connection and thus leave the conversation, the others remain in communication without effect from the absence of the exiting party. Similarly, a new computer may join the conversation at any time without causing upset to the communication scheme that connects the others.

The Internet is therefore an efficient means for computers to be connected to other computers and to exchange data and information. Computers of different types running different operating systems may be coupled to the Internet by way of communication rules known as 'Internet Protocol' IP and standards such as HyperText Transfer Protocol, HTTP; HyperText Markup Language, HTML; and eXtensible Markup Language, XML. Thus any computer to make requests of another and to receive a response therefrom.

4. The Wireless Application Protocol WAP Gateway

WAP - Wireless Application Protocol - is the bridge between mobile communication and the Internet. Because mobile devices have attributes with limitations particular to those devices, for example, limited power, limited screen size, limited bandwidth, limited keypad, among others, mobile devices are not well positioned to communicate directly with the Internet standards including the HTML standards. However, the wireless application protocol is a world standard aimed and bridging the gap between mobile devices and today's Internet.

A mobile telephone may be used to make an Internet request for information. A request formulated in the mobile unit, encoded and transmitted via the wireless network. The wireless network is arranged to communicate further with a WAP gateway which processes requests and passes them to an application server which may be positioned as a common Internet server computer.

5. Server Computer

A server computer of the instant inventions may be a computer in communication with the Internet whereby other computers can make requests thereof and receive information therefrom. By way of the route described above, a mobile device passes requests including information parameters to the application server. The request thus carries information relating to a user's needs. In particular, and with great emphasis, it is pointed out that the request carries information about the physical state of the mobile unit, i.e. its address state. Thus position and attitude parameters, among others, may be included as part of an encoded request.

In response to receiving such a request, an application processor can digest the information passed to it from the requesting client (mobile device) and determine an appropriate response. In some preferred applications, an application server searches a database of pre-programmed information to recall information which relates to the position and attitude parameters passed via the request. Therefore some database searches of these inventions are dependent upon the position and attitude information passed from the mobile unit.

6. Preprogrammed Database

Databases of these inventions incorporate important and unique data structures. In particular, data structures which connect geometric descriptor type data elements with data relating to a particular object are anticipated and taught here. Thus in preferred embodiments, a database record comprises at least a geometric descriptor associated with an object and information elements associated with the same object. Thus the database record is the 'glue' which connects information relating to an object to the object's physical being via the geometric descriptor. In this way, geometric descriptors may be used as indexing means by which information relating to objects may be recalled in a database search action.

II. SYSTEM HARDWARE - OTHER ELEMENTS

1. MOBILE UNIT

A. Point Reference

As briefly mentioned previously, a point reference may be a mere geometric construct. However, it is essential structure with regard to apparatus of these inventions and its importance should not be discounted because of an apparent lack of size or concreteness. One will appreciate that the nature of a point reference allows it to be assigned a location which may or may not correspond to a physical element. Thus, a point reference may be for example assigned a location described as two meters to the left of a certain object where that location is merely a location in space occupied by nothing.

In systems of these inventions, position measurements are made. These measurements are made with respect to the point reference and some arbitrary frame of reference. For example, a frame of reference coordinate system may be adopted whereby location or position is described by a latitude, longitude and altitude values. Preferred versions of these inventions include a point reference which is coupled to a position determining means whereby the position determining means operates to measure the position of the point reference in a particular frame of reference.

B. Direction Reference

Similarly, a direction reference may also be merely a geometric construct. In agreement with the common definition of a 'vector', a direction reference has an endpoint and infinite extent along a line in one direction away from the endpoint. A direction reference is essential structure with regard to apparatus of these inventions and its importance should not be diminished because of its apparent lack of size or concreteness. A direction reference may be assigned such that it may or may not correspond to a physical element such as an elongated pointer.

In systems of these inventions, attitude measurements are made. These measurements are made with respect to the direction reference and some arbitrary frame of reference. For example, a frame of reference coordinate system may be adopted whereby tilt, roll and pitch values may be measured and specified. Preferred versions of these inventions include a direction reference coupled to an attitude determining means whereby the attitude determining means operates to measure orientation of the direction reference.

In some versions, a spatial relationship exists between the point reference and the direction reference. A point reference may be arranged to be coincident with an origin of a vector which represents the direction reference.

C. Position Determining Means

A position determining means is coupled to and arranged to determine the position of the point reference. Further, the position determining means is coupled in a manner which allows position measurements to be passed into requests conveyed to an application server.

In some preferred versions of these inventions, the position determining means is at least partly integrated within the mobile unit. In alternative versions, a position determining means is arranged to determine the position of the mobile unit (via a point reference) but the hardware from which it is comprised is part of the wireless network or other external apparatus. Accordingly, a position determining means may exist within the mobile unit or within the wireless network without loss of generality. For purposes of this disclosure, the limitation of a 'position determining means' is met when means are arranged to determine the position of a point reference associated with a mobile unit.

i) Global Positioning System GPS

In devices where position determining means is integrated within a mobile unit, a first preferred arrangement has a Global Positioning System GPS receiver contained in the mobile unit case. A GPS receiver is sufficiently small in size whereby it is easily incorporated as a portion of an electronic hand-held device. The accuracy of position measurements made by a GPS receiver is quite good and within the required parameters necessary for devices of these inventions which sometimes rely on accurate position measurements. Similarly, energy consumption is low in GPS receivers which are engineered to be conservative with respect to energy consumption. In agreement, devices of these inventions may use an off-the-shelf GPS receiver available from original equipment manufacturer suppliers such as GARMIN International of Kansas City.

By referring to the drawing figures appended hereto, and in particular Figure 5, one gains a more complete understanding of how a GPS is coupled with systems of these inventions. The global positioning system is a satellite-based navigation system consisting of a network of orbiting satellites 51 that are eleven thousand nautical miles in space and in six different orbital paths. The satellites are constantly moving, making two complete orbits around the Earth in just under 24 hours or about 1.8 miles per second.

GPS satellites are referred to as NAVSTAR satellites. Transmitter power is approximately 50 watts, or less. Each satellite 52 transmits two signals 53, L1 and L2; civilian GPS uses the 'L1' frequency of 1575.42 MHz. Each satellite is expected to last approximately 10 years. Replacements are constantly being built and launched into orbit.

The orbital paths 55 of these satellites take them between roughly 60 degrees North and 60 degrees South latitudes. Accordingly, one 54 can receive satellite signals anywhere in the world, at any time. As one moves close to the poles, the GPS satellite signals remain available. They just won't be directly overhead anymore. One of the biggest benefits over previous land-based navigation systems is GPS works in all weather conditions.

The GPS signal contains a 'pseudo-random code', ephemeris and almanac data. The pseudo-random code identifies which satellite is transmitting—in other words, an I.D. code. We refer to satellites by their PRN (pseudo-random number), from 1 through 32, and this is the number displayed on a GPS receiver to indicate which satellite(s) is(are) being receiving.

Ephemeris data is constantly transmitted by each satellite and contains important information such as status of the satellite (healthy or unhealthy), current date, and time. Without this part of the message, your GPS receiver would have no idea what the current time and date are. This part of the signal is essential to determining a position.

Almanac data tells the GPS receiver where each GPS satellite should be at any time. Each satellite transmits almanac data showing the orbital information for that satellite and for every other satellite in the system.

Each satellite transmits a message which essentially says, "I'm satellite #X, my position is currently Y, and this message was sent at time Z." GPS receivers read the message and saves the ephemeris and almanac data for continual use. This information can also be used to set (or correct) the clock within the GPS receiver.

To determine position, a GPS receiver compares the time a signal was transmitted by a satellite with the time it was received by the GPS receiver. The time difference tells the GPS receiver how far away that particular satellite is. If distance measurements from a few more satellites are added, triangulation techniques yield a position measurement. This is exactly what a GPS receiver does. With a minimum of three or more satellites, a GPS receiver can determine a latitude/longitude position—sometimes called a 2D position fix. With four or more satellites, a GPS receiver can determine a 3D position which includes latitude, longitude, and altitude. By using a series of position measurements, a GPS receiver can also accurately provide speed and direction of travel (referred to as 'ground speed' and 'ground track').

A typical civilian GPS receiver provides 60 to 225 feet accuracy, depending on the number of satellites available and the geometry of those satellites. More sophisticated and expensive GPS receivers, costing several thousand dollars or more, can provide accuracy within a centimeter by using more than one GPS frequency. However, a typical civilian GPS receiver's accuracy can be improved to fifteen feet or better (in some cases under three feet) through a process known as Differential GPS (DGPS). DGPS employs a second receiver to compute corrections to the GPS satellite measurements. The U.S. Coast Guard and U.S. Army Corps of Engineers (and many foreign government departments as well) transmit DGPS corrections through marine beacon stations. These beacons operate in the 283.5 - 325.0 kHz frequency range and are free of charge. DGPS Beacon Receiver may be coupled to a GPS receiver via a three-wire connection, which relays corrections in a standard serial data format called 'RTCM SC-104.'

ii) E-911

An alternative position determining means may be arranged as part of the wireless network. In consideration of the time of arrival of radio signals at multiple receiving stations a position measurement of the transmitting device may be effected. Sometimes referred to as 'e911' positioning, the system is being considered for installation in wireless networks for use in determining locations of callers for example in times of emergencies. In this arrangement, the load on the mobile unit is lighted as power and space requirements are removed from the mobile unit and placed at the wireless network which has much greater tolerance of these parameters.

In systems where the PDM is in the wireless network, an encoded request is received at the wireless stations with attitude information but without position information. The wireless network computers then compute position information and attach that to the encoded request. Finally, that encoded request is transmitted to the WAP gateway where the request has position and attitude information therein. It is important to recognize that although position determining hardware is physically located in the wireless network, that hardware is coupled to a point reference associated with the mobile unit. Accordingly, position measurements are made of the mobile unit regardless of the actual location of the position determining means.

Although best configurations anticipated either have a GPS or E-911 type position determining means, it is recognized that some versions may rely upon other positioning systems. With respect to these present inventions, there is to be no importance place with regard to any particular type of position determining means so long as that means is arranged to determine the position of a point reference associated with the mobile unit. Thus any conceivable manner of determining position of a point reference in a mobile unit is considered part of these inventions.

D. Attitude Determining Means

An attitude determining means is coupled to and arranged to determine the attitude of the mobile unit direction reference. Further, the attitude determining means is coupled in a manner which allows attitude measurements to be passed into requests conveyed to an application server.

In some preferred versions of these inventions, attitude determining means are integrated within the mobile unit. In alternative versions, it is arranged to determine the attitude of the mobile unit but the hardware from which it is comprised is part of a wireless network or other external apparatus.

For purposes of this disclosure, the limitation of 'attitude determining means' is met when means are arranged to determine the attitude or 'pointing direction' of a direction reference associated with a mobile unit.

i) Solid State Magnetoresistive Sensors

Preferred versions of attitude determining means include solid state devices arranged to sense magnetic fields natural about the Earth's dipole. A determination of the strength of magnetic fields in three orthogonal directions allows one to compute a pointing attitude. Mobile units of these inventions can be integrated with such solid state devices and supporting hardware whereby pointing actions can be monitored and measured. These solid state sensor packages are available as off the shelf items ready for integration. For example Honeywell three-axis magnetic compassing sensor attitude reference HMC2003 based on magnetoresistive principles.

At the earth's surface, the Earth's magnetic field intensity is about 0.5 to 0.6 gauss and has a component parallel to the Earth's surface that always points toward magnetic north. This is the basis for all magnetic compasses. Anisotropic Magnetoresistance AMR sensors are best suited for electronic compasses since their range of sensitivity is centered within the Earth's field. The Earth's magnetic field can be approximated with the dipole model shown in Figure 6. This figure illustrates that the Earth's 61 magnetic fields 62 point down toward North in the northern hemisphere, is horizontal and pointing north at the equator, and points up toward north in the southern hemisphere. In all cases, the direction of the Earth's field is always pointing to magnetic north. It is the components of this field that are parallel to the Earth's surface that are used to determine compass direction. The vertical portion of the Earth's magnetic field is ignored. To achieve a one degree accurate compass requires a magnetic sensor that can reliably resolve angular changes to 0.1 degrees. The magnetic fields in an X and Y plane will typically be in the 200 to 300 milligauss range—more at the equator, less at the poles. Using the relationship:

Azimuth = arcTan (y/x)

the required magnetometer resolution can be estimated. To resolve a 0.18 change in a 200 milligauss field would require a magnetic sensitivity of better than 0.35 milligauss. Solid state magnetoresistive sensors are available today that reliably resolve 0.07 milligauss signals giving a five times margin of detection sensitivity. Often compasses are not confined to a flat and level plane. As devices of the present invention are preferably hand held, it is difficult to determine an azimuth associated with the reference or heading direction since the compass is not always horizontal to the Earth's surface. Errors introduced by tilt angles can be quite large and depends on the tilt angle. A typical method for correcting the compass tilt is to use an inclinometer, or tilt sensor, to determine roll and pitch angles illustrated in Figure 7. The terms 'roll' 71 and 'pitch' 72 are commonly used in aviation: roll refers to the rotation around a forward direction indicated in the drawing as 'X', and pitch refers to the rotation around a left-right, direction indicated as 'Y' in the figure. Liquid filled tilt sensors use electrodes to monitor fluid movement as the sensor changes angles. Newer solid state accelerometer tilt sensors are available that measure the Earth's gravitational field by means of an electromechanical circuit. The outputs of these devices are electrical signals equivalent to angles of tilt.

To compensate a compass for tilt, knowing the roll and pitch is only half the battle. The magnetometer must now rely on all three magnetic axes (X, Y, Z) so that the Earth's field can be fully rotated back to a horizontal orientation. In Figure 7, a compass is shown with roll 71 and pitch 72 tilt angles referenced to the right and forward level directions of the mobile device. The X, Y, and Z magnetic readings can be transformed back to the horizontal plane (X_H, Y_H) by applying the rotational equations shown below:

$$X_h = X\cos\phi + Y\sin\phi - Z\cos\theta\sin\phi$$

$$Y_H = Y\cos\theta + Z\sin\theta$$

$$Azimuth = \arctan(\tfrac{Y_H}{X_H})$$

Once the X and Y magnetic readings are in the horizontal plane, the equation for azimuth in a horizontal plane can be used to determine the azimuth with a tilt bias.

A block diagram for a tilt compensated compass is shown in Figure 8. After the azimuth is determined, the declination correction can be applied to find true north according to the geographic region of operation. Solid state magnetic sensors 81, cooperate with tilt sensors 82, to arrive at signals which are processed digitally 83 in a computing apparatus. The entire device has been made quite small and versions are easily integrate with common wristwatchs.

ii) Simple Magnetic Dipole Compass

Systems which include solid state sensors described above are certainly preferred because of their accuracy and versatility. However, simpler versions of these inventions also yield considerable benefit. Because modern telephones do not yet come equipped with attitude sensing apparatus, and integration of those types of semiconductors with small telephones presents a significant engineering challenge, alternative versions are presented here where a simple dipole compass is used with user input operations to provide information regarding the address state of a device. As such, a dipole compass in combination with user inputs is considered 'attitude determining means' for these simplified versions.

Figure 9 shows a hand-held mobile type telephone 91 with keypad and flip type mouth piece. Upon turning 92 the phone over to expose the backside 93 one can appreciate that there is considerable space for incorporating mechanical elements such as a compass 94. A simple dipole compass may consist of a pointer needle having a magnetic bias which is set to float in a liquid where it may freely turn about an axis. When exposed to the Earth's magnetic fields, the dipole aligns itself such that it points to magnetic north. Although a simple dipole compass is very ineffective when a telephone is held upright as shown, the compass becomes operable when the phone is held substantially level in a horizontal plane.

Figure 10 presents a mobile telephone 101 lying in a near horizontal plane having a simple dipole compass 102 on its backside. A pointing needle 103 is aligned with the Earth's magnetic fields. Used in proper fashion, the telephone, and consequently the compass, is rotated about a vertical axis 104 to cause the floating needle to become further aligned with indicia 105 on the compass bezel 106 which indicates North. In this way, a user can determine the pointing attitude of the telephone and reference direction 107 with respect to Earth's magnetic North.

With reference to Figure 11, a mobile telephone 111 is presented substantially in a horizontal plane with reference direction 112. The telephone bottom portion is configured with special mechanical interlock devices 113 whereby an add-in 115 unit may be firmly coupled to the telephone at the bottom by inserting 114. The add-in unit is accompanied by a simple compass 116 having pointing needle 117.

Although general purpose compasses used in conjunction with maps and charts are quite conveniently arranged with a reference to the direction North, it is not necessary in systems which relate to these inventions that emphasis be placed on North as a reference direction. It is also not necessary that a needle type dipole be used. Instead, it serves as a great simplification if the dipole is configured as a disk rather than a needle and is made to freely rotate in fluid and become aligned with the Earth's magnetic field. As the phone is pointed in various directions, the disk aligns itself appropriately to reveal directional information. Indicia on the disk directly references the direction in which the mobile unit is pointing.

Thus, in improved versions, a floating disk which may be integrated into an add-in module 121 allows the telephone 122 and consequently the reference direction to be pointed in a direction of interest while a disk 123 rotates about a vertical axis 124 to align indicia 125 with a reference mark 126. A careful observer will note that indicia shown appears in a viewing window having magnifying properties thus improving readability of very small compass devices. Upon determining the direction of interest via visual observation of the compass, a user can enter that information by way of tactile manipulation of a keypad or other user input interface. As illustrated, simple dipole compass as described can be affixed to the back of a telephone by a user as an 'after market' addition. A common telephone purchased at the time of this writing is easily modified with the addition of a compass so attached to its backside.

Because a compass arranged as taught here is quite slim and mechanically simple, it is easy to integrate directly with the case of a mobile telephone unit. In some circumstances, it can be integrated with an accessory such as a battery housing. Figure 13 shows a streamlined mobile unit 131 having a reference direction 132 and dipole disk compass integrated therein the back side of the unit housing. Indicia 133 is visible through a window 134 with a lens.

Special Indicia for Mobile Wireless Systems

As mentioned, mobile electronic devices tend to have limited facilities. Power, weight, screen size, et cetera are all limited by the portable nature of the devices. In addition, the key pad generally used with mobile telephones is limited in the number of keys available for user input. Further, because encoding protocol used in wireless devices is aimed at cooperating with such brief keypads, user input is limited in that regard also. Therefore, a special scheme is devised whereby the directions about a compass, are translated to cooperate with a 10-key keypad of a mobile unit as follows.

Recall that the 10-key keypad having numerals 0 - 9 is arranged in three rows and three columns with a '0' key centered thereunder. It is a useful mnemonic to envisage the 10-key keypad superimposed upon a simple compass rose including the eight primary points of the compass directions: North, South, East, West, Northeast, Southeast, Northwest, Southwest. In this proposed scheme, North is meant to correspond to the '2' key of the keypad which lies in the upper middle of the keypad in a standard arrangement. South is aligned with the '8' key, '6' being East, and '4', West. It then follows that the '7' key is Southwest, and the other keys assignments logically follow. Curiously, this scheme which assigns a key to each of the eight points of a compass, leaves the '5' key and the '0' unused.

With the otherwise unused keys '5' and '0', the scheme is further arranged to provide a prefix to the points described about. Using the '0' key as a prefix to any of the other keys indicates the direction assigned to the key minus 25 degrees. For example: The '7' key is assigned to Southwest, which is 225 degrees. If a '0' prefix is used before a '7' key, then the direction being refereed to is 200 degrees. Similarly, the '5' key is used as a prefix to indicate the value of the assigned key plus 25 degrees. Therefore, composing a '5' and a '7' causes the direction input to be 250 degrees. With this special coding scheme, one simplifies the process of alerting the system as to a particular direction of interest. This can be more readily appreciated in view of the drawing figure ~N which shows a single number in a windows. By pointing the phone to an interesting object, reading the number from the back of the phone, entering the number read via the keypad, the system has identified the direction of interest and can form a request accordingly. Since the number in the figure shown in the window is '57'; a user is prompted to press index key '5' followed by direction key '7' to indicate 250 degrees as the direction of interest. Thus, this process relieves even most basic of users the complexity of using a compass and translating directions.

E. Computer Processing Facility

A computer processor arranged to run programming in the form of instruction sets is provided within mobile units. The computer processing facility includes typical supporting elements such as: memory, bus, display, input/output, power supply support et cetera. A general processing facility may be preprogrammed via stored code in a ROM type memory, or may be a generalized processor arranged to execute stored code as well as code received from external devices.

i) Input / Output for sensors

To support input and output operations, a computer processing facility may be configured with special means of communication between devices such as sensors and other measurment apparatus. Similarly, programming running on the computer processing facility may include support for interupts and messaging technique which interacts with or responds to signals present at input and output ports.

ii) A Wireless Application Protocol browser

Development of 'Wireless Application Protocol', or 'WAP', is being driven by the WAP Forum, initially founded by Motorola, Nokia, Ericsson and Unwired Planet now more precisely known as 'Openwave'. Since its inception, the WAP Forum has grown dramatically and now comprises over 80 members drawn from the world's leading mobile telecommunications and software companies.

WAP is a technology designed to provide users of mobile terminals with rapid and efficient access to the Internet. WAP is a protocol optimized, not only for use on the narrow band radio channels used by second generation digital wireless systems but also for the limited display capabilities and functionality of the display systems used by today's mobile terminals. WAP integrates telephony services with microbrowsing and enables easy-to-use interactive Internet access from the mobile handset. Typical WAP applications include over-the-air e-commerce transactions, online banking, information provisioning and messaging. WAP will enable operators to develop innovative services to provide differentiation in competitive market environments.

Devices of these inventions therefore may include a module known as a WAP browser. This browser is implemented in software and allows devices to communicate with the WAP gateway by way of wireless networks.

iii) Preprogrammed Code in ROM/RAM

Although one may envisage a 'device' as consisting of hareware elements only, it may be instructive to include software as part of the device. Software or computer instruction code may be stored in a memory such as a RAM module which is part of the computer processing facility. Alternatively, a memory device such as a CD-ROM may be employed to run programming particular to a certain application. That an infinite number of applications are possible should not disturb the notion that a pointing device responsive to position and attitude measure is a unique invention in and of itself without regard to any particular application associated with that functionality.

F. Local Database

Although most preferred versions of the inventions described include communication with a remote server having a database, it should be noted that some versions will employ a local database as well.

A local database can be envisioned as a database separate from a system main database. In some versions of these inventions, a specialized request is sent to a server computer who returns as a response a small portion of a primary database. In effect, this database may be a subset of the data stored in the primary database but may be useful in the mobile unit as a temporary database of limited extend for quick searching and other operations which do not generate a new call/request through a network.

An illustrative example works as follows: On initiation, a system make be arranged to take a preliminary position measument. This measurement may result in the determination that the user is in a particular city; for example San Francisco. Upon this conclusion, a remote server may send a data set of anticipated targets, i.e. those targets in San Francisco, to a database cache. When a more precise position measurement and an attitude measurement are combined to suggest an address indicator the cache may be searched first as it has been preloaded with a primary data set. In this scheme, it is not necessary to transmit a request and response through a network, but rather the entire process would be handled within the mobile unit and with regard to a limited database held there.

A local database may also be set-up as an empty template which operates to *receive* data therein in response to actions applied to the mobile unit. For example, a mobile unit may be set into a program mode to collect data in accordance with a particular scheme. In one scenario, a salesman of lawn fertilizer may be interested in generating a mailing list of customers who are particularly in need of lawn fertilizer products. While driving down a residential street, the salesman may use a mobile device of these inventions to address houses with poor quality or unhealthy lawns. Upon being addressed, mailing information associated with a particular house may be pulled from the primary database containing all houses and entered into a local database of houses to be sent an advertisement relating to lawn fertilizer. Of course, many other scenarios may be set forth where actions applied to a mobile unit stimulate construction of a local database. It is impossible to present an exhaustive list of these and no attempt at such is made here. However, it will be noted that in any such operation, it is to be considered a version of these inventions so long as actions applied to a mobile unit as described cause a database to become populated with data.

G. User Interfaces

User interfaces may be included as elements in a mobile unit. Interfaces of these inventions may be classified as either an input type interface or an output type interface. Input type interfaces are arranged to convert physical conditions external to the system into electronic signals which may be processed by the systems. Output interfaces convert system electronic signals into physical embodiments perceptible to observers users of the systems. Electronic transducers and transducer systems are coupled to mobile unit computing processing facilities by input or output communications ports and operate as either input or output type interfaces.

i) Input Interfaces

Some examples of input type user interfaces include, but are not limited to, tactile switches, wheels, trackballs, keypads, touch pads, angular displacement detectors, voice recognition systems. Although the following presentation illustrates some of the anticipated uses of input interfaces, it is impossible to catalogue all possible uses in the limited space of this disclosure in view of improving readability and understanding. Accordingly, it will be appreciated that systems which employ input interfaces not described here explicitly will remain systems of these inventions as long as they incorporate all other elements and a element meeting the general description an 'input interface'.

a) Tactile Switch

Perhaps the most important input interface is a simple tactile switch. To perform and realize a 'click' event, a simple switch operable under influence of finger actions is arranged. Analogous to the buttons of a mouse type peripheral computer device, a tactile switch may be arranged as a button which may be easily engaged by a human finger.

A tactile switch yields exceptional utility because it may be associated with any of a great plurality of computer actions which may be offered at appropriate times during the runtime of a computer program. Code may be prepared such that the computer is set to respond in a particular way whenever a click event, i.e. an operation of the tactile switch, is detected. Accordingly, best versions of systems of these inventions include an apparatus having a tactile switch arranged to generate click events which are detected by computer processing facilities.

A illustrative example include the 'send' key of a mobile telephone. Upon stimulation of the send key, a mobile telephone is set into an operation wherein a connection to another telephone is created. On systems of these inventions, a keypad may include a 'get' key which activates a processing step and forms a request for information.

b) Wheels and Trackballs

Wheels and trackballs are tactile devices providing a continuous or analog signal of increasing amplitude rather than a discrete or non-linear signal associated with a switch. Thus a wheel or trackball may be associated with functions such as zoom or volume controls which are more closely associated with analog type adjustments. In some applications where an input interface is used, a wheel or trackball tactile device is employed to provide a continuous analog input.

c) Touch Pad or Touch Screen

Another type of tactile device which may be used in various apparatus of these inventions is the touch pad type device. A touch pad allows one to drag a fingertip across a sensitive surface which provides position indication to the system. Generally a button or two are placed in close proximity for the purpose of 'click', 'left-click' and 'double-click' type interactons.

A touch screen device marries an image display screen where information is displayed thereon and associated with a position on the screen and that position on the screen is addressable via touch actions generated with a user's fingertips. As such, 'clicks', or more precisely screen 'taps' serve as stimulus or events to lauch programming.

d) Angular Displacement Detection System

Another input-type user interface includes a system to detect displacements which are rotational or angular in nature. These may be accelerometers, gyroscopes or electronic compass devices. When a mobile unit is manipulated in a predetermined manner, i.e. moved in a manner described as an angular displacment, the mobile unit may cause an associated response. For example, a display showing four options in a listbox with one option having a focus property indicated by a highlighted background. Upon wanting to choose one of the non-selected items in the list, a user can cause the mobile unit to be rotated about a horizontal axis to cause the forward end dip. Upon detecting such motion, the focus can be switched to a successive item in the list. Repeated similar motions cause the focus to pass from one item to another in the list.

Obviously, this simple example suggests how well known computer interface tools, a 'listbox' and 'focus indicator', and operation thereof, in a unique way via motion of a mobile device, in particular angular displacement motion.

e) Voice Recognition System

Voice recognition systems may be employed to drive computer commands in a normal fashion. Because mobile telephones are well equipped with audio devices such as a speaker and microphone, some versions of these inventions will employ voice recognition to interface with the underlying computer processing facility.

f) Other sensors

Other sensors may be used to provide measurement information relating to matters such as atomospheric pressure, outside temperature; wind speed, wind direction, background audio level, humidity; time; interdependant parameters such as those which depend on more than one parameter, for example position and time, parameters 'velocity' and and 'acceleration' are of this type.

ii) Output Interfaces

a) Audio

Audio indicators, for example buzzers and speakers, may be used to communicate with human users by way audio cues and signals. In a 'finder' application for example, a mobile unit can be set into an operational mode whereby a pan operation or scan motion allows the device to produce a 'beep' response in connection with a the unit being aligned with a selected type target.

b) Visual

Mobile units of some preferred embodiments may include output interfaces for providing a visual feedback signal to a user. For example, visual type output interfaces such as a simple text display may serve to provide text information. Preferred pixelized displays including color pixel elements are quite common and becoming very inexpensive. Even single LEDs may be appropriate for use as user interfaces in some simple versions of these inventions.

2. WIRELESS NETWORK

A. Components of a Wireless Network

A wireless network may be thought of as a communication link between two terminal ends. In the most common of wireless networks, a mobile telephone handset forms a first of the terminal ends. In some specialty applications a personal digital assistant PDA, or a simple laptop computer may describe the appliance which forms the terminal end of a wireless network link.

A second terminal end is typically a wireline telephone, but may alternatively be: another wireless telephone handset, a computer, a PDA, et cetera. Either terminal end communicates with another via transmission of radio signals. Radio signals may propagate from a terminal end to a receiving station. A receiving station, sometimes referred to as a 'cell site', may be connected to a wireline network. In special cases, cell sites may operate to direct certain transmissions into the Internet via a WAP gateway. In this configuration, a wireless network is sometimes referred to as 'mobile Internet' or the 'wireless web'. Some best mode versions of the invention anticipate use of a wireless network in a 'wireless web' configuration, in particular, a wireless network having as a portion thereof, a WAP gateway member.

Thus, mobile units of the invention may communicate with server computers in agreement with wireless protocol presently in service. Although WAP is presently leading technology, it is not an essential element whereby its absence would cause defects in any of the devices suggested here.

It is hereby acknowledged that WAP is designed and directed to second generation of wireless networks and simple display screens. It is not yet certain that the protocol used in newer wireless networks such as UMTS or HDR will bear the name 'WAP'. It is however certain that some standard will prevail and that standard will allow wireless devices to communicate with application servers connected to the Internet. A good faith effort to meet 'best mode' requirements suggests the detailed description of WAP be provided herein.

Accordingly, one will appreciate that these inventions do not depend upon the WAP standard and will work equally as well when a new protocol arrives. One will fully understand that mobile units convey requests which includes description of the physical state of the mobile unit, in particular position and attitude information, and that information is used in execution of a special database search to retrieve data relating to objects having a spatial relationship with the requesting mobile unit.

B. Special Function Facility

Wireless networks of these inventions can be set-up to include special function facilities. For example, while generalized hardware in a wireless network may include transmitters, computers and wireline interconnects, specialized hardware may be integrated to perform certain special function. A terminal in the network may include machinery which can be triggered to perform a desired task.

i) Remote Machine Operation

To illustrate this point, the reader is reminded the extraordinary city named Breukelen near Utrecht in Holland has many canals. These canals include a devices known as 'locks' which require the attention of a lock master when a boat is to pass from a first canal to another. When a mariner arrives at a lock where the lock master has left his post, the mariner is necessarily delayed until the lockmaster returns. To alleviate this problem, a mariner equipped with a mobile device of these inventions could merely point the device toward the lock system. In response, the server computer determines the mariner is addressing the lock and presents the mariner with a list of choices. Upon designation of a command to open and flood a portion of the lock, the wireless network transmits the request to the special function facility, i.e. a pump and gate system, the lock is operated without the attention of the lock master. This example illustrates how a wireless network terminal in the form of a special function facility may cooperate with devices of the invention to allow a user to choose and operate a machine remotely by merely pointing at the system and interacting with a graphical user interface.

ii) Point-to-call Facility

Another example of a special function facility of particular importance is herein referred to as a 'point-to-call' facility. Mobile units placed in a certain operational mode may trigger a request which is transmitted to the wireless network. This request directs the wireless network to place a telephone type connection to any telephone in the world. Thus, by merely pointing to any object to which a telephone may be associated, and further by executing a 'send' type command, a user may initiate a telephone call. The portion of the wireless network which operates to process these types of requests may be considered the special function facility. Well trained wireless engineers will note that these requests may be captured and processed without need to install additional equipment; i.e. the wireless computers in place today may be arranged to handle 'point-to-call' requests from mobile customers.

3. SERVER COMPUTER

A server computing unit of these inventions is charged with tasks including handling requests from a client unit. In preferred versions, a mobile unit or handset unit transmits a request over a wireless connection to a remote server computer which hosts a database and modules to handle such requests. It is important readers note that it is not considered a necessity that the server computer be remote from the client. Indeed, it is entirely possible that a server computer be an integral part of a handheld device in some alternative versions. Due to power and space, among other constraints, best mode versions may have a server remotely located and in communication with handheld units. In all cases, server computers are arranged to receive and process requests. Primarily, this task includes receiving address indicator information and forming a database query, performing a database search, receiving search results, transmitting those results to the requester.

Thus, important structural components of server computers of these inventions include provision for receiving requests, means for executing programming code, means of forming connections and communications with databases, and means for transmitting results back to a requester.

B. Special Function Facility

Special components of server computers may include a special function facility in the form of a programming module arranged to perform a particular desired function. For example, a server may be set-up to log all activity of a particular user. Where security requires records be kept of system transactions, a special function facility may be set to record transactions made by selected users. A server computer in normal operation receives requests, performs database searches, transmits results, and carries out the special function of logging the transactions taken.

4. DATABASE

A database is considered an essential element of devices of the invention. An extremely unique data structure is formed where general information relating to an object is connected to and associated with a multi-dimensional spatial description of the object. This connection between information and spatial description allows the database to be searched in a manner which allows data to be recalled in response to an alignment of a handheld unit with regard to the spatial desription. This important aspect should not be overlooked as it remains a key to a full understanding of these inventions. The essential 'glue' is the association between a geometric descriptor which describes a space associated with an object and general information relating the object. In this way, information may be recalled in response to a test for the condition whereby the address state of a mobile unit forms an intersection with a geometric descriptor. With reference to figure 14, an application server 141 having a search module 142 cooperates with database 143. Data may be kept in a matrix of high order whereby a record 144 relates to a unitary object comprising at least a geometric descriptor element 145 and additional multi-media data elements 146.

This important relationship embodied by the database record allows recall of information elements relating to an object via the object's geometric descriptor. An expert database designer will recognize that many database designs could be configured to serve functions of these inventions. Thus, there is no benefit in proposing any particular scheme and that is left as an engineering task. It is sufficient to say that a database is formed with prerecorded information relating to objects where that information includes both a definition of some spatial extent associated with the object and some multi-media data associated with the object.

A. Geometric Descriptors

A geometric descriptor is a definition of the spatial extend which is associated with an object. For example, a certain building on a particular city block may be said to occupy a cubic shaped space which may be specified by mathematically. Thus the building is said to have a geometric descriptor associated therewith which defines the space substantially occupied by the building.

B. Multi-Media Data

In addition to a geometric descriptor, a database record also has multi-media data associated with the object. Digitally recorded information such as audio files such as those known as '.wav' or midi, video files such as MPEG, simple text lists, text fields, graphics, photographs, control objects, et cetera, among others, are examples of multi-media data which may be included in an object record as 'information elements'.

C. Hierarchical Datasets

In advanced versions, both information elements and geometric descriptors may be arranged in hierarchical datasets. As such, a single field element of any record may be defined as another record containing a plurality of field elements. In this way data and data structures may be arranged in a 'nested' fashion without practical limits as to the depth. Even in hierarchical data structures, it is important to note the connection which lies in all data structures. Data arrangements invented and described here include an association between a geometric descriptor and an object having some spatial extent connected therewith. In this way, the physical state of a mobile unit causes a database pointer to become connected to various data stored in the database without regard to the precise database schema.

B. METHODS

I. OPERATIONAL MODES

Mobile units are set into various operational modes via computer code running on the computing facility. Because programming code is highly dynamic and easily changed from one application to another, mobile units may be operated in various operational modes.

In some preferred versions, a mobile unit computing facility includes programming directed to providing adjustments in functionality whereby various subsets of instructions are selectably executed, each corresponding to a different 'operational mode' or application specific arrangement. A system user may, by keypad entry or other control, change the operational mode of a mobile unit from a currently running mode to another mode, in accordance with various user desires which change from time-to-time.

Operational modes may change automatically. Certain device arrangments may provide for a change in operational mode when a mobile unit is carried into a region, as detected by a position determining means, where actions of interest are anticipated in view of the current position of the mobile unit. For example, a certain user leaving the city of San Diego, California after a portion of the 'Hot Rum' winter sailboat racing series may find herself making the transition from San Diego Bay to the international airport at Lindburg field, immediately next to the port. As the user's location changes from the harbor to the airport, devices of the invention may anticipate that the user is no longer interested in navigational aids such as bouys, ranges, and day shapes, but rather is now interested in gate locations and airport shops. A sailboat racing operational mode may include a menu list of functions which are not useful, indeed not applicable for air travelers. Thus an automatic change in the operational mode may be stimulated in response to a change in position of the mobile device without explicit cue from a user.

Despite the fact that various operational modes may be engaged from time to time, methods of the invention may be generalized as having the following steps where the specific manner of executing the steps may vary in one operational mode in view of another operational mode. To further illustrate this, a special section below sets forth some steps which are directed to particular methods. One will appreciate that it is impossible to set forth here in this disclosure all detail of every imaginable operational mode. Accordingly, one should remain mindful that the general nature of the inventions as set forth in the claims is intended to include many application specific species.

II. SYSTEM METHODS - PRIMARY STEPS

In general, most prefered methods of these inventions include the following steps illustrated in the block diagram of Figure 15: determine address state 151; form request 152; transmit request 153; and take action 154. More precisely, a determination of the address state of a mobile unit is made; a request which relates to the address state is formed in accordance with an current operational mode; the request is transmitted to a server running application software; and an action based upon the received request is taken. Although this brief description serves well as an guideline, a more complete complete understanding will be realized in consideration of the following more detailed presentation.

1. Determining Address State

Mobile unit devices of these inventions, at any instant, are said to have an 'address state'. As mentioned previously, an address state is defined by physical conditions in which a mobile unit exists, and in particular, conditions with respect to certain prearranged references sometimes including a position reference and a direction reference. A mobile unit's address state may be specified by a data set herein refered to as an 'address indicator'.

To determine an address state 161, a computer processor exectutes four substeps and may repeat that execution. First, a template which suggests which parameters are necessary for a currently running application, and how those parameters are to be determined is received 163 as input 162. In view of this template, values for all required parameters are collected in a 'collect parameters' substep 164. These parameter values are then combined 165 into a single data set to form the address indicator. Finally in a transmit substep 166, the address indicator is passed as output 168 of the 'determine address state' step to the request generator. The substeps may be repeated via a loop 167 command which causes each step to be reexecuted in turn.

Since an address indicator is a description of the physical nature of a mobile unit, the address indicator may include many parameters. Values for these parameters may be found via several approaches, including at least: physical measurement;

applying preset defaults; receiving user inputs; performing logical deduction routines; among others. Accordingly, the 'collect parameters' substep 171 may be further detailed as follows in view of drawing Figure 17. Inputs 172 include instructions relating to which parameters are to be collected and how to collect them.

Physical measurement 173 techniques include those such as performing a position measurement with a global position system, GPS. In a time difference of arrival scheme, radio signals received from orbiting satellites form the basis of this physical measurement system. Other parameters may also be found by electronic measurement apparatus.

Defaults may be set in advance and applied 174 in the 'determine address state' steps. For example, a range gate setting to specify that objects to be subject to address will always lie further than .5 miles and closer that 5 miles. In this regard, part of the description of a mobile unit address state includes a preset default parameter.

User inputs may also be used in routines executed in the 'determine address state' step. A user may operate a computer interface to provide 175 values for any of the parameters which make up an address indicator. In some versions, this may be viewed as an override where a sub-system measures the parameter but a subsequent user entry replaces the measured value.

Logical deduction routines 176 may be executed which derive a value for an address indicator parameter in response to assumptions and coded into the logic routines. For example, where a series of events suggests to the computer than a certain activity is happening, the computer may adjust parameters to provide a more favorable address indicator which facilitates recall of best information which relates to the detected activity.

Each of the above mentioned techniques may be employed in combination to arrive at values for parameters which make up the address indicator and form an output in the 'Collect Parameters' substep.

2. Preparing a Request

Requests are prepared in agreement with the various operational modes which may be running on a mobile unit at any time. Figure 18 illustrates a request generation module 181 having input 182 from the determine address state step. An address indicator is received 183 and a request is formed 184 in agreement with values of address indicator parameters and further in view of a current operational mode. A computing module is the basis of a request generator. The computing module executes instructions to formulate a brief data set which may be transmitted to a server as output 185 of the prepare request module. For example, where a mobile unit is located in San Rafael and has a directional reference pointing towards San Jose, the request generator may produce a request in the form of a uniform resource locator, a URL. Thus, requests of these inventions may be a well known and highly used format of usual Internet protocol. Alternatively, a request may include datasets particular to systems of the invention and not related to other Internet techniques. For example, a system can be configured to use the XML standard where data objects are described in a document type definition such that receiving applications of any platform can properly recognise the information. In either case, a request is prepared in agreement with the operational mode and the parameters from which an address indicator includes.

Accordingly, the 'build request' module 191 may be further described as follows with reference to Figure 19, a block diagram drawn to that process. Inputs 192 to the build request module include both instructions from any active operational mode, and information received as an address indicator. The operational mode suggests the format of the request to be built. The request therefore may include portions known as a header, data specific elements, scripts, user IDs, and return type address information. A request is build by assembling these components in agreement with formatting rules inherited in an operational mode program. Thus, the substep includes actions: set forth a header 193, insert address indicator data 194, apply scripts 195, and prepare return ID information 196. Together these components form the output 197 of the build request module.

3. Transmitting the Request

So formed, requests are then passed to or transmitted to a server computer in a 'transmit request' substep 201 where requests are received as inputs 202. For example, some best modes of these inventions may have requests prepared as encoded messages. These encoded messages can be transmitted to remote server facilities via wireless transmission means. A radio transmission originates in a mobile unit, propagates through space, to a base station including a high data rate radio receiver, routed via a WAP internet gateway, via landline, i.e. copper or fiber network, and finally to a server. A request therefore may encounter a great deal of transmission activity as part of a 'transmitting the request' step.

Alternatively, a server computer may be running within the mobile unit and a 'transmit request' step merely suggests passing request parameters into processing routines resident on a local device or devices. Accordingly, the step is complete and well performed whenever an existing request finds its way from a request forming module to a server configured to process such requests. Combinations of these are also anticipated. Where a server is appropriate for some but not all requests, it may be a local server with a limited data set, it can handle certain requests while others are passed into the network with the destination of a remote server. Appropriate routing of requests is handled as part of the transmit request step.

Therefore, the transmit request step may be envisaged as including two steps as follows: a select appropriate route step 203, and an execute transmission sequence 204 step. The output 205 of the transmit request module is a request having been passed to a server.

4. Processing Request

Requests are processed 211 in a manner regulated by a stratagem set forth in an application. In brief, substeps: 'receive request' 213, 'execute instructions' 214, 'search database' 215, 'take action' 216, and 'form reply' 217 are performed. Although these substeps may have variations due to differences in operational modes, their general nature will be fully appreciated.

In a first substep, requests are received at a server. A server is configured, in some cases, to receive requests from many mobile units. Thus, receiving a request includes managing a plurality of transactions with a plurality of requesting parties and the computing overhead associated therewith. Request handling and management services permits the process request module to address these complex transactions.

A received request may have therewithin a script or computer code unit which instructs the server to behave in a modified way or to process a function to arrive at some result. In this way, a part of a 'process request' step includes special processes to be run at the server. Sometimes such function will be employed to shift a computing load to the server thereby freeing the mobile unit processor from load which may be difficult to handle there. Another occasion where special instructions may be used prior to a database search is when a user has indicated that special data filters be applied. This occurs when a user selects conditions and limits offered as options in a particular operational mode. For example, in a hotel locating application, a user may wish to only receive results which include hotels of three stars quality or higher. From an options menu a user specifys this condition and it may be passed in a script as part of the request. When executed at the server, the script controls the server to perform a database search in accordance with the user selected specifications.

One processing action taken in all versions of these inventions is a 'database search' based upon information in the request which relates to the address indicator. This search is generally used to produce a result set of information relating to objects being addressed by the mobile unit. Thus it can be said that a primary objective of any database search of these inventions is to determine objects which are being addressed and to retrive information which relates thereto. Recall the database structure described previously which provides a connection between a object's geometeric descriptor and information relating to the object via a database record. In review, an object is said to be 'addressed' whenever the address indicator which describes a device's physical nature forms an intersection with any portion of an object's geometric descriptor.

After a determination is made as to which objects are being addressed, actions are taken where the actions may depend upon the specific objects being addressed. In most instances, actions depend upon information relating to the addressed objects as recalled from the database. These actions may be taken at the server, at the mobile unit, in places therebetween, or in completely unconnected locations.

It is useful to further detail and diagram two of the above mentioned substeps; namely, the 'database search' step and the 'take action' steps.

A database search 221 as illustrated in drawing Figure 22 illustrates the major steps of a database search.

Inputs 222 prepared in prior processing are recieved into the search module. These inputs may be in a form of strict or highly regulated form. For example, certain databases have a language which cooperates with retrieving select information from the database via a database 'query'. For example, Structured Query Language, or SQL specifies a form that can be run against any database schema complying with the language rules. An input to the database step of this section therefore may be a highly structured database query string. This string is prepared in agreement with any current operational mode, user applied filters, and in further view of a mobile unit's address state.

Once received in the database module, a SQL string is processed in an 'examine records' step 223.

Records may exist in a database in a plurality of tables where some tables may have known relationships with respect to others. For example, a primary table may have information recorded therein which relates to fundemental properties of objects which are further common to all objects. For example, data fields such as 'date created'; 'information source'; and 'expiration date', et cetera. Other tables may be arranged and connected to a primary table whereby those tables contain information in a structure which applies only to a class of object. For example a restaurant class object may contain data fields: 'food catagory'; 'quality rating'; and 'price range'. Objects belonging to a class different than the restaurant class may not find those fields applicable. An object such as a baseball stadium would not have any data relating to 'food category'. In the examine records step, a SQL command iterates through all records which may be of interest in view of conditions which arise in an operational mode. This of course means that a plurality of tables, as well as a plurality of records, may be addressed while the SQL command is being executed. A well guided iteration through the database information occurs in the 'examine records' step.

In a step where a single record is being considered at a particular time, a determination is made with regard to precisely one object attribute. As mentioned, each object has associated therewith a geometric descriptor. A step to detect intersection 224 considers a data record's geometic descriptor in view of conditions defined in the search command to detect an intersection with the address indicator. When an intersection occurs, the object is marked as a 'hit' object, or in other words, an object currently being addressed by the system.

Upon a such determination of an object being addressed, data associated with the hit object in a plurality of tables is marked for recall and may be placed into a dataset type container. As it is not a certainty that only one object is being addressed at any one time, a database search continutes after finding a hit object. Records are examined one at a time in turn, as directed by the query command, each additional target identified as an addressed target has information relating thereto recalled and placed into the dataset. In this manner, the database search is said to include a 'populate dataset' 225 step.

When the search is completed and there remain no records left to examine for intersection, the search is concluded by emitting an output 226 which includes a completed dataset with information relating to all hit objects. The output may also include markers which may be used in computer processing routines for management of related operations. For example, a marker may be included to describe the success, failure or completeness of the search or to describe the dataset such as the total number of records found. These indicators are produced as a clean-up method which may be performed as database search overhead.

The results of a database search are passed into a 'take action' module 231 illustrated in Figure 23. Actions may include a wide range of tasks and operational execution which may be initiated by a computer. This is very important because in some cases it is not the computer which actually performs the task but rather the computer merely commands that it be done. For example, where an object being addressed is the garage door of a person's home, the action to be taken may be to open the door. Thus the computer may generate an 'Open' command and pass it to the door opening machinery. In this sense, the door opener is not an integral part of the system, but is a system in *communication* with devices of the inventions whereby it may receive commands therefrom.

An action module receives database search results including the dataset as inputs 232. The action module receives 233 the dataset and information relating to objects being addressed for processing therein. This information may be used in or to control actions taken in the module.

Tests may be performed to determine properties of the data contained in the dataset. As part of a take action process, tests are performed 234 against the dataset and the information contained therein. The results of these tests may suggest precisely which actions are to be taken. For example, a test may be performed to determine whether some of the objects being addressed by a user are objects which cannot be readily seen by the user due to the object's position behind another object in a user's line of sight or view. In this case, i.e. a positive result of having performed the test, a certain action may be triggered to provide a graphical representation of the object in relation to other nearby objects, a map. This is further described in a prior U.S. application having serial number 09/384,469. Other tests may be executed to determine the true nature and state of the dataset and these test results may be used to trigger various actions.

When the results of a test suggests some actionable condition, an instruction set may be called and executed in an 'execute instructions' 235 step. These instructions may produce a result locally at the server or may cause an external operation to be triggered.

In addition to tests being performed and instructions executed, the server preforms a 'build reply' 236 step. An appropriate reply is prepared in view of data recalled and in further view of any instruction particular to an operational mode running on the system. The reply may include data elements and further organization of said elements as suggested by templates which may be particular to an application. For example, a reply template may command that a XML reply be sent where the document type definition of the XML reply is used to arrange data recalled in a fashion whereby it can be well received in the requesting client.

Finally, the 'Take Action' step ends in a 'Transmit Reply' 237 step where the reply is passed as output 238 into a routing algorithm and sent back to the unit where the request was initiated.

III. SYSTEM METHODS - Further Details Included in Some Versions

In addition to those steps outlined above, some preferred methods may also include additional steps. Those steps discussed below should be considered advanced version subsets of one of the more general methods presented above. Further, steps described above may be defined with additional detail as follows in this description. Similarly, detail methods should also be considered advanced version subsets of one of more general methods presented above.

1. User Action to Cause Address of Object of Interest

In preferred versions, a user manipulates a mobile unit to cause it to point at an object of interest. Since a mobile unit may be encased in an elongated shell with an easily discernable pointing reference, a user may simply hold the mobile unit while moving the wrist to cause the device to address an object.

In best mode versions of these inventions, a user would merely align the antenna of her mobile telephone so that it points to an object such as a supermarket. In this way, a user effects the step 'addressing an object'.

2. User action to Cause a Trigger Event

To ask for identity information with respect to the addressed supermarket, the user may indicate to the computer that the addressed supermarket object is to be processed further. To cause this, a user may stimulate a click event while the supermarket is being addressed. A click event is one whereby a user operates a switch to provide indication to the computer. While an object is being addressed, a click event may cause the computer to divert into an instruction set where any of a great plurality of processes may occur. The essence of this step is independent of the action taken. The act of providing an indication to a computer while simultaneously addressing an object of interest thereby setting the computer into any action relating to the particular object being addressed is fundemental to this step.

3. Determine Address State

A. Application Specific Address Indicator Templates

In some operational modes it is not necessary for the address indicator to account for various tilt states. This may be true where the only objects of interest lie substantially in the horizontal plane of the user. A shipping application where distances are large and the field of interest, i.e. the ocean surface, is flat. In other application versions, there is absolutely no regard for time and address indicator templates for these versions will ignore the time parameter. Of course many very useful versions of these inventions will not provide any measure of more obscure parameters such as wind direction and atmospheric pressure.

Upon application development, an application designer decides which of the available address indicator parameters are useful and required and designs templates with instructions in agreement with the stratagem of her application. This template tells the system which parameters will carry default values, which of the other parameters will have empty values and which of the remaining parameters will acquire their values by way of measurements in subsystem activity.

i) Initialization with Defaults

When an application executes its initialization procedures, a portion of the procedure sets a template as an input to the receive template module. The template includes a listing of the elements required in the application, and also provides default values for elements where appropriate. For elements requiring values but where defaults cannot be supplied, instruction is passed to set up and initiate subsystems for making measurements for those parameters or otherwise acquiring data values for those parameters. While position is typically measured, time is not. A time value must be 'read' from a clock reference. Strictly speaking, an address indicator value may be left empty, set by default, set by reference, or measured.

ii) User Set-up to Adjust Defaults

After initialization steps are completed, an address indicator template can be modified in agreement with user inputs. For example, in a mapping application, a user may only be interested in objects which are relatively near the user's location. Accordingly, a 'range' parameter set by default to eight miles may be changed to three miles in an interactive procedure whereby a user resets the value for the range parameter in the template. Other parameters can receive values in their respective ways; either omission, measurement, or reference.

B. Take Action

In view of a result set produced in the database search, and in accordance with any instructions received as part of a request, and in agreement with any user selected operational mode, a server produces a response which sets forth or triggers an action. Actions may be widely varied in their embodiments, but generally they may be classified in the regard as to *where* the action occurs. By illustration, various types of actions are described. One will appreciate the exact number of different actions which may be taken is unlimited and no attempt is made here to catalogue them. It is sufficient to say that any action which can be set into being is contemplated as being part of these inventions so long as it is done so in view of the preceding and following steps. Although sometimes an action is taken entirely within a server, in other instances the action may be taken up outside the server. Where actions are taken outside the server, a server command is used to initiate the action.

i) Action taken in Server

Sometimes an action is one which can be taken entirely within the server. Actions taken at the server may include, by way of example, performing special operations on the result set produced in the database search. A result set may be modified and updated and returned to the database. A record recalled in the database search may be updated to reflect changes to objects which occur from time-to-time.

When a retail operation shuts down and moves from a particular location, the database becomes due for an information update. A request transmitted from a mobile unit may include instructions which cause records associated with a certain geometric descriptor (being addressed) to be changed to reflect the termination of the business. Similarly, where a new business is opened in its place, the database record requires an update. Therefore a request process may include instruction to take action within the application server or a database connected to said server.

An action taken by a server may include one whereby the action is within a group of related actions performed serially in view of a plurality of requests. In example, the server may include a module configured and arranged to construct an activity history with regard to a particular client or group of clients.

In the case of a group of actions relating to a plurality of requests from a single user, the following example is illustrative. A business advertising executive user may set forth on a journey to document billboards in ideal locations for advertising products of concern to the business. While driving about a city, the executive chooses preferred billboards, points and clicks a mobile device theretowards the chosen billboards. In response, the server can be arranged to build a data set of chosen billboards adding each to the list as it is addressed and identified via the address indicator and database search. This illustrates how server actions to a group of requests are processed at the server to yield a useful product. At the server, each time a request arrives the database search produces the identity of the addressed object and that identity is added (as one of a group of server actions) to a data set which forms documentation desired by the user.

In the case of actions taken with respect to requests from a select group of people, consider the following example. Requests may be of a form recognized by the server to cause them to be handled in view of special procedure. A group of people belonging to a certain social club and registered as such may cause requests to be sent which notify the server of the requestor's present location. Any member of the club could then ask the server to expose the locations of other club members in order that meetings are more easily and frequently brought about. Thus, each incoming request from any member of the group causes a server action to be taken whereby the server updates a list of club member locations.

ii) Action at Wireless Network

A server may produce a command and convey that command to the wireless network whereby an action is taken there. A good example of this case includes what is described herein as a 'point-to-call' function. Users of mobile units can find themselves in the position of wishing to contact the entity residing in some building of interest. The building, being addressed by the user, has contact information in the database. On request for this type of action, the server passes a command into the wireless network to place a telephone call to the addressed entity.

iii) Action at Mobile Unit

In some versions of these inventions a server may convey a command to a mobile unit, or a plurality of linked mobile units, to effect an action at the mobile unit. In a game methodology, devices of these inventions may operate in a manner including such action at a mobile unit.

In a game sometimes and herein referred to as a 'Hide-and-Seek' game, a person who is 'it' attempts to locate other players who are hiding. By using a mobile unit of these inventions to point-and-click on various locations where players may be hiding the user causes a request to be sent to the server where a response includes a command to alert the user as to the status of the point-and-click action in relation to the game scheme. If an opponent player is hiding in the subject location (addressed location) a server response includes a command to drive an alert signal at the mobile unit. For example, an audio 'Buzz' sound can be provided to indicate a failed attempt to find a hiding person while a 'BeepBeepBeep' sound can be provided to indicate a successful attempt to discover a players hiding location.

Thus, game versions of these inventions illustrate where actions can be taken at the mobile unit portion of systems via a command sent from the server computer.

iv) Action at Addressed Object

An action may be taken at the object being addressed. In an example where a user wishes to cause a reservation to be made at a restaurant which is the subject of an address and further a point-and-click operation, an application is arranged to provide a command from the server to the object being addressed in order that an action be taken there. As part of a database search, information concerning contact information for restaurants being addressed is recalled. In systems arranged to perform accordingly, a server may contact a subject restaurant by telephone, alternatively by e-mail, or even dynamic web page interaction, to cause a reservation to be made with all parameters appropriate for meal reservations being supported in the user's request action.

It is therefore easy to fully understand how systems of these inventions can include actions occurring at the object being addressed where a server command is transmitted to the object and the action is taken there.

v) Action at another location.

It is sometimes of great interest to cause an action to be taken not at the actual object being addressed but rather at a location which relates to the object being addressed. To illustrate this use of systems of these inventions, it is useful to consider our duty to our community as citizens.

While in travel, one may have the occasion to notice facilities in disrepair, i.e. a defective street light; a damaged train crossing signal; or a leaking damn. Additionally, one might happen upon an automobile accident wherein tire tread separation causes a fully loaded sports utility vehicle to make a considerable mess in a roll-over disaster. The onset of a forest fire also presents a similar happenchance for a nearby observer to aid his environment and community via systems of these inventions. All of the above mentioned events require timely reporting to appropriate agencies. Details regarding precise time and place are also important. These necessary details are usually not sufficiently provided by verbal descriptions provided by the reporting person. In view of a forest fire on a remote mountain in a region unfamiliar to the reporter, one can truly understand the dilemma. Accordingly systems of these inventions include reporting applications where a user points-and-clicks on an incident scene to cause a report to be generated and transmitted to appropriate authorities. In the simple case of a defective traffic light a server causes a report to be logged at a city facilities unit. In the case damaged train crossing, the railway operations people are provided an alert at their central office. In the case of a broken damn, forest fire, or traffic accident, authorities appropriate for handling a response to those types of emergencies are contacted.

Each of the above examples illustrates the function whereby a point-and-click action on devices of these inventions results in a server providing a command to execute an action at a remote location where that location is not the object of the address, is not the server, and is not the mobile unit, but rather is a *related* but remote location. It is easy to understand how impossible it would be to explain all relationships between objects and remote locations; therefore, one should remain mindful that the precise relationship does not make these inventions but rather the mere fact that there exists some relationship causes great utility and novelty in the combinations taught.

C. DETAILS ON SPECIAL TOPICS

Although the presentation above follows logically from the elements of devices and the steps of methods, a few items are preferrably described in complete detail outside that framework. In example, a geometric descriptor which is a construct used in systems is not tangible structure. In discussions of hardware elements, details relating to such geometric descriptors were left absent. As the inventors wish to provide the fullest and most complete description possible, further details are provided with regard to geometric descriptors and the term herein used 'address states'. Finally, while the presentation above suggests some basic information elements which may be manipulated by systems, a special section herefollowing describes some advanced multi-media type data which adds to the full description. These details are presented separately in the interest of clarity as they do not readily follow within the logical form of the outline but are never-the-less considered important aspects of these inventions.

Special Topic 1: Geometric Descriptors

A geometric descriptor includes the combination of a mathematical definition of a geometric construct or body and an association with an object. By way of example, a certain building on a particular city block may be said to occupy a cubic shaped space which may be specified mathematically in some reference coordinate system. Thus the association with the building (an object) together with the specified shape (mathematical definition) forms a 'geometric descriptor'. In this case, the geometric descriptor defines the space substantially occupied by the building. Although this is not always the case, one will recognize a trend where the object with which an association is made generally occupies a space which becomes the space described in the geometric descriptor. A mathematical definition of a shape and location alone cannot form a complete geometric descriptor without a connection to some object. Thus, all geometric descriptors are comprised of at least a description of some spatial extent, a precise position specification and an association with an object.

Geometric descriptors of these inventions may be set and preloaded into a database as a field type data element; i.e. part of a record. Upon programming a database, an application designer chooses appropriate geometric descriptors in agreement with the application being designed. In certain conditions, a geometric descriptor may be a simple shape without complex detail; in other conditions, a geometric descriptor may include considerable detail with great attention to precise and intricate geometries.

With reference to the drawing figures, in particular Figure 24 which contains an image of interest including several objects, specifically the San Francisco Bay 241, the sky above Marin 242, and the famous Golden Gate Bridge 243. Geometric descriptors may be configured and arranged for each of these objects. An example of a geometric descriptor having an association with the Golden Gate Bridge is presented in the perspective of the image viewpoint in Figure 25. Again, the image contains the bay 251, the sky 252, and the bridge 253. In addition, the image shows a graphical representation of a geometric descriptor associated with the bridge and superimposed thereon. A heavy black outline 254 suggests the periphery of such geometric descriptor. It will be understood that the geometric descriptor actually extends beyond the limits of the image 255. Although for practical purposes the figure illustrates a two dimensional representation of the geometric descriptor, it is readily understood that this geometric descriptor is actually comprised of a three dimensional geometric body. Better contrast is envisaged in consideration of Figure 26 which shows the geometric descriptor 261 in the image space 262 without distractions of the image. One can imagine that as the viewpoint from which a geometric descriptor is viewed is changed, then so will its appearance; thereby confirming its three dimensional nature.

While the precision and level of detail of the geometric descriptor shown in Figures 24 - 26 are moderate, it is easy to imagine that an object can be more precisely modeled and thus a geometric descriptor of considerable detail may be formed for the same object, the Golden Gate Bridge. This becomes necessary in some applications where high resolution demands precise definitions of the spatial extent of which is occupied by an object. Figure 27 shows a different geometric descriptor which can be associated with the Golden Gate Bridge in applications requiring extra detail. It is noted that geometric descriptor carefully accounts for the roadway 271, the tower 272, the base members 273 and 274, and finally, the distant base 275.

With recall to Figure 25, it is easy see that a user of devices of these inventions who points the device exactly towards the region identified in the figure by numeral '256' will be addressing the bridge because he causes the device to point at the rather coarse geometric descriptor. However, applications using geometric descriptors of greater precision will resolve that a user is not addressing the bridge, but rather addressing the sky above Marin which is behind the bridge; see Figure 27, numeral 276.

As mentioned above, a building may simply be represented by a cubic geometric descriptor in some applications. However, preferred applications clearly anticipate geometric descriptors of far higher precision. Figure 28 illustrates this without ambiguity. A user points a device of these inventions 281 towards awnings 282 and 283, and a banner 284 presented as advertisement by a restaurant. These awning and banner objects may be included in a group of geometric descriptors associated with the Karl Strauss Brewery & Grill of La Jolla. They may be envisaged more clearly via the presentation of Figure 29. The device is shown as 291, the awnings as 292 and 293, the banner being 294. A pointing vector is shown as dotted line 295. In addition to geometric descriptors which describe a physical building, additional geometric descriptors may also be associated with the same object, i.e. the restaurant. As such, by pointing at *either* of the geometric descriptors, a user causes the restaurant to be addressed. In response to addressing the restaurant, a computer make take an action whereby the user receives a menu of the afternoon specials presented on the display of the device for convenient review.

It is noteworthy to point out that a geometric descriptor may include geometric shapes which are not three dimensional but rather infinitely thin. This is the case for the banner which may have a geometric descriptor that is planar in nature. Thus a geometric descriptor is not always descriptive of a space but may also describe planar, linear, or even a point geometry.

Nested geometric descriptors are fully anticipated. Accordingly, subsets of buildings may independently form separate but related geometric descriptors within other geometric descriptors. An housing domain may exist whereby it is comprised of five separate buildings, each building having four single family units each, each single family unit having three rooms therein. The domain may have a master geometric descriptor; each building may also have a geometric descriptor, that geometric descriptor being a slave to the master geometic descriptor associated with the domain; each single family unit likewise has a geometric descriptor which is said to 'belong to' the geometric descriptor associated with the building, and further to the geometric descriptor associated with the domain. In this way, certain properties and functions can be passed into subsets of geometric descriptors from their parent descriptors.

Special Topic 2: Address Indicators

In many parts of this disclosure reference is made to simplified address states comprising position and attitude parameters. Indeed, in some explanations, even those position and attitude parameters are abbreviated. For example in discussions regarding position sometimes position is specified as a latitude and longitude measure without more. However, position is not perfectly described by mere latitude and longitude measure, but rather it may also include altitude measure. Similarly, although a compass heading figure such as '254°' may be useful to reflect attitude, attitude is really incomplete without specification of pitch and roll, i.e. the angular displacement about two orthonormal axes. In applications where abbreviated address states are used, there is basis for taking assumptions where unmentioned parameters may be left redundant or unneeded.

In some cases it is not possible to ignore certain details and a more full description of an address state is required. This can be clearly understood in view of the drawing figures 30 and 31 where a measure of attitude includes not only a compass heading but also a pitch parameter(s) as well.

Figure 30 depicts a user 301 of a system of these inventions. A hand-held mobile unit device 302 is pointed in a direction indicated by arrow 303 towards a building which houses several unrelated businesses. It is easy to appreciate that the user's position as described by latitude, longitude and altitude values is well defined. It is similarly easy to appreciate that the pointing direction corresponds to a compass heading roughly south, or more precisely 254°. However, with those parameters alone it is not possible to determine whether the user is pointing at 'Bozo's Comic Book Store' 304, a shop on the 4th floor, or at 'Mr. Juice Sandwich Shop and Juice Bar' 305, a shop on the 2nd floor, i.e. two floors therebelow the comic book store. This is because altitude only suggests the horizontal plane indicated as dotted line 306 in which the mobile device lies. The pointing direction or heading assures that the device is being pointed south-southwest along the 254° heading, in which both the juice bar and comic book store lie. However, with the stated parameters it remains ambiguous as to whether the device is being pointed above or below the horizon.

Without changing position, altitude or compass heading, the user can realign the mobile unit by tilting it downward to address a different shop. Figure 31 shows the young boy 311 equipped with a mobile unit of these inventions 312 pointing in a direction indicated by arrow 313 *below* the horizon indicated by dotted line 314 towards the juice bar. Thus it is evident that a change in the pitch angle of the device without changes to other address parameters may cause a different object to become the addressed object. In the drawing figure 30, the comic book store is addressed, in figure 31 the juice bar is being addressed.

Altitude

In high precision devices of these inventions, it is not enough to merely have latitude, longitude, heading, information. This is due to the fact that two systems may have identical latitude and longitude values while pointing along the same compass heading but have very different altitude and pitch values. Figure 32 shows how a gentleman 321 using a mobile device 322 positioned directly above a lady 323 with a similar hand-held device 324, both pointing as indicated by arrows 325 and 327 respectively, to the same object, the 'Mr. Juice' juice bar. In this case, the altitude and pitch angles greatly affect the outcome of a determination of an address state and corresponding database search for addressed objects. There is a distinct difference in altitude; the horizontal plane indicated by dotted line 326 for the gentleman is different than a horizontal plane indicated by dotted line 328 for the lady. Both persons are addressing the same object, Mr. Juice, however, they have very different values for both pitch and altitude. Thus, preferred devices of these inventions have attitude determining means which *includes* a pitch sensor and a GPS type positioning means which *includes* an altitude determination.

Further, it would be very wrong to assume that an address state is limited to position and attitude even in it most detailed forms. To more fully appreciate the entire invention, it is important to consider that address states may extend far beyond mere position and attitude parameters.

In most general terms, an 'address state' is a description of the pointing nature of a device. Some versions of these inventions may include address state parameters as follows: *position* which is preferably described as: **Latitude; Longitude; and Altitude,** measures and *attitude* which is preferably described as: **Heading; Pitch; and Roll.** Although in simplified versions position and attitude may be sufficient to completely describe an address state of a certain device, other versions may include additional description of an address state.

In review, attention is directed to the drawing figures where Figure 33 shows a point reference and direction reference represented by point 331 and arrow 332. The point is arranged at the endpoint of the direction vector for convenience. This geometric construction is consistent with simplest versions of these inventions introduced herethroughout. A position determining means is coupled to the point reference represented by the point 331 and makes a measurement of the location including latitude, longitude and altitude of the point. Likewise, an attitude determining means is coupled to the direction reference represented by the arrow 332 and makes a measurement of the pointing nature including compass heading, pitch and roll of the direction reference. For a more complete understanding of the full invention, preferred versions include an address vector having spatial extent in three dimensions.

Figure 34 shows an illustration of an interesting representation of an address indicator. A point 341 is joined with a pointing vector 342. An angular measure indicated as Θ 343 describes an extension to previous address indicators. The angular measure suggests a conic shaped volume to represent the address indicator; i.e. the address indicator has extent in a transverse sense, extent which increases as a function of the distance from the point of origin. This is a natural extension for an address indicator because is approximates a beam of light which has been used by all to point towards things, for example a flashlight, or even the headlights of an automobile. Thus, pointers having finite transverse extent are particularly useful.

Unlike a beam of light pointer, an address indicator may be arranged to have minimal and maximal distance limits associated therewith to set forth a range gate. Figure 35 shows a conic section address indicator specified by a point 351 in combination with a pointing vector 352. In addition, an elliptical element 353 suggests a minimum distance parameter while an elliptical element 354 suggests a maximum distance parameter. By convention, an address indicator can be said to exist as the volume of space occupied between the limit surface elements: the conic surface 355, minimum ellipse 353 and maximum ellipse 354.

Upon review of the illustration in Figure 36 it is easy to realize that an address indicator comprising point 361 and vector 362 may be described as a volume 364 which is not circular, in cross section 363. Angular measure in two orthogonal directions, i.e. shown as Θ and Φ in the drawing, each is different in value, can be set to describe a special address indicator. The address indicator which is rectangular in cross section of Figure 36 is provided with a maximal distance limit without a minimum limit to yield a pyramid shape address indicator. Careful readers will understand that the true shape of the maximum limit may be a spherical section rather than a mere rectangle as shown in the drawing for simplicity.

With address indicators fully described in detail, one will now enjoy a complete description of the notion known here as 'Intersection' of address indicators and geometric descriptors. First, it is useful to recall how a user may influence the address state of a mobile unit and thus the address indicator associated therewith.

The arrangement of position and direction references is firmly coupled to a mobile unit whereby displacements and rotations of the mobile unit causes corresponding displacements and rotations of the address indicator of the mobile unit. In this way, a user may use a mobile unit of these inventions by moving it about to address objects of interest. Figure 37 illustrates a case where a simple address indicator in the form of a vector 371 comprising a point reference 372 and a direction reference 373 is directed toward a certain object of interest represented by a geometric descriptor. The pointer is aligned such that a (dashed) portion 374 of it intersects a first geometric figure 375, a rectangular cylinder while not forming an intersection with a second geometric figure 376, a circular cylinder. Such action taken by a user is said to cause the rectangular cylinder to be addressed. The circular cylinder is not being addressed because the pointer does not form an intersection therewith.

To form an "intersection", a geometric descriptor must share at least a single point with an address indicator. Figure 38 shows the case where an address indicator 381 is coincident with a geometric descriptor 382 at only a single point 383. At no point does the circular cylinder geometric descriptor 384 coexist with any portion of the address indicator and therefor the circular cylinder is not being addressed by the system illustrated.

Some geometric descriptors are defined as infinitely thin constructs, a pointer 391, 392 may intersect a planar geometric descriptor 393 at a single point 394 as shown in drawing Figure 39.

Geometric descriptors of complex shapes are most certainly anticipated. One such geometric descriptor is shown in Figure 40. An address indicator 401 is directed towards a geometric descriptor 402 of complex shape such that a portion of the address indicator 403 forms an intersection. Thus the object associated with the complex shape shown is being addressed by a system of these inventions.

By applying certain rules to an embodiment of one system, an address state of a mobile unit is configured to include a range or range gate. A description of range limits or complementary minimum and maximum distance limits with respect to the point reference may be used to define a particular region of interest. For example, two objects which lie on a single line with respect to a user's perspective may include one object further from the user than the second which is nearer to the user. To express an interest in the farthest lying object, a user may set an address indicator range gate. Figure 41 illustrates this case more completely. Position reference 411 and direction reference 412 form an address indicator which passes through two objects. An address indicator may be provided with a range parameter having a minimal distance limit 413 and a maximal distance limit 414. The cubic object 415 otherwise would be said to form an intersection with the pointing vector as the address indicator passes therethrough, however it is not within the *range gate* so it does not form an intersection for purposes of this discussion. On the other hand, the portion of the address indicator within the range gate, i.e. marked as line segment 416 in the drawing, does pass through the circularly cylindrical object 417. Thus it is said to be addressed.

It is entirely possible to form a range with specification of an upper limit and without a lower limit. Point reference 421 and direction reference 422 together with maximal distance limit 423 form a address indicator to represent an address state. An intersection is formed between object 424 and the address indicator at line segment 425. Because object 426 lies outside the range, no intersection exists between the pointing vector and that circular cylinder object despite the fact that the object lies on the direction reference 422. 427 is said to be a address indicator which represents an address state having a range limit.

Figure 43 is provided to show an address indicator having finite transverse extent comprised of a point reference 431, direction reference 432 together with a range gate forming a conic section 433, having intersection represented as portion 434 with a circular cylindrical geometric descriptor 435.

Finally, the address indicator 441 of figure 44 is shown to form an intersection with an irregularly shaped geometric descriptor 442.

When using a system to address objects having a position not changing in time, or having any other factor which is time dependent, a time-of-day parameter may be omitted from a description of the address state of a system. However, a time of day parameter is very important to many other applications. For example, in applications where a menu is displayed for restaurant type objects being addressed, it is important to alternatively display the dinner or lunch menu in agreement with the time-of-day. For bars and clubs, a 'happy hour' includes specials valid only for certain hours; those specials should only be presented during appropriate hours. In certain cases, an object has a geometric descriptor which changes shape and/or position in time. The highly regular trains in Japan move with very certain and well defined regularity. Thus, a geometric descriptor may be configured to move with the train as a function of time. Users of systems of these inventions are thereby enabled the function of addressing a moving train to learn more information about the train. Accordingly, some preferred systems include an address state having a time-of-day parameter.

As an illustrative example, the following information is provided to describe a particular address state of a certain device.

Latitude: 32° 21' 57"

Longitude: 117° 34' 25"

Altitude = 143'

Heading = 294°

Tilt X (Pitch) = 23°

Tilt Y (Roll) = 0°

Range Gate = 5' - 200'

Pointer Extent = conic, 2°

Time of Day = 21:28 GMT

It is easy to understand that alternative units may be used, however, one will appreciate that regardless of the particular units used, an address state describes the pointing nature of a device as defined by the parameters themselves rather than any particular systems of units and coordinates.

It will be appreciated that subsets of these address state parameters may also form useful systems and address states which omit any of these parameters may be included as certain versions of these inventions. It is also to be understood that other parameters may be introduced which specify the phyical state of a mobile unit as it might relate to addressing an object. Accordingly, use of such parameters may also be considered as versions of these inventions.

To make a determination of the values for each of the parameters of an address state, the system is equipped with means for providing those values. Although one system may use a different arrangement than another, arriving at parameter values for an address state as described is essential to the step determining the address state of a mobile unit. For example a mobile unit may be provided a clock or a data link to a clock.

Special Topic 3: Multi-media data

In addition to a geometric descriptor, a database record also has information elements associated with an object. Included in these information elements are a special class herein referred to as multi-media information elements. When systems of these inventions determine that a particular object is being addressed, a response may include recalling multi-media information elements from the database and presenting that information at a user interface of the mobile unit. In a simple example, when a user points a mobile unit towards an object, the device may 'recognize' the object via a test for intersection and provide an audio announcement to the user regarding the object's identity.

One can more perfectly understand this and related concepts with reference to figure 45, where a mobile unit 451 is illustrated as being pointed, via pointing vector 452, towards a restaurant building 453. The system may be set in a special mode to provide an automatic response whenever a known object has been addressed. In this special mode, objects upon being addressed, cause an identification step to be executed whereby the mobile unit recalls an object identity audio clip from the database and plays that clip at an output type user interface, for example a speaker 454. The speaker produces sound waves 455 to alert the user that the device is being pointed at "Tony Anita's Pizza". This example illustrates a first type of multi-media information element which may be associated with a particular object, stored in a database, recalled in response to an object being addressed, and presented at a user interface. There are other types of multi-media information which similarly can be presented to a user.

Moving graphics are quite popular on Internet web pages. Since moving graphic devices enjoy benefit of having minimal bandwidth requirements, they will prove to be popular in devices of these inventions as well. In addition to the audio clip presented above, a further response to a mobile unit's address indicator being directed towards a pizza restaurant object by way of its geometric descriptor may include presentation of a moving graphic on an image display screen. Figure 46 shows a mobile unit 461 having a pixel display screen 462 as an output user interface. Three images 463, 464, and 465 having slight variations between them, played serially with a rapid frame rate, gives the impression of Tony Anita 466 waving 467 his hands in the air. Such a display allows the restaurant to invite a user for lunch in a clever and attractive advertisement played in response to the restaurant object being addressed by the user.

After a brief introductory phase, the system programmed to deliver information of greater utility, shows what is for lunch. Figure 47 includes a mobile unit 471 being pointed via address indicator 472 at the pizza restaurant 473, where a response further shows a text list presented on display screen 474, including a pizza menu 475, and specifically 'Four Cheese' pizza 476. The 'Four Cheese' Pizza may be ordered directly by selecting the item from the list and clicking a trigger thereby causing a request function to send a message to the restaurant. This very important concept illustrates yet another incredible use and function of these inventions to cause an action at the object being addressed as compared to an action at the mobile unit is of spectacular consequence.

Although simplicity of these drawing figures suggests that Tony Anita's Pizza is readily viewed by a user from the user's location, such may not actually be the case. A user may have pointed the device to the restaurant which is hidden behind other nearby buildings. In this case as illustrated in Figure 48, a map 481 of the neighborhood is played at the output user interface, a display 482, as yet another type of multi-media information element associated with the object Tony Anita's Pizza 483.

Although a few types of multi-media data are illustrated here, one will appreciate that other types not shown as examples may serve valuable function in various systems of these inventions. Digitally recorded information such as video files, text fields, icons, photographs, control objects, et cetera, among others, are examples of multi-media data which may be included in an object record as 'information elements'. In agreement with methods of these inventions, they may be presented in response to objects of which those information elements are associated, being addressed.

Special Topic 4: Objects

Although examples above generally include objects which are concrete and of readily discerable structure for example buildings and the like, under some circumstances, an 'object' may not have any physical structure at all but may never-the-less have a geometric descriptor associated therewith. In these cases, an object may be referred to as a 'virtual object'. An example is the restricted airspace over a sitting president's residence, The White House. A rectangular cubic volume of space delimits a region in which unauthorized air travel is strictly prohibited. This is one example of an object having a discrete spatial extent which may be described by a geometric descriptor whereby the object is merely space and has no physical part or concrete structure. Similarly, an infinitely thin planar region may form an object of interest to which a geometric descriptor may be associated and thus systems of these inventions may address. An example of this type of object is the boundary of a baseball playing space known as the foul ball plane. Extending in a vertical plane from home plate and into the cheap seats, the foul ball planes, there are two on each field, marks the limits of the playing field. A foul ball plane may be a virtual type object in certain versions of these inventions.

Further example include cases where an 'object' may be a group of things. Use of the singular form of the word 'object' is not intended to imply there be a limit of only one 'thing' in the object. A collection of buildings such as a group of related apartment units may form a single object for purposes of a geometric descriptor. Thus a large plurality of buildings in a group may be included as a single object having one geometric descriptor.

It is not a requirement that objects be stationary. Moving objects, so long as their motion is well known to a computer system via some means, are fully considered as objects which may be addressed by systems of these inventions. An interesting example is the moon. This object moves quite regularly with respect to GPS sattelites and the Earth. Further all planets similarly move about the sun in a well known and regulated manner. It is a simple matter of applying a bit of mathematics in view of sidereal time to precisely locate a planet. Therefore, Pluto may be an object for purposes of these inventions.

Special Topic 5: Database Filtering

An important aspect of data management, with regard to limited bandwith systems and further in view of the position dependent nature of data of interest, includes forming a data subset and caching it in a readily accessable fast memory. For example, when a mobile device of the invention is located in San Francisco, data relating to objects in Detroit are not of significant consequence. It is unlikely that the General Motors headquarters building would be addressed by users in San Francisco (although, strictly speaking it is possible). Accordingly, programming can be arranged to read a data set and extract portions of data therefrom whereby the extracted data depends upon the user's current position. That position dependent dataset then is transmitted to a special memory which is limited in size but fast in access operations, further that memory can be within the hand-held device thus reducing round trip requests/responses on the network.

In this regard, some preferred mobile units may additionally contain a memory which supports this function. Preferred methods include steps whereby a pre-determined dataset is transmitted to a mobile unit for fast access upon multiple address steps.

D. ILLUSTRATIVE EXAMPLES

As great detail has heretofore been provided with attention to completeness and clarity with regard to a description of the methods and devices, that disclosure is now further improved with a few illustrative examples. These examples show, when properly arranged and provided with detailed information, how these systems will operate to provide exceptional utility and value to all persons who are exposed to these remarkable inventions.

Special Operational Mode #1; Cursor Driver

It is now quite easy to appreciate that the pointing direction of a mobile unit can be manipulated to address objects. In addition to this, there exists special functionality which cooperates with the purpose of these inventions; this functionality is also driven by particular movements of the mobile unit. While the reader is now particularly aware of how systems cooperate with the address states of a mobile unit, the systems heretofore described were concerned with static address states where only an instantaneous address state was considered. In some special versions of these inventions a particular well defined change to an address state controls or triggers useful function.

As thoroughly described in the section on apparatus, tilt sensors are configured to measure angular displacements about two orthogonal axes. Thus *rotations* about the mobile unit reference direction are detectable and useful to drive functionality some versions of these inventions. A very careful observer would note that a twisting motion about the mobile unit reference direction does not necessarily cause the object being addressed to change. An address indicator can remain unchanged as the mobile unit is rotated about the reference direction axis. Careful observers will note this is a special case where the address state changes but the address indicator remains the same; i.e. best versions have an address indicator which is independent of rotation of the mobile unit about the reference direction axis. This is not always the case but remains the in most examples detailed in this disclosure. (See Figure 36 for an exception). These motions of the mobile unit can be coupled to software event triggers which operate to launch various actions in computer code including branching into subroutines to perform predetermined tasks.

Similarly, angular rotations about a vertical axis are measured as changes in heading. These motions can also be used with software event triggers; although it is noted that in this case the address state is changed in a manner which may cause objects being addressed to change. Accountability for such complexities is considered in various operational mode options. This is presented in further detail herefollowing.

With attention directed to Figure 50, the reader will be able to more fully appreciate these concepts. A pretty young lady user 501 extends her arm to point a mobile unit 502 at the Karl Strauss Brewery & Grill and thus causes same to be addressed because pointing reference 504 forms an intersection with banner 505. Set in a special mode for restaurants and in response to a restaurant type object being addressed, the computer offers a toolbar of icons appropriate for such object types on the mobile unit's output user interface, a display 503.

Figure 51 illustrates a mobile telephone 511 used by the lady of figure 50. The device includes an output type user interface in the form of a pixelized display 512, whereon the name of the object being addressed appears in an identity header

513. Additionally, a 'toolbar' 514 of important icons which relate to the object being addressed includes a 'menu request' icon 515 which is selected via the highlighted selection cursor 516. The display arrives in this condition automatically because the address state of the telephone includes an address indicator 517 which is pointing at a geometric descriptor associated with a *restaurant* type object (see Figure 50). The computer knows the object being addressed is a restaurant type object because the results of a database search produces a dataset of addressed objects where one record corresponds to the Brewery and a field in that record identifies the class of the object as belonging to the restaurant class. Provision for sub-classes may additionally be included such that the computer could be notified the addressed object is a restaurant of the type serving American food. Presentation of toolbars as well as other information can be made responsive to the fields containing information relating to objects being addressed.

In view of the fact that the lady pictured desires placing a telephone call to the restaurant, she would like to select the 'place call' icon and deselect the 'menu request' icon. To effect this, she must operate the device in a prescribed manner. Figure 52 sets forth illustration of such an action used to drive movement of a selection cursor. Pretty lady 521 holding mobile telephone 522 simply twists 523 her wrist slightly in a clockwise manner which is detected by tilt sensors. Note the pointing vector 524 remains without change and the banner object 525 remains addressed throughout the twist action. In this situation, before and after address states are considered. It is not an instantaneous address state which triggers action but rather a particular change to the address state from one instant to the next.

In consideration of the drawing in Figure 53, showing telephone 531 with display screen 532, having object identity header 533 and toolbar 534 including 'place call' icon 535 and selection cursor 536, one can agree that simple twist motion can be used to drive a selection cursor without change to an address indicator.

While it cannot be denied that the above described tool is incredibly useful, there are still further useful arrangements which provide significant function to devices of these inventions. Where it is not a concern that the address state is changed, a different rotational motion may be used to drive a selection cursor about a display screen. This alternative technique, a special select mode, is extremely versatile in that it yields greater total control than the previously presented technique.

Figure 54 consists a mobile unit in the form of a telephone. The telephone has a body 541 which is elongated in nature where the length is considerably greater than the width and thickness (not shown). A radio frequency antenna 542 extends from and protrudes outwardly from the telephone body to give a natural feel and a bias with regard to a pointing direction; the antenna suggests a natural pointing direction for the telephone. A display screen 543 is an output type user interface of the type having a pixelized array of discrete picture elements. The a pixelized display screen nicely supports use of icon devices in a toolbar arrangement 544. The mobile unit may have a point reference 545 in the geometric center of the device. In agreement with a natural pointing direction, the mobile unit reference direction 546 is arranged parallel with the antenna on the axis of the elongated telephone body. For purposes of this discussion, the drawing includes five regions separated by thin lines and a special marker dashed line 547.

In an initialization step of this special select mode, a display screen toolbar as well as a direction origin may be set as follows. The mobile unit 551 having a display screen 552 with toolbar 553 having an icon in the center arbitrarily initiated with the 'focus' or the selection cursor 554 (the terminology which includes the word 'focus' is consistent with that used in programming arts and languages to refer to a programming object having the attention of the current process). Upon initialization, mobile unit pointing direction 555 causes an origin direction 556 to become set. The field indicated by stippling in the drawing is the addressed field 557.

While placed in a special select mode, a user wanting to change the selection cursor from the center icon to either of the other icons can cause such action by merely manipulating the pointing direction of the phone to cause the selection cursor to move accordingly. Figure 56 illustrates a mobile unit 561 having been initialized as described above and further having been rotated about a vertical axis by approximately ten degrees counterclockwise whereby the telephone pointing direction 562 no longer points towards the origin direction 563 but rather now points to a newly addressed field 564. This rotational displacement to newly addressed field 575 is detected via the attitude determining means and causes the computer to shift the selection cursor 565 to the adjacent icon to the left, the same direction as the angular displacement.

Similarly, a user can use the mobile telephone 571 of Figure 57 to cause the selection cursor 572 to engage a 'check' icon. In accordance, pointing direction 573 has been displaced from origin direction 574 by approximately 20 degrees in a clockwise rotational displacement. Although this manner of choosing from a plurality of function icons is quite useful on its surface, the full utility of this selection mode can be better appreciated in view of the following example directed to a more well-known problem.

When entering alpha-numeric data into a device having a limited keypad there exists the problem of repetitive and complex key stoke combinations to arrive at a certain character. To relieve this problem, a special selection mode has been devised and invented. First consider the telephone 581 depicted in figure 58. Imagine this phone has been placed into a phone book data item entry mode as indicated by phone book icon 582. A telephone number "366-1108" 583 is entered as a number to be stored in memory along with the name of persons assigned that telephone number, "Frank and Judy", indicated by name label 584. While in a conventional telephone creating or modifying the name label requires entering alpha-numeric characters via a key pad, these inventions include a special selection mode where entry of alpha-numeric characters is made simple via mere rotational displacements of the telephone.

While in a special selection mode, no regard is given to objects being addressed and no database searches are necessary. Rotational movements of the mobile unit cause various scroll activity at the display. With reference to Figure 59, one preferred technique is illustrated. Similar to the last arrangement a set-up step includes establishing an origin direction 591. While the mobile unit addresses the middle field, a 'hold' function is realized and the character remains unchanged. To advance to another character in a character set one could enter a 'Forward Slow Scroll' 593 function by addressing the field right of and adjacent to the center field.

A rotation further causes a 'Forward Fast Scroll' 594 function to be initiated whereby the characters are rapidly changed from one to a succeeding character. Similarly, a 'Reverse Slow Scroll' 595 and a 'Reverse Fast Scroll' 596 function are achieved via rotational displacements of between about five degrees and fifteen degrees and fifteen degrees and twenty-five degrees respectively in a counterclockwise sense.

The scheme is not limited to angular rotation in a horizontal plane. Rotations characterized as pitch could also be detected and used to cause additional function. Figure 60 shows a special grid of labels in a middle row 601 including: 'Reverse Fast Scroll'; 'Reverse Slow Scroll'; 'Hold'; 'Forward Slow Scroll'; and 'Forward Fast Scroll' character advance functions. In addition, a top row 602 corresponds to a 'Last Letter' function and a bottom row 603 corresponds to a 'Next Letter' function.

Figure 61 shows the grid of figure 60 in a perspective view with a mobile unit of these inventions 611 pointing indicated by arrow 612 towards 'Forward Slow Scroll" 613 field. The reader will be reminded that the present pointing state is compared to an origin pointing state illustrated as 614. To cause a 'Last Letter' action, the mobile unit is tilted upward at least five degrees causing the 'Last Letter' 615 field to be addressed. It should be noted that this mode ignores position altogether and it can be used wherever a mobile unit is at anytime.

This very important example illustrates that abstract objects such as fields assigned to certain functions may be addressed with mobile units of these inventions. More particularly, a user can enter and exit functional modes of the computer by changing the address state of the mobile unit.

Although the example presented is considered exceptional, of more importance is the fact that general computer function is engaged and controlled via changes to address states. Accordingly, one should be cautious when considering the scope of this part of these inventions. It should not be limited to functions where characters are changed but rather the techniques apply to any computer functions which are to be set into action.

Special Operational Mode #2; Point to Call

Although briefly mentioned in several places above, a 'point-to-call' function can be better understood in view of the following more complete description. As some preferred versions include integration with a common mobile telephone, telephone services may cooperate well with function provided by '*point-and-click*' activity. Presently, when a person wishes to contact someone by telephone it is a requirement that a numeric address, a telephone number be entered in order that the call be routed to the desired recipient. Without a telephone number, it is impossible to connect the call. To get the correct telephone number, a user may employ the services of a directory assistance at extra costs, both money and time, to the caller. In addition, it requires the sometimes difficult step of explaining to an operator the correct title of the intended recipient which is not always known to the caller. Due to these difficulties, among others, this process is quite unpopular.

In contrast, a user may easily place a telephone call with the aid of concepts presented here. By simply using a '*point-and-click*' action, a user can become connected by telephone to a desired entity. The mobile telephone having a pointing reference is directed by the user towards an object to which a telephone call is to be placed. Objects may includes such entities as hotels, restaurants, ticket agencies, et cetera. Any object which has a telephone associated therewith can become the subject of this special operational mode. Upon a trigger action, the mobile unit determines the object being addressed, recalls from the database data relating to the object including a telephone number, and completes the point to call action by initiating a voice connection to the addressed object via wireless link. The activity remains mostly transparent to the user, who merely has to point the device and click a switch to place a call.

Special Operational Mode #3; Friends and Family

To locate members of a social group, or to facilitate meetings of persons belonging to a club, systems may be arranged to cooperate with this objective. The opposite is also true; where a person is an undesirable contact, a *persona non grata*, or a person to be avoided such as in the case where a restraining order has been placed against one individual with regard to contact with another, devices can be arranged to aid managing these scenario.

A group of persons operating in conjunction with others from the group may act as follows. By 'registering' with the special operation mode manager a person alerts the system to the desire to be fount by others in the predefined group. When another group member attempts to learn of the whereabouts of others via a point-and-click action, the system may respond by providing indication of the presence or absence of group members or individuals.

In other schema, users are provided via computer functionality the ability to create private virtual objects. For example a user may wish to place a billboard for others to see where the billboard is only known to particular registered users. The data associated with the virtual object, for example text data, may also be created and provided by an initiating user. By applying point-and-click actions, a user in 'the know' enjoys the opportunity to address the virtual object set up by his friend.

Where a court orders a person to refrain from coming into contact with another users of apparatus and methods may check to see if a building is 'clear' of certain persons who may be registered by order of a court.

Special Operational Mode #4; Shopping

Shopping tasks are simplified in view of the devices presented here. By now, most serious shoppers are aware of the bulk warehouse shopping stores sometimes operated under tradenames such as 'Costco' and 'PriceClub'. In these stores, huge palettes of product in extra-large sizes rests in rows upon rows of goods. A shopper will quickly fill a shopping cart or two with items before passing through the entire store. A simpler method for bulk shoppers is to point-and-click on items to be purchased. In this way, a data list is formed which can be brought to a checkout counter. While clearing checkout, store staff assembles and packages the entire order without need for handling the items at the checkstand. Arrangement for delivery may be immediate to the parking lot or postponed for delivery at a remote location. One will appreciate that casually walking the aisles of a superstore while pointing-and-clicking on items will simplfy shopping. Accordingly, devices may be arranged to determine position and the pointing attitude of a hand-held device which thereafter is connected to a product offered for sale.

Special Operational Mode #5; Challenge Games

One cannot deny the importance of computer type electronic games which has partly inspired and accompanied the rapid development of the digital age. In that regard, it is important to consider that gaming strategies will quickly be built upon the foundation of the devices first taught and presented in detail here.

Gaming strategy may be developed from infinite sets of rules whereby rules relate in-part to positions of things in relation to positions of other things. When formed in cooperation with systems taught here, gaming strategy offers a completely new dimension to computer game theory. Computer games which bring the user's immediate environment into the action and objectives of the game will be enjoyed by all who carry a telephone. A few examples herefollowing suggest how games will be created to employ the powerful notion of '*point-and-click*' in the real world.

Hide and Seek - Although the simplicity of '*Hide and Seek*' suggests a child's game, we rely on it here as a clear and straightforward example. Players having mobile devices set out from the start of the game and travel to well dispersed positions; each player taking up a different location. Their mobile device, in communication with a central processing unit, i.e. via a network, reports the position to the game managing code. A geometric descriptor is formed for each player with regard to the position reported. Thereafter, the person who is 'it' must address locations where it is suspected that players are hiding. Upon being addressed, the game managing code makes a determination whether a player is hiding therein. On finding a player in this manner, the both the person 'it' and the player are properly notified. The last player found becomes the new person to be 'it'.

It is important to note that without modification whatever to the devices taught here, a game code running at a server transforms a device into a computer game type device. It should not be considered novel that one may dream up various games arrangements each employing the devices identical to those presented. Thus, the reader is reminded that no attempt has been made to catalogue all possible games scenarios, but rather we respectfully point out that devices of our inventions will be well positioned to be arranged as games of many sorts.

Special Operational Mode #6; Surveying

When configured properly, devices of these inventions are quite useful in surveying techniques and procedure. For example, excavation projects are troubled with the issue of unintentionally digging into facilities which are easily damaged. When digging to replace a aged and broken water pipe in a Point Loma residential neighborhood in California recently, the city workers had to take great care not to puncture a pipe carring Jet5 type jet fuel; Point Loma is near the San Diego International Airport at Lindberg field. The project suffered considerable delays because the pipes carrying jet fuel could not be easily located.

Equipped with a mobile unit having position and attitude determining means and a connection to a database with detailed information relating to pipes, pipe types and their precise locations, construction staff could immediately determine where the jet fuel pipes were located and hence where it was safe to dig.

Similarly, a geologist can locate previously mapped mineral fields. By simply arriving in a mining field and pointing toward various suspect locations a geologist can receive detailed data found in previous explorations without having to read complex charts and make translations into the real world which are highly subject to error.

In addition, a shipping company can provide a ship with a computerized database of information relating to underwater formations including reefs and wrecks. A ship captain and navigator can point a device toward suspected underwater features to precisely locate them. To the casual observer this may at first seem unremarkable. However, in view of highly dynamic true perspective presentation of information, the systems are extremely powerful.

One will now easily and fully appreciate how systems configured with attitude and position determining means may be arranged in methods and apparatus for the purpose of addressing objects of interest, and further for providing information relating to those objects being addressed, and still further for manipulating information relating to objects being addressed. Although the present invention has been described in considerable detail with clear and concise language and with reference to certain preferred versions thereof including the best mode anticipated by the inventors, other versions are possible. Therefore, the spirit and scope of these inventions should not be limited by the description of the preferred versions contained therein, but rather by the claims appended hereto.

What is claimed is:

1) An apparatus for addressing objects, the apparatus comprising:

a directional reference;

a point reference;

a position determining means;

an attitude determining means;

a computer processor; and

a user interface,

said position determining means being arranged to determine the position of the point reference and convey position information to said computer processor;

said attitude determining means being arranged to determine the attitude of the directional reference and convey attitude information to said computer processor; and

said user interface being in electronic communication with said computer processor.

2) An apparatus of claim 1, said computer processor further comprising a database having stored therein information relating to objects being addressed.

3) An apparatus of claim 2, said stored information including a geometric descriptor.

4) An apparatus of claim 3, said stored information including associations with objects being addressed.

5) An apparatus of claim 3, said geometric descriptor being a mathematical definition of a geometric body having spatial extent which may form an intersection with an address indicator.

6) An apparatus of claim 5, said address indicator being defined by an address state of said apparatus.

7) An apparatus of claim 5, said geometric descriptor is an approximation of the space occupied by an object associated with the geometric descriptor.

8) An apparatus of claim 6, said address state is defined by parameters in the group including: position, attitude, range, transverse extent, and time.

9) An apparatus of claim 8, said address state is defined by parameters in the group including: latitude, longitude, altitude, compass heading, pitch, roll, transverse extent, range, range gate, and time.

10) An apparatus of claim 6, said address indicator is defined in part by the position of said point reference as determined by said position determining means and the attitude of said direction reference as determined by said attitude determining means.

11) An apparatus of claim 2, said database including a plurality of records where each record is arranged to correspond to a single object and is arranged to comprise a plurality of fields.

12) An apparatus of claim 11, said records each comprise a geometric descriptor and an association to the object.

13) An apparatus of claim 12, said records further comprise information elements containing multimedia data relating to the object.

14) An apparatus of claim 9, said user interface is a display screen operable for forming images and graphical forms.

15) An apparatus of claim 9, said user interface includes a speaker.

16) An apparatus of claim 9, said user interface includes tactile output.

17) An apparatus of claim 1, the apparatus further comprising a plurality of information elements stored in the computer in a database, each information element

comprising stored information relating to an object which may be addressed by the apparatus.

18) An apparatus of claim 13, each of said information elements further comprising a geometric descriptor being a definition of a geometric body which may be associated with an object which may be addressed by the apparatus.

19) An apparatus of claim 13, said apparatus further comprising an address indicator, said address indicator being a definition of a geometric body being associated with said directional reference and point reference, whereby said address indicator may be caused to form an intersection with one or more geometric descriptors.

20) An apparatus of claim 18, said geometric body being a cone.

21) An apparatus of claim 18, said geometric body being a conic section.

22) An apparatus of claim 18, said geometric body being a conic section is arranged in accordance with a range gate definition.

23) A method of presenting information relating to an object being addressed, the method comprising the acts:

addressing an object;
determining position;
determining attitude;
searching a database; and
presenting information,

said addressing an object being further defined as causing a reference pointing direction to be aligned towards an object;

said determining position further defined as measuring the position of a point reference;

said determining attitude further defined as measuring the orientation of a directional reference;

said searching a database further defined as comparing an address indicator against a geometric descriptor of an information element; and

said presenting information further defined as reporting results of a search where correlation is found.

24) A method of claim 23, said presenting information including information relating to an object being addressed in the addressing an object step.

25) A method of claim 23, said geometric descriptor being associated with an object which is an object being addressed in the addressing an object step.

26) A method of claim 23, said address indicator being associated with said reference pointing direction and said point reference.

27) A method of claim 23, said determining position step includes principles used in global positioning systems.

28) A method of claim 23, said determining position step includes principles used in radio signal triangulation systems.

29) A method of claim 23, said attitude determining step includes principles used in accordance with triaxial magnetometer systems.

30) A method of claim 23, said attitude determining step includes principles used in accordance with laser gyroscope systems.

31) A method of claim 23, said presenting information step further including presenting information at a transducer operable for creating a physical disturbance which may be perceived by a human operator.

32) A method of claim 31, said presenting information step further including presenting information on a display screen in image and graphical form.

33) A method of claim 31, said presenting information step further including presenting information on an audio speaker.

34) A method of claim 31, said presenting information step further including presenting information on a transducer which produces a tactile output.

35) A method of claim 23, said searching a database step further comprising recalling information stored in information elements, each information element comprising stored information relating to an object which is the object being addressed.

36) A method of claim 35, said information elements further comprising a geometric descriptor which is a definition of a geometric body and which is associated with an object that is an object being addressed.

37) A method of claim 23 said address indicator being a geometric body which is associated with said directional reference pointing direction and said point reference.

38) Pointing systems comprising:

a mobile unit;

a wireless network;

a wireless application gateway;

the Internet;

an application server; and

a database,

said mobile unit being in electromagnetic communication with the wireless network, the mobile unit comprising: a computing facility; a point reference coupled to a position determining means coupled to said computing facility whereby the position of the point reference is conveyed to the computing facility, a direction reference coupled to an attitude determining means coupled to said computing facility whereby the attitude of the pointing reference is conveyed to the computing facility, the mobile unit being operable for transmitting requests with encoded position and attitude information to said wireless network, said wireless network is coupled to a wireless application gateway operable for receiving encoded requests from the wireless network and translating encoded requests into Internet Protocol requests and routing them via the Internet to said application server,

said application server being an application specific computer processor operable for receiving requests having position and attitude information therein from mobile units and processing those requests in accordance with a preprogrammed scheme,

said database coupled to said application server via a communication link where information may be exchanged, the database having therein preprogrammed information including geometric descriptors associated with data relating to an object where said geometric descriptors are a spatial definition of the object.

39) Pointing systems of claim 38, said database containing a plurality of records, each record comprising:

a geometric descriptor; and

a plurality of multi-media data elements,

each record relating to a single object, the object having spatial extent and a well defined fixed location associated therewith,

the geometric descriptor being a specification of that spatial extent and well defined fixed location,

the multi-media data elements being information relating to the object associated with the geometric descriptor.

40) Pointing systems of claim 39, said multi-media data elements being from the group: audio information, video information, still photo, graphical, bitmap images, simple text, and animated clips.

41) Pointing systems of claim 38, said application server comprising general purpose computer programming to effect the following steps:

receiving a request from wireless application gateway;

extracting position and attitude information from said request;

performing search to determine addressed objects;

preparing a response; and

transmitting said response to said wireless application gateway.

42) Pointing systems of claim 41, said response includes a message 'no objects in database'.

43) Pointing systems of claim 41, said preparing a response includes forming a list of addressed objects as determined in search of geometric descriptors contained in said database.

44) Pointing systems of claim 41, said preparing a response includes recalling data from a database and using said data to form the response.

45) Pointing systems of claim 38, said mobile unit is comprised of elongated case having a longitudinal axis.

46) Pointing systems of claim 45, mobile unit is further comprised encoding facility.

47) Pointing systems of claim 46, mobile unit is further comprised transmission facility.

48) Pointing systems of claim 45, point reference is within the case.

49) Pointing systems of claim 45, direction reference is aligned with a longitudinal axis of said case.

50) Pointing systems of claim 45, position determining means is GPS.

51) Pointing systems of claim 45, position determining means is e911.

52) Pointing systems of claim 45, attitude determining means is a magneto resistive device.

53) Pointing systems of claim 45, attitude determining means is a dipole compass.

54) Pointing systems apparatus comprising:

a) a direction reference;

b) attitude determining means;

c) computer; and

d) display,

said direction reference being movable via influence from a user,

said attitude determining means so coupled to said movable direction reference whereby a measure of pointing direction may be made,

said computer being in communication with said attitude determining means whereby attitude information relating to said direction reference may be conveyed to said computer, and

said display being conventionally coupled to said computer.

55) Pointing systems of claim 54, said computer further comprising a selection control, said selection control comprising:

i) a plurality of selection items; and

ii) a selection cursor,

said selection cursor is associated with either of said plurality of selection items to form at least one selected item, and

said selection cursor being operable for switching from a first item to a second item in response to a change in pointing direction as determined by said attitude determining means.

56) Pointing systems of claim 54, said computer further comprising a selection control, said selection control comprising:

i) a selection range; and

ii) a selection cursor,

said selection cursor is associated with a value within the selection range, said selection cursor being operable for switching values within the selection range in response to a change in pointing direction as determined by said attitude determining means.

57) Pointing systems of claim 55, said selection control being represented as a graphic played at said display.

58) Pointing systems of claim 57, said graphic being a list of items whereby each of said plurality of selection items appears in the list as a text label.

59) Pointing systems of claim 57, said graphic being a group of icons whereby each of said plurality of selection items is represented in the group by a single icon.

60) Pointing systems of claim 59, said group of icons being a toolbar type arrangement of icons arranged in a linear fashion.

61) Pointing systems of claim 60, said switching occurs from a first icon to a second icon in response to rotational displacements about a vertical axis.

62) Pointing systems of claim 58, said switching occurs from a first text label to a second text label upon rotational displacements about a hoizontal axis.

63) Pointing systems of claim 61, said displacements are about between 3 degrees and 20 degrees.

64) Pointing systems of claim 62, said displacements are about between 3 degrees and 20 degrees.

65) Pointing systems of claim 55, where the effect on the control is applied proportionally with respect to the magnitude of the displacement.

66) Pointing systems of claim 65, where the effect is a rate of change of letters changing serially from one to the next in the order of an alphabet.

67) Pointing systems of claim 65, where the effect is applied to a volume control.

68) Pointing systems of claim 65, where the effect is a brightness control.

69) Methods for triggering computer action relating to an object being addressed comprising the steps:

determining an address state of a mobile unit;

forming a request including parameters of the address state;

transmitting said request to a server computer; and

processing said request at said server computer to trigger an action in accordance with a program running on said server computer.

70) Methods of claim 69, said determining an address state includes a step of forming an address indicator which specifies the address state.

71) Methods of claim 69, said forming a request further includes instructions in agreement with a user selected operational mode.

72) Methods of claim 69, said transmitting said request to a server computer includes systems where the server computer is integral with the mobile unit and transmission is via a wireline connection.

73) Methods of claim 69, said transmitting said request to a server computer includes systems where the request is transmitted via an electromagnetic communication.

74) Methods of claim 73, said transmitting said request to a server computer includes systems where the request is transmitted via a wireless network.

75) Methods of claim 74, said transmitting said request to a server computer includes systems where the request is transmitted via a wireless network in communication with the Internet.

76) Methods of claim 75, said wireless network is coupled to the Internet via a wireless application protocol gateway.

77) Methods of claim 69, processing said request includes a database search step of searching a plurality of records each associated with a particular object.

78) Methods of claim 69, computer action is an action taken at a server computer.

79) Methods of claim 69, computer action is an action taken at an object being addressed.

80) Methods of claim 75, computer action is an action taken in a wireless network.

81) Methods of claim 69, computer action is an action taken in a mobile unit.

82) Methods of claim 69, computer action is an action taken at a remote location which relates to an object being addressed.

83) Methods of claim 78, said database search step further comprises a step of searching records including a geometric descriptor and at least one information element relating to objects.

84) Methods of claim 83, said geometric descriptor and at least one information element are associated with a particular object.

85) Methods of claim 83, said database search includes a step performing a test for intersection between an address indicator and a geometric descriptor to determine objects being addressed.

86) Methods of claim 81, said action taken at the mobile unit includes a step comprising providing an alert perceptible to a user.

87) Methods of claim 86, said action includes steps relating to a gaming scheme.

88) Methods of claim 80, said action includes a step comprised of generating a report at said object being addressed.

89) Methods of claim 89, said report is a reservation for space at a dining facility.

90) Methods of claim 79, said action at server includes a step comprising forming a database of addressed objects.

91) Methods of claim 81, said action taken in a wireless network includes a step comprising effecting a telephone communication connection.

92) Methods of claim 83, said action taken at a remote location includes a step comprising providing an alert to authorities as to an emergency condition.

93) Methods of claim 83, said action taken at a remote location includes a step comprising providing an alert to authorities as to a maintenance condition.

94) Methods of claim 69, the steps thereof being preceded by a pointing step comprising: manipulating a mobile unit having a point and direction reference to cause the point and direction reference to form a spatial relationship with an object of interest.

95) Methods of claim 70, said address indicator is comprised of parameters from the group including: position, attitude, time, temperature, humidity, atmospheric pressure, velocity, acceleration, audio level and wind velocity.

96) Methods of claim 70, said forming an address indicator is comprised of the step measuring position with a global positioning system.

97) Methods of claim 70, said forming an address indicator is comprised the step measuring attitude with a magnetoresistive transducer.

98) Methods of claim 70, said forming an address indicator is comprised the step measuring attitude with a dipole compass.

99) Methods of claim 74, said transmission step is further defined as transmitting data with via a wireless network in a wireless telephone protocol.

100) Methods for triggering computer action relating to an object being addressed comprising the steps:

manipulating point and direction references of a mobile unit to cause a spatial alignment with an object of interest;

causing a trigger event while simultaneously holding said spatial alignment;

in response to said trigger event, measuring the address state of said mobile unit;

generating a request in accordance with a program running on a mobile nit computer processor including at least a specification of the address state including position and attitude measurement;

transmitting said request from said mobile unit to a server computer running application programming;

executing a database search including a step performing an intersection test in view of said request against at least one database record including at least one geometric descriptor to produce a result set;

taking an action in agreement with said application programming whereby said action relates to said result set;

returning data produced in said database search and conveying said data to said mobile unit.

101) Methods of claim 100, said manipulating a point and direction reference step is further defined as pointing a mobile telephone handset toward an object of interest whereby said direction reference substantially intersects the space occupied by the object to form a spatial alignment and association between the mobile telephone and the object.

102) Methods of claim 101, said causing a trigger event is further defined as depressing a tactile switch of a mobile telephone handset while said direction reference substantially intersects the space occupied by the object being addressed.

103) Methods of claim 100, said measuring the address state of said mobile unit is further comprised: measuring the position of said point reference by a global positioning system to determine latitude, longitude and altitude values.

104) Methods of claim 100, said measuring the address state of said mobile unit is further comprised measuring the attitude of said direction reference with a magnetoresistive transducer to determine heading, pitch and roll values.

105) Methods of claim 100, said transmitting request to server step is further defined as transmitting a digital data stream by wireless telephone network link to a wireless application protocol gateway and further to an Internet port and finally to an Internet node connected to a server computer.

106) Methods of claim 100, said intersection test is further defined as performing a mathematical determination for coincidence between a geometric descriptor which defines a spatial extent and an address indicator geometric construct to yield a data set of elements each having been determined positive in the coincidence test.

107) Methods of claim 100, said taking an action step is further defined as calling a computer program function which executes instructions to operate an data produced in said intersection test.

108) Methods of addressing objects comprising the steps:

determining position of a point reference;

determining attitude of a direction reference;

forming an address state indicator which depends on determined position and attitude;

performing an intersection test with said address st
ate descriptor against data stored in a database to yield a result set of data relating to objects being addressed; and

taking an action which depends upon the result set.

109) Methods of claim 108, said action is an action taken at a mobile unit device.

110) Methods of claim 108, said action is an action taken at an object being addressed.

111) Methods of claim 108,said action is an action taker eleswhere.

112) Methods of claim 109, said action is stimulating an output type user interface.

113) Methods of claim 112, said action is forming a list of related data elements.

114) Methods of claim 108, the steps thereof being preceded by a pointing step comprising: manipulating a mobile unit having a point and direction reference to cause the point and direction reference to form a spatial relationship with an object of interest.

115) Methods of claim 114, said spatial relationship is further defined as one where an address vector forms an intersection with a geometric descriptor associated with an object.

116) Methods of claim 108, further comprising the step of transmitting position and attitude information over a wireless communication link to an application server.

117) Methods of claim 108,

118) Methods of claim 109, where said action is initiating a telephone call.

119) Methods of claim 109, where said action is recording object data in a database local to the mobile unit.

120) Methods of claim 112 where action is providing an alarm signal.

121) Methods of claim 120, where said alarm signal is illumination at least one light source.

122) Methods of claim 120, said alarm signal is sounding an audio alert.

123) Methods of claim 112, said action is displaying an image.

124) Methods of claim 113, said list comprises objects being addressed.

125) Methods for triggering computer action relating to an object being addressed comprising the steps:

receiving a request including parameters of an address state of a mobile unit at a server computer; and

processing said request at said server computer to trigger an action in accordance with a program running on said server computer.

126) Methods of claim 125, said processing said request includes a database search step of searching a plurality of records each associated with a particular object.

127) Methods of claim 126, said database search step further comprises a step of searching records including a geometric descriptor and at least one information element relating to objects.

128) Methods of claim 127, said database search step further comprises a step of forming an address indicator which specifies an address state.

129) Methods of claim 128, said database search step further comprises a step of performing a test for intersection between an address indicator and a geometric descriptor to determine objects being addressed.

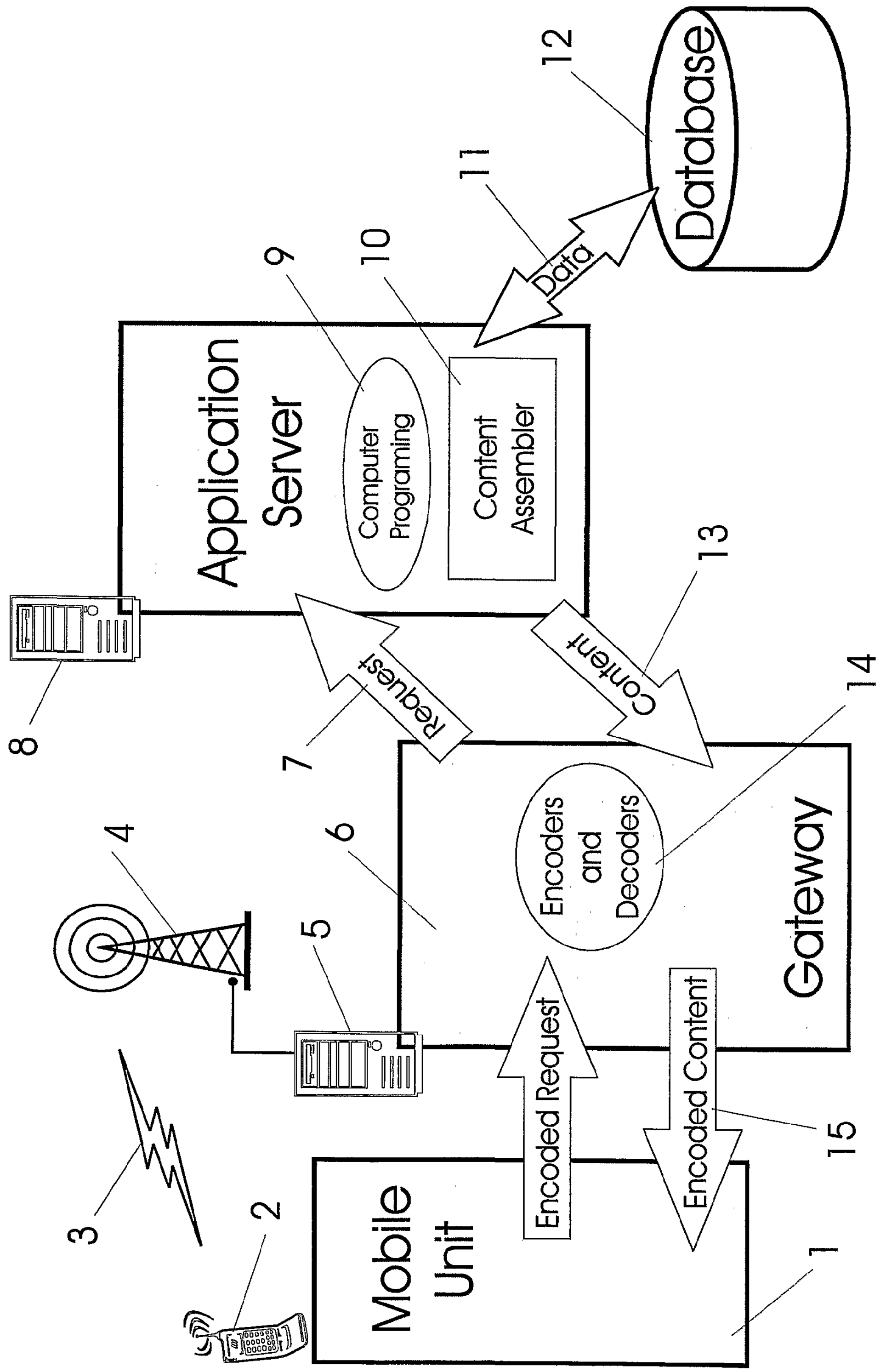

Mobile Unit
Encoded Request
Encoded Content
Gateway
Encoders and Decoders
Request
Content
Application Server
Computer Programing
Content Assembler
Data
Database
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

Fig. 1

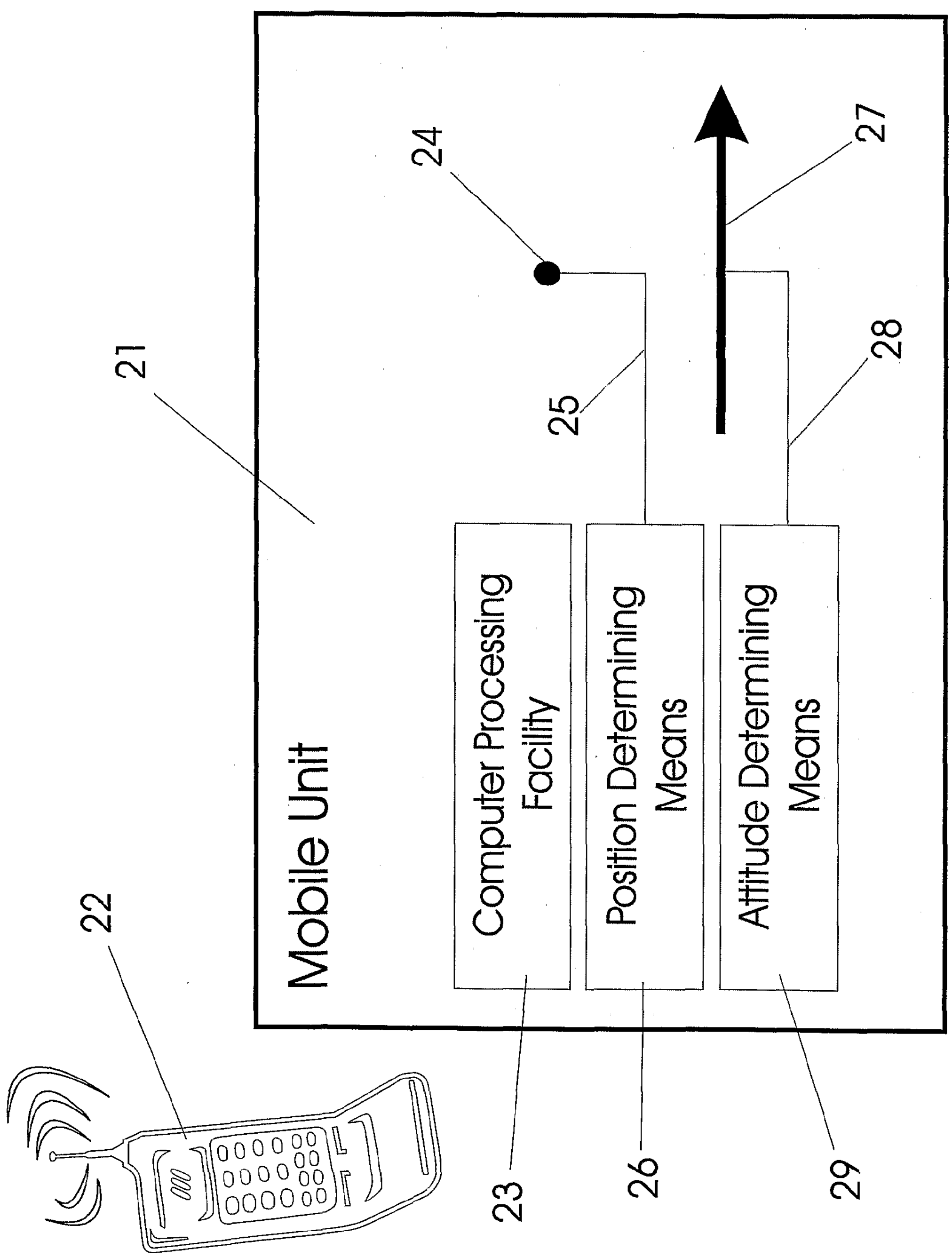

Mobile Unit
Computer Processing Facility
Position Determining Means
Attitude Determining Means
21
22
23
24
25
26
27
28
29

Fig. 2

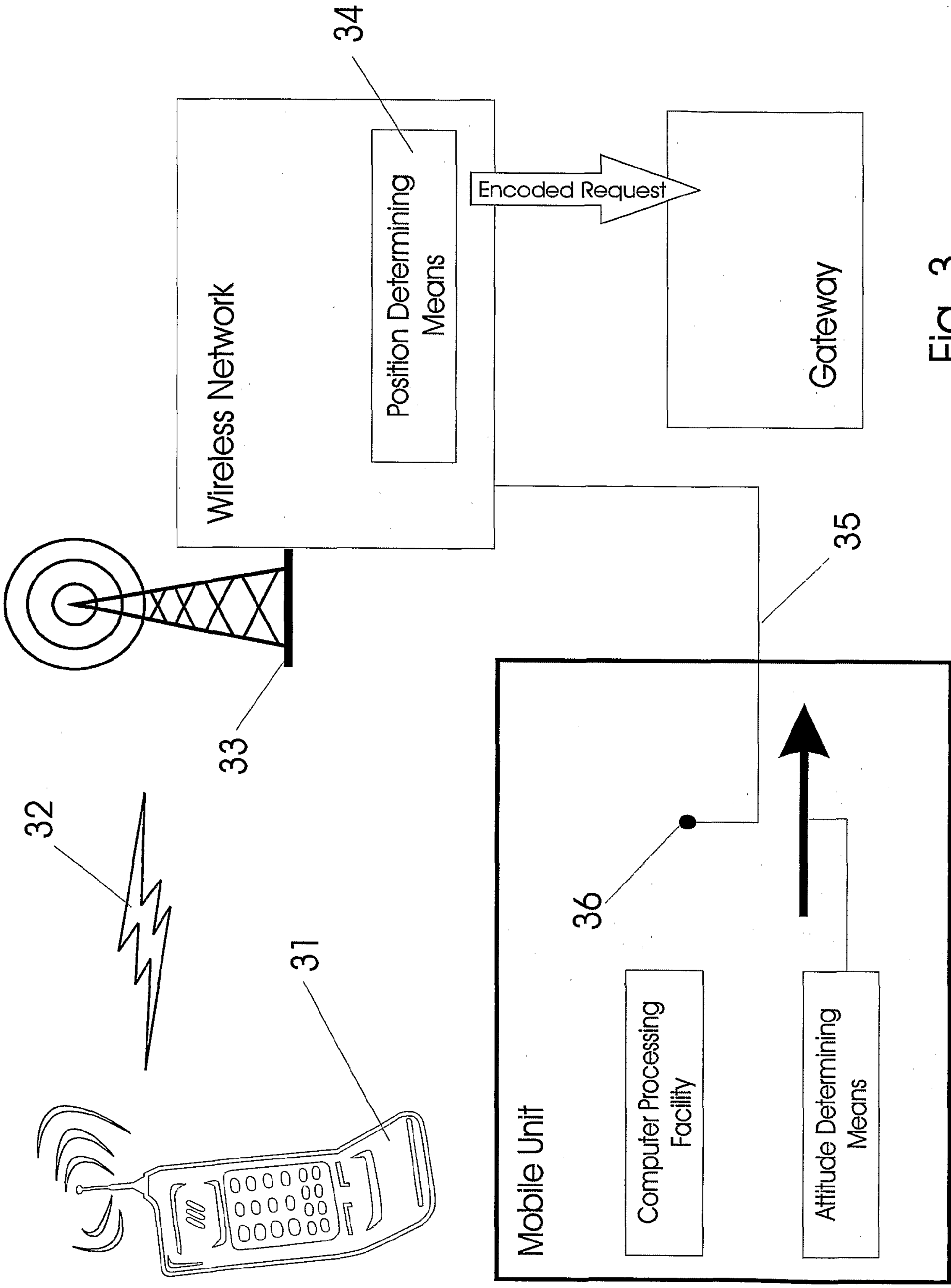

34
Wireless Network
Position Determining Means
Encoded Request
Gateway
33
32
31
35
36
Mobile Unit
Computer Processing Facility
Attitude Determining Means

Fig. 3

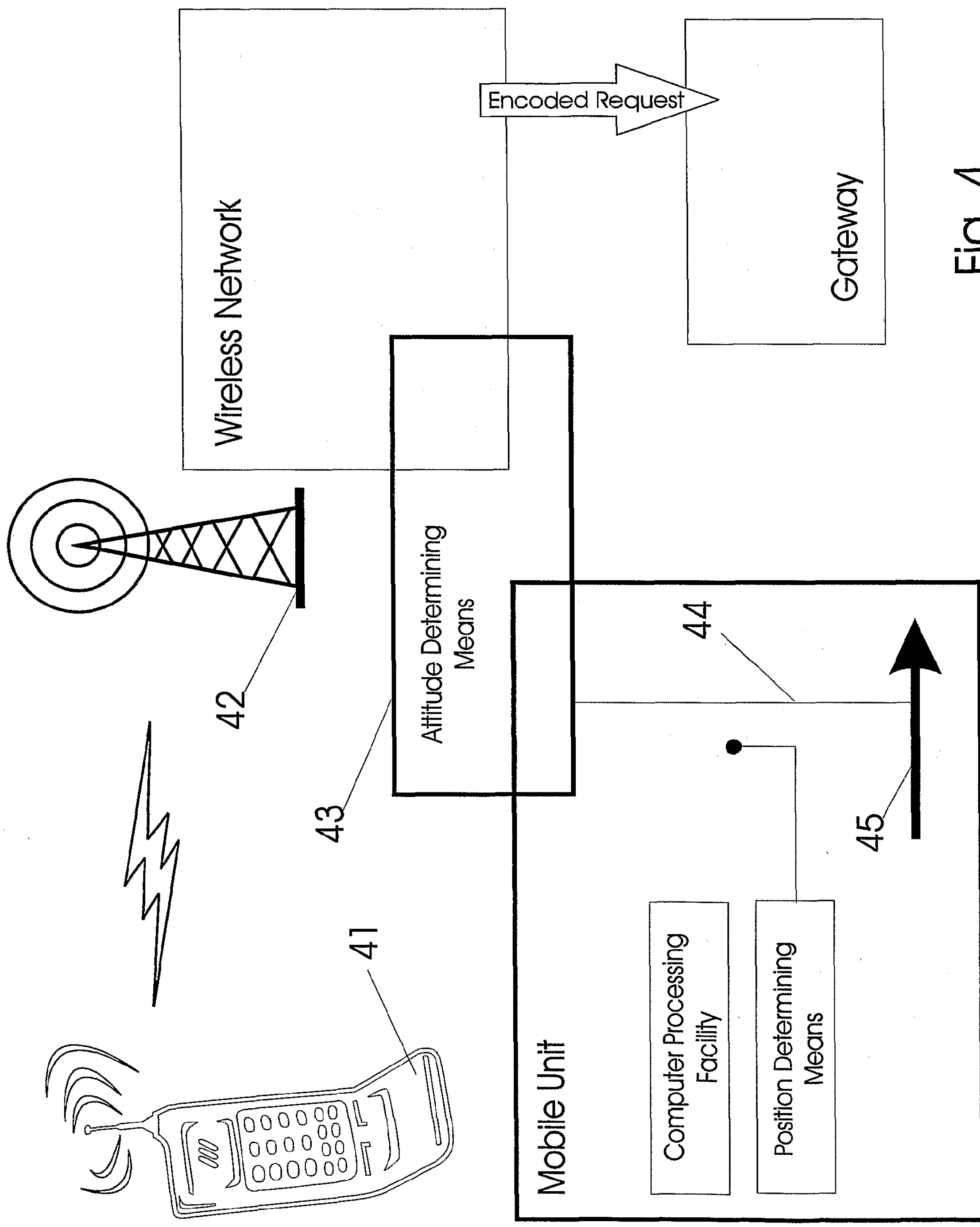

Wireless Network
Encoded Request
Gateway
42
Attitude Determining Means
43
44
45
41
Mobile Unit
Computer Processing Facility
Position Determining Means

Fig. 4

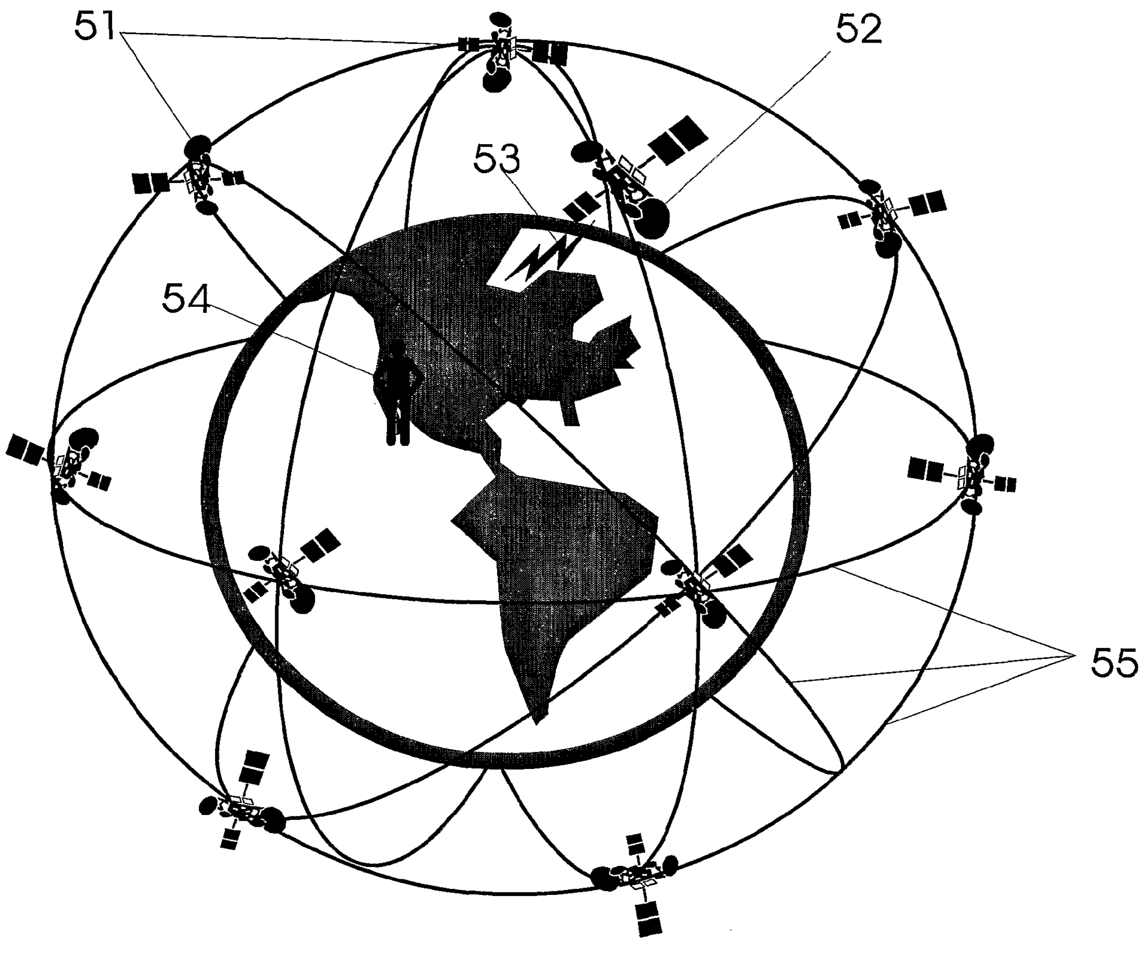


Fig. 5

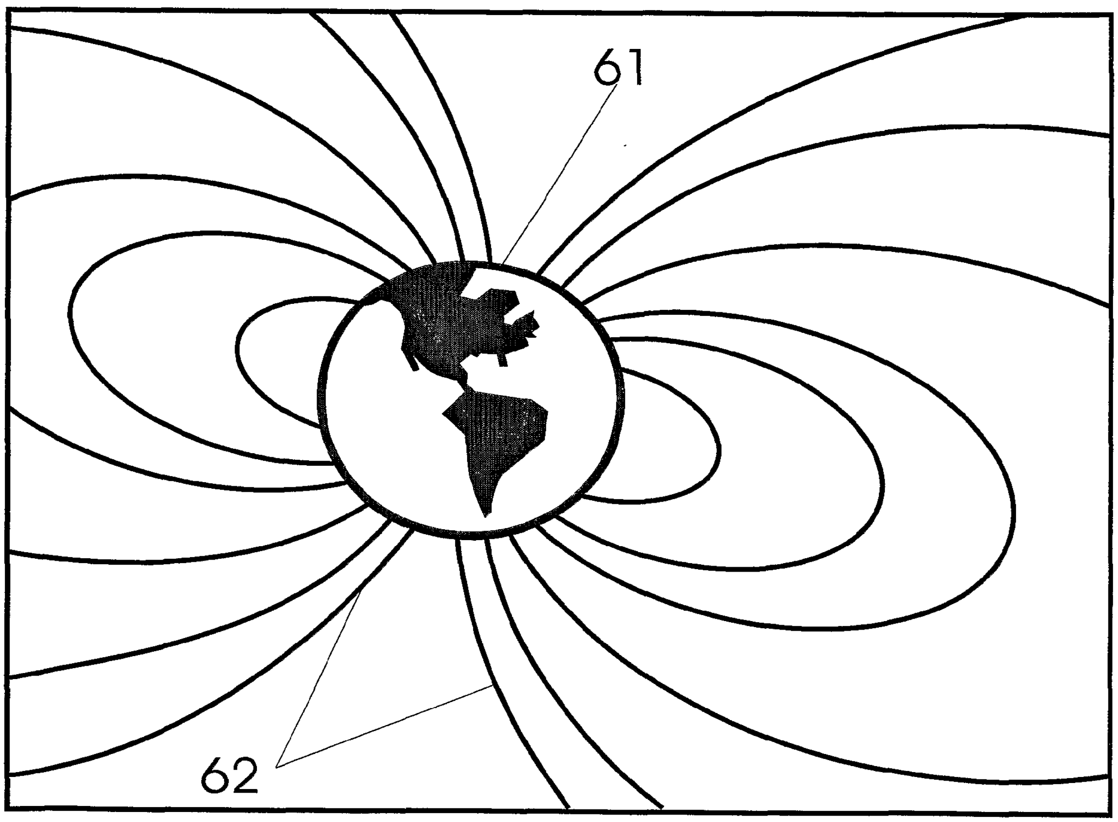


Fig. 6

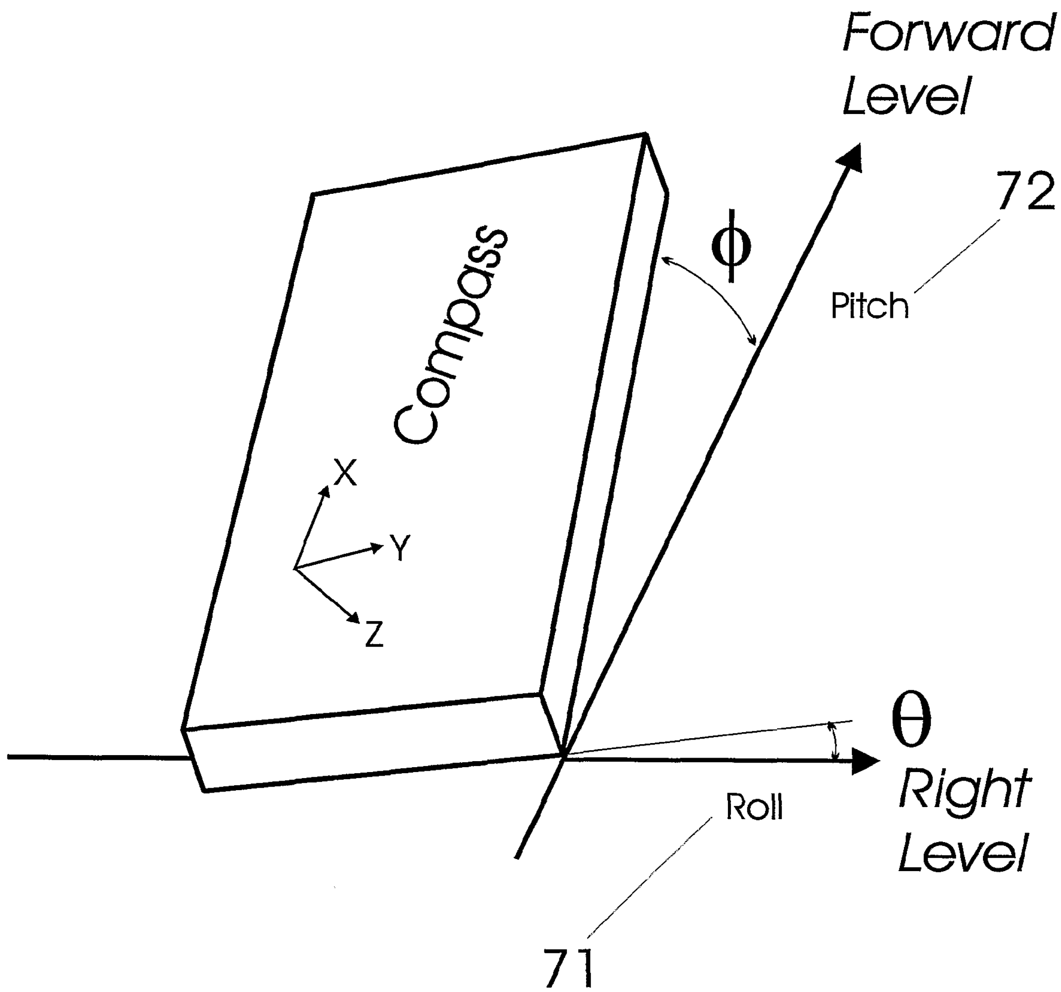


Fig. 7

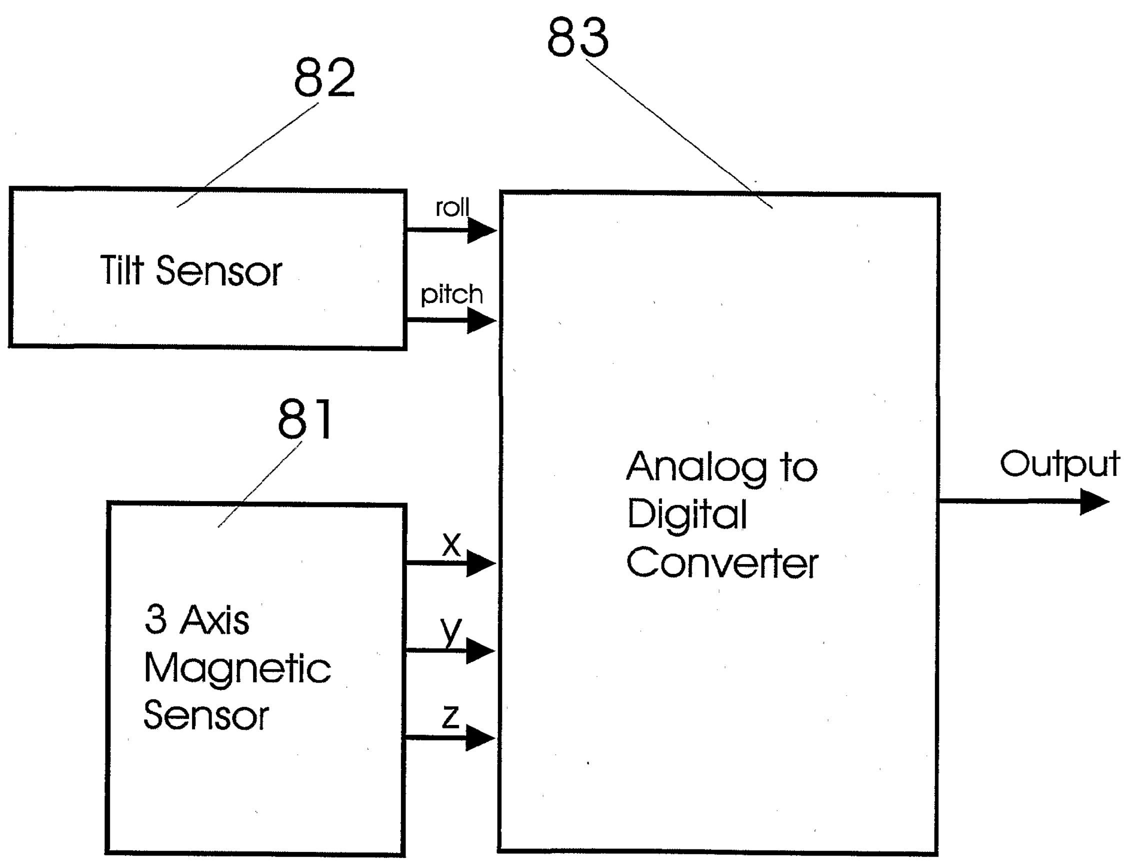

83
82
roll
Tilt Sensor
pitch
81
Analog to Digital Converter
Output
x
3 Axis Magnetic Sensor
y
z

Fig. 8

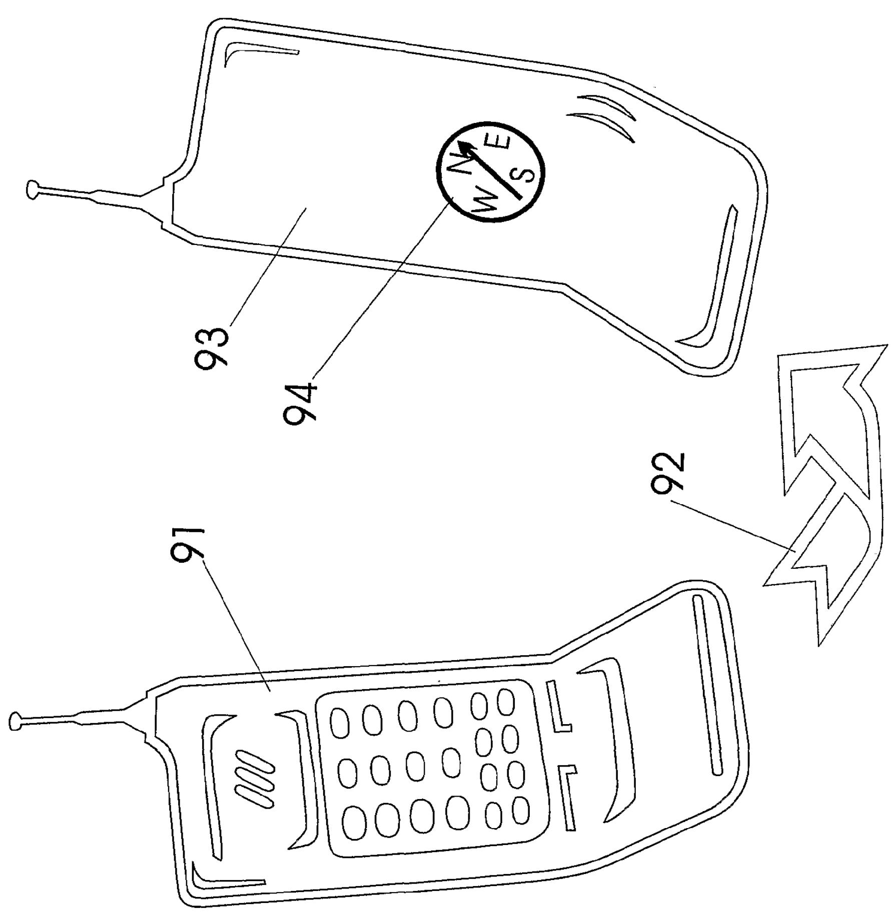


Fig. 9

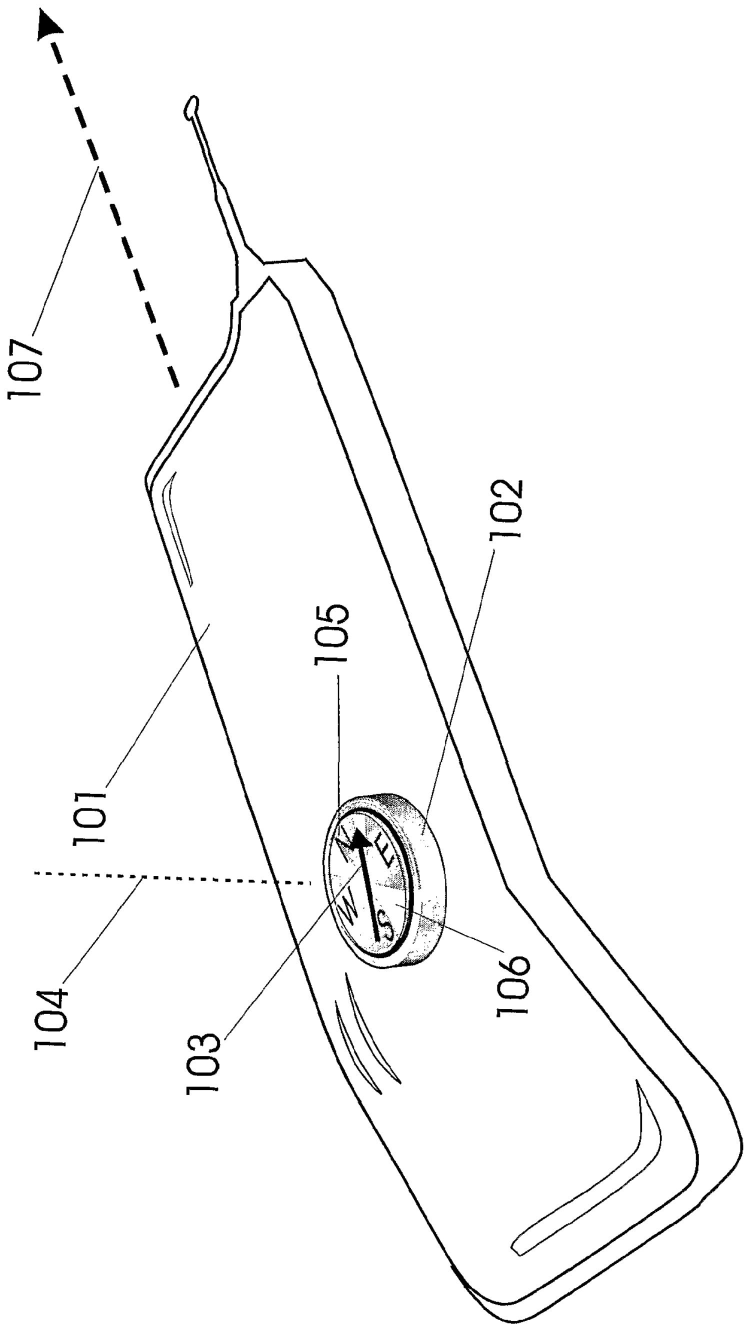


Fig. 10

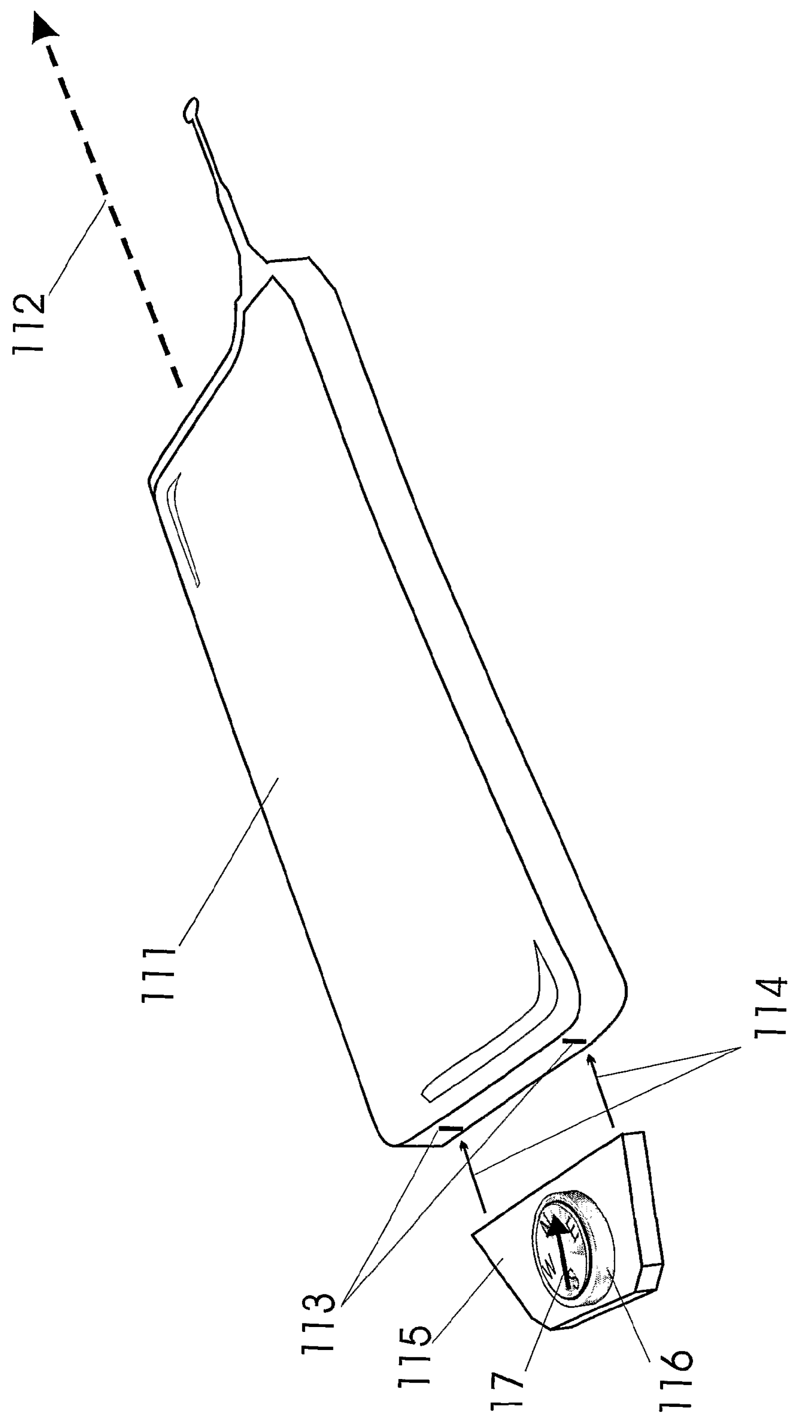


Fig. 11

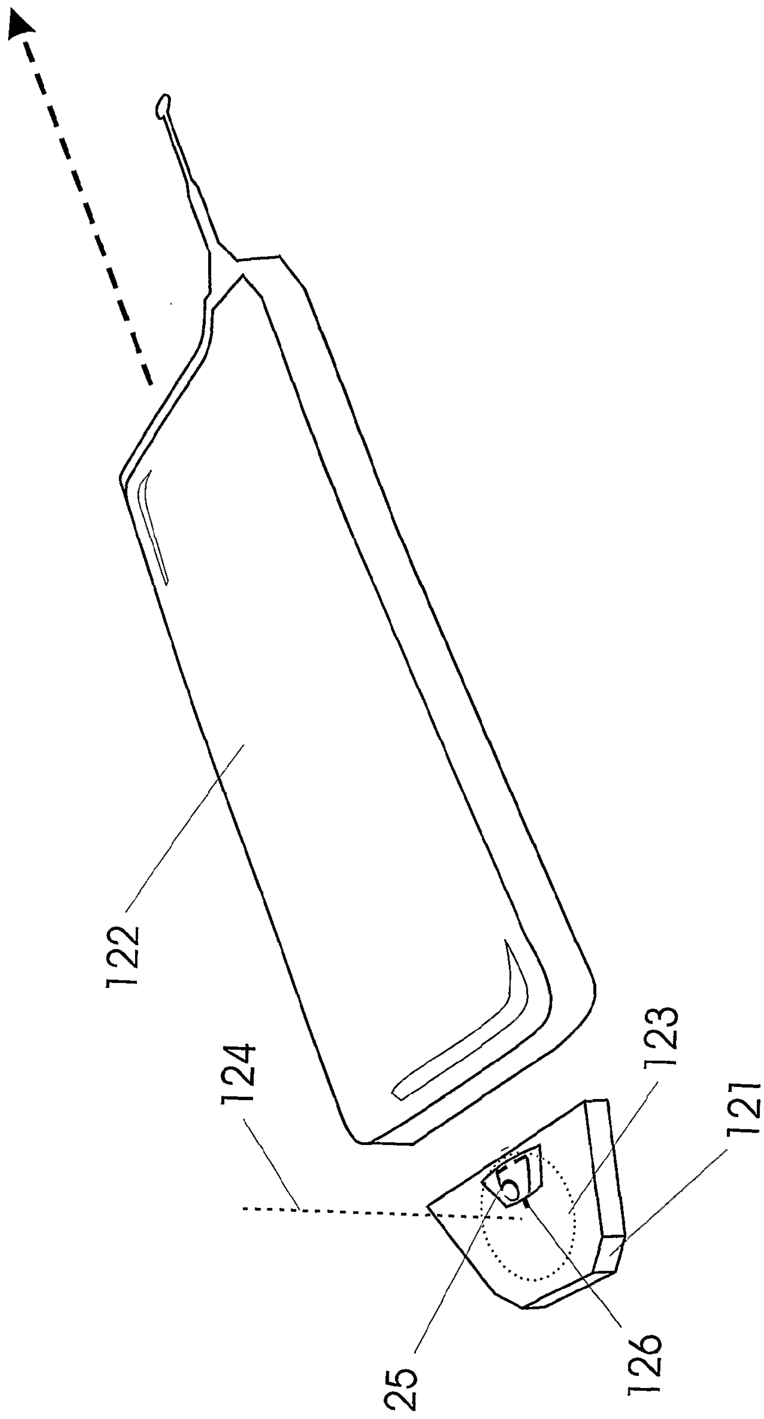


Fig. 12

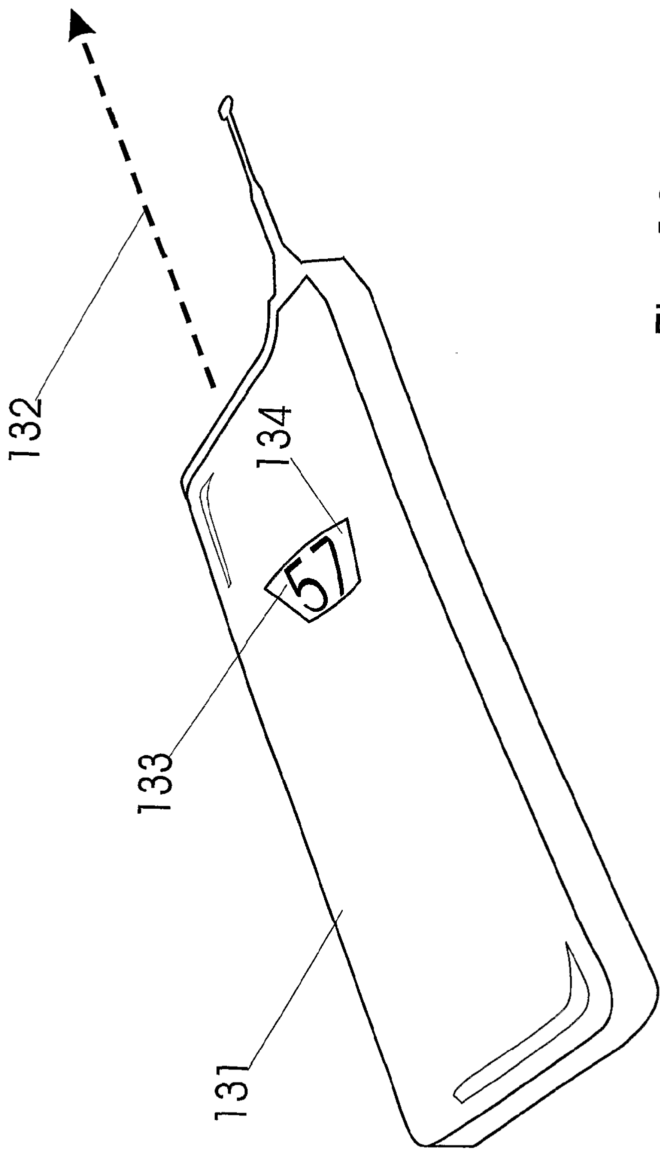


Fig. 13

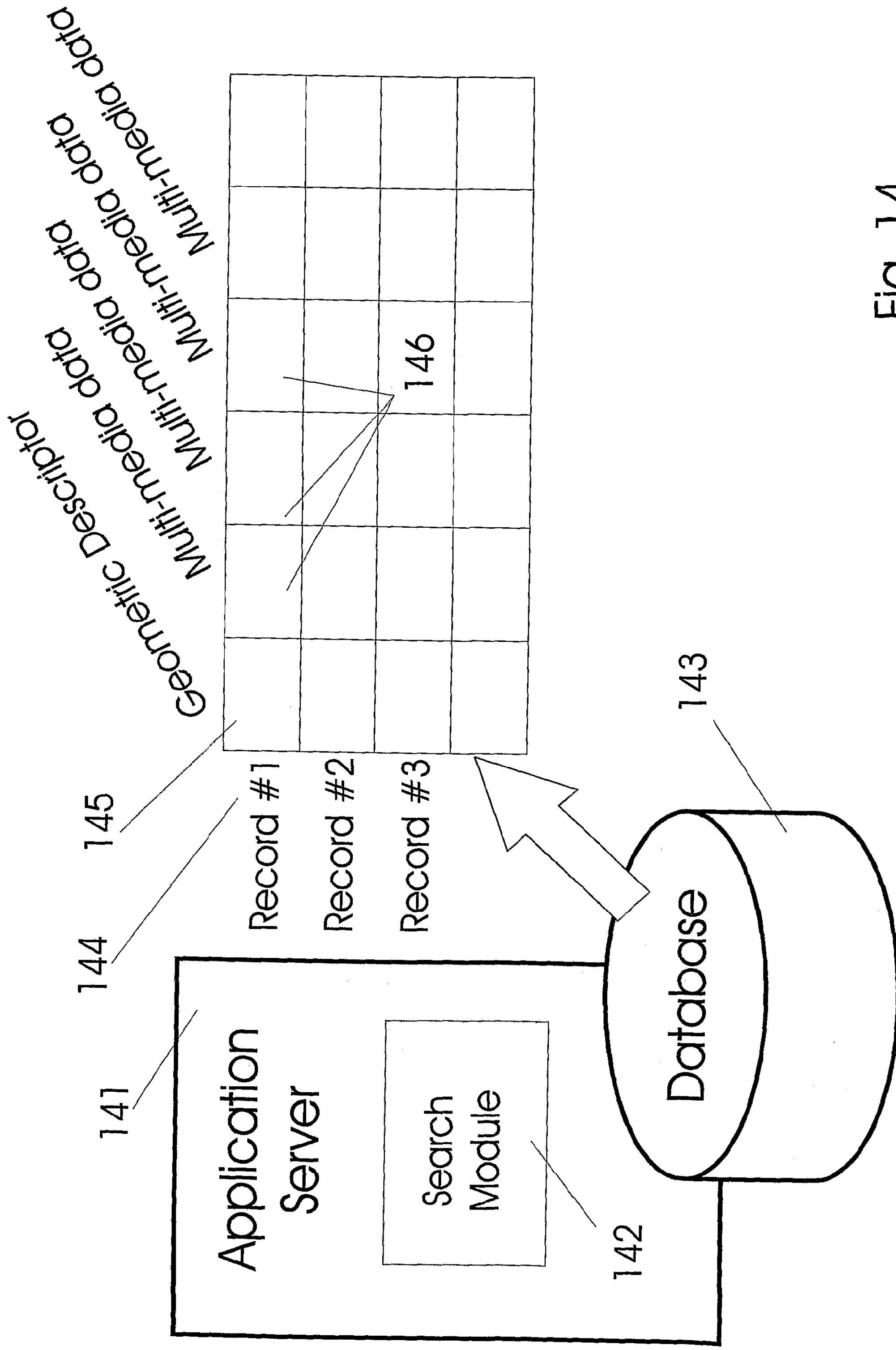

Geometric Descriptor
Multi-media data
Multi-media data
Multi-media data
Multi-media data
146
145
144
Record #1
Record #2
Record #3
143
141
Application Server
Search Module
142
Database

Fig. 14

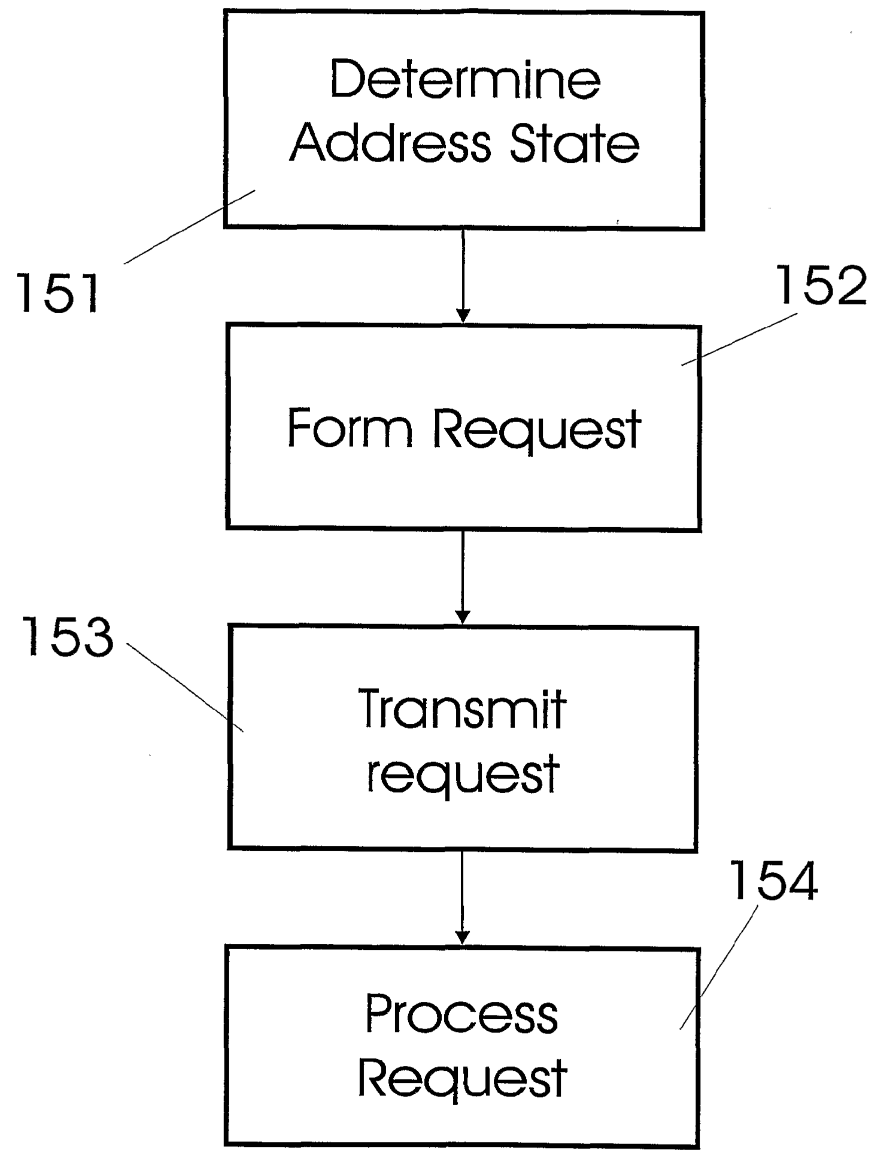

Determine Address State
151
152
Form Request
153
Transmit request
154
Process Request

Fig. 15

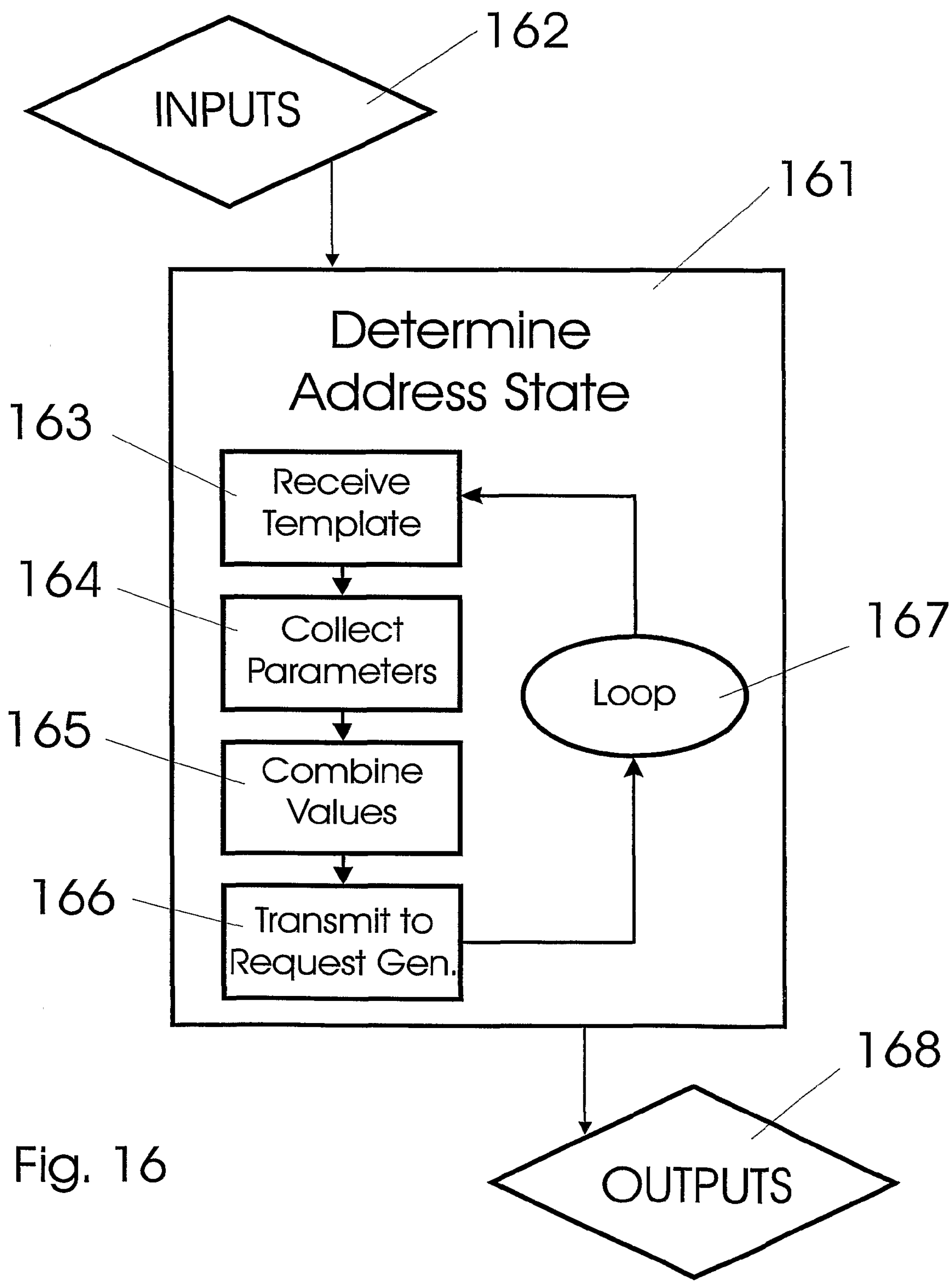

162
INPUTS
161
Determine
Address State
163
Receive
Template
164
Collect
Parameters
165
Combine
Values
166
Transmit to
Request Gen.
Loop
167
168
OUTPUTS

Fig. 16

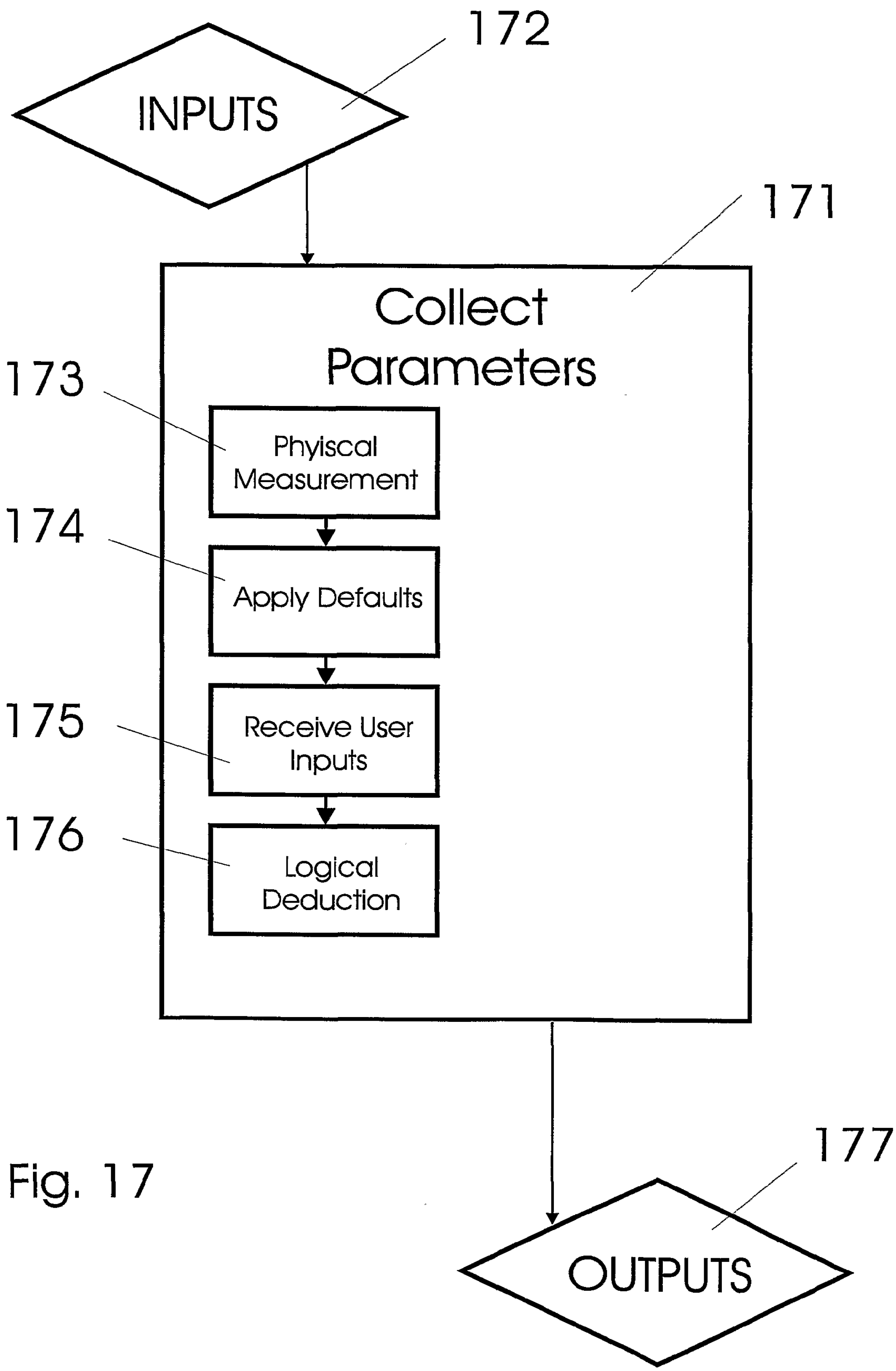

172
INPUTS
171
Collect Parameters
173
Phyiscal Measurement
174
Apply Defaults
175
Receive User Inputs
176
Logical Deduction
177
OUTPUTS

Fig. 17

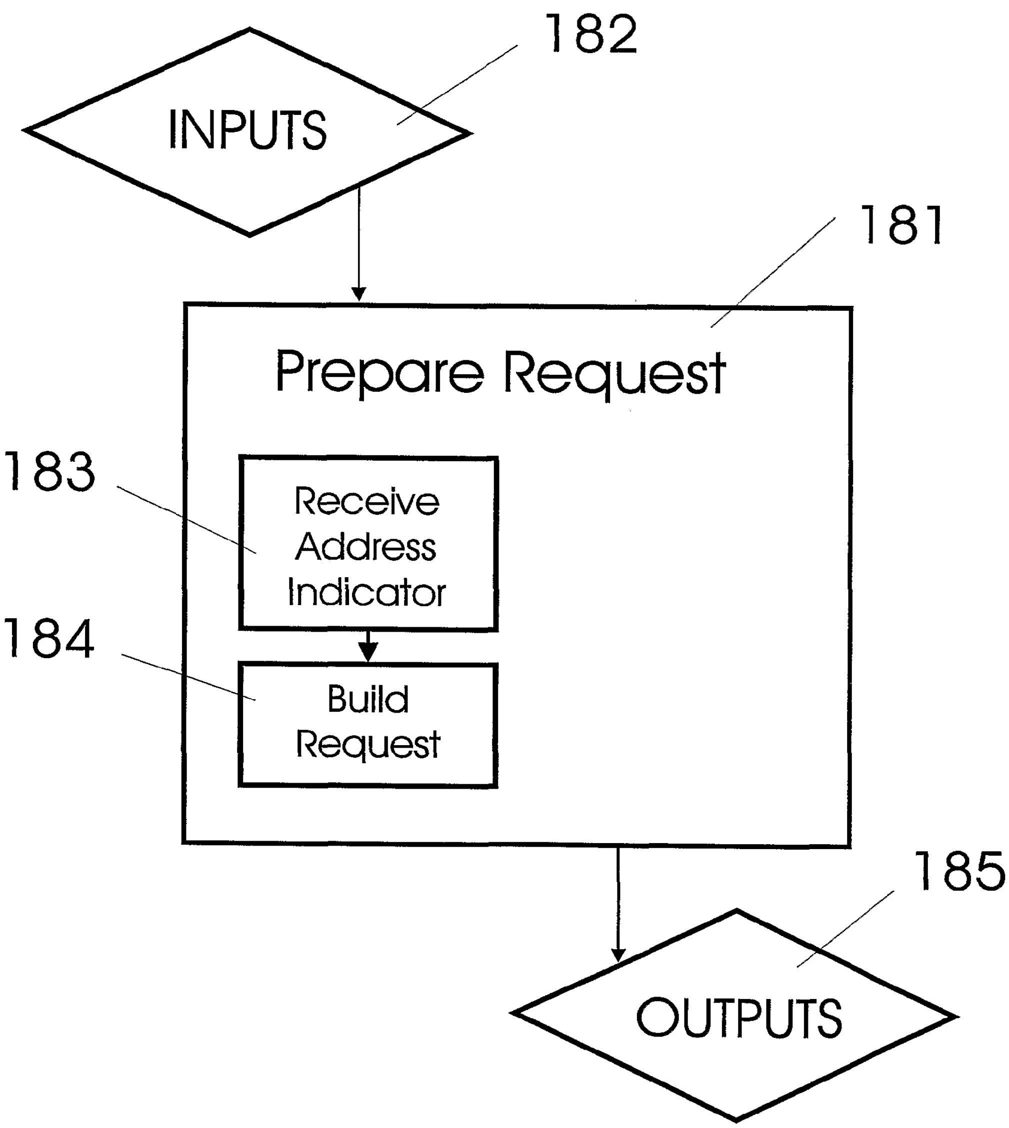

182
INPUTS
181
Prepare Request
183
Receive Address Indicator
184
Build Request
185
OUTPUTS

Fig. 18

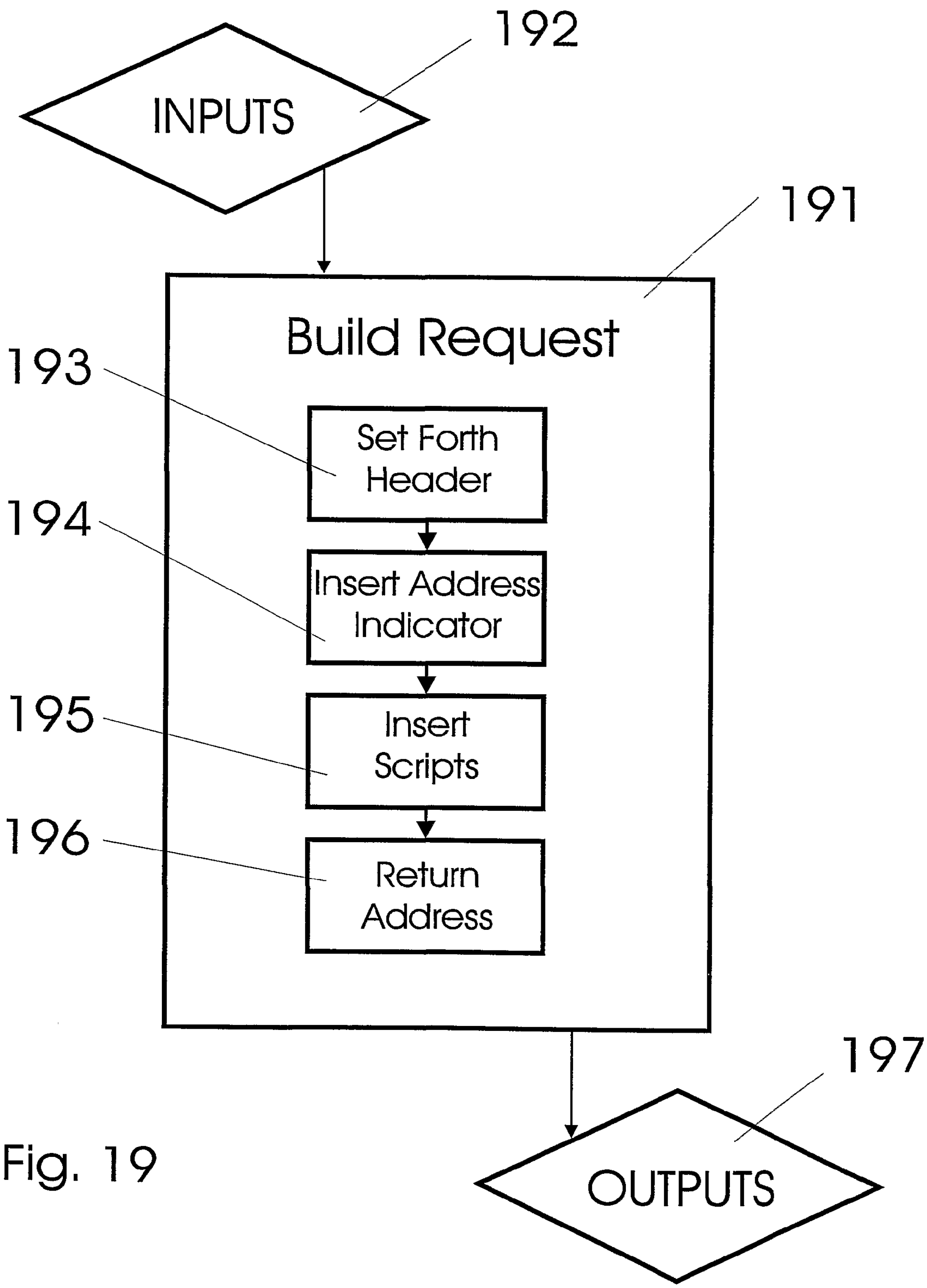

192
INPUTS
191
Build Request
193
Set Forth Header
194
Insert Address Indicator
195
Insert Scripts
196
Return Address
197
OUTPUTS

Fig. 19

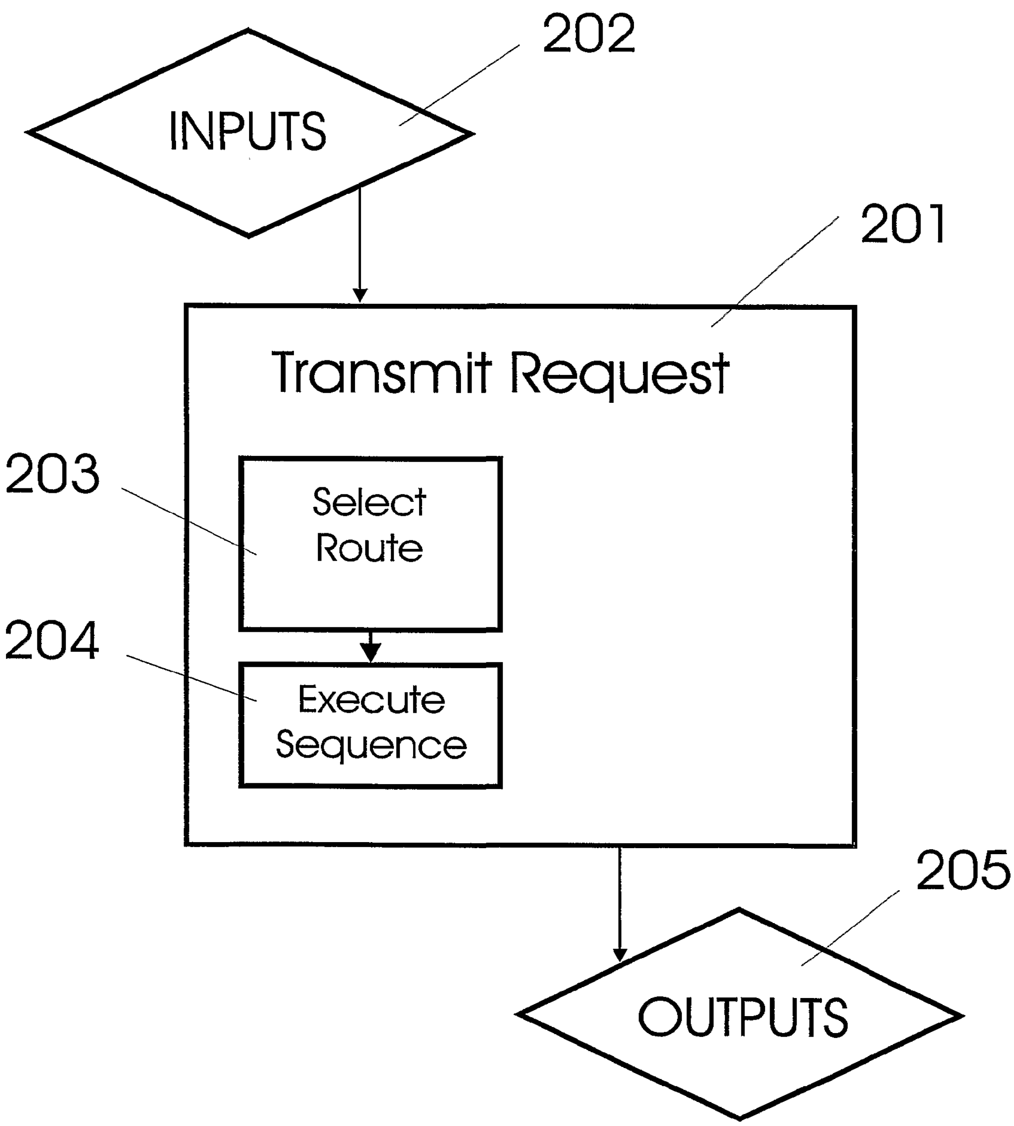

202
INPUTS
201
Transmit Request
203
Select Route
204
Execute Sequence
205
OUTPUTS

Fig. 20

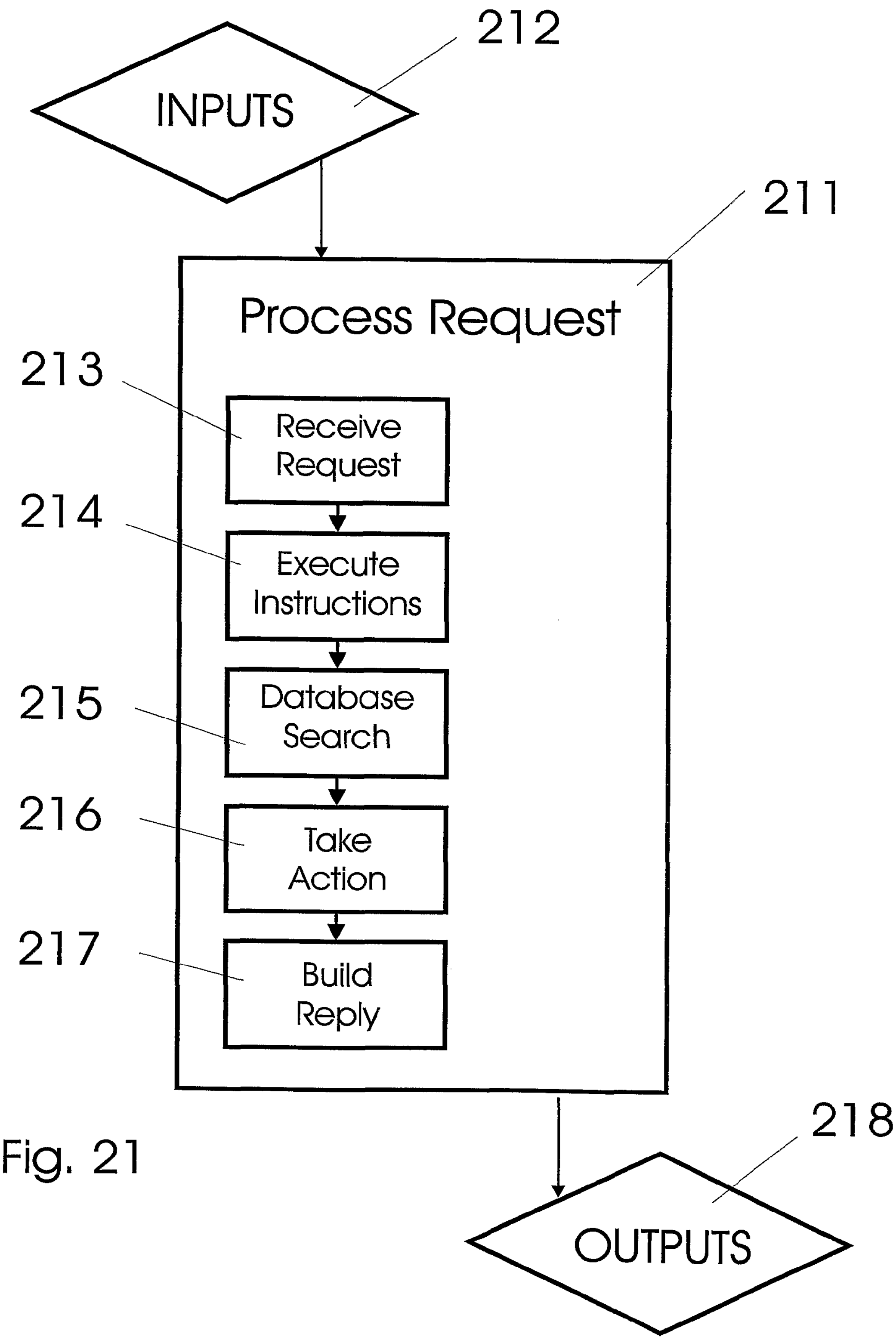

212
INPUTS
211
Process Request
213
Receive Request
214
Execute Instructions
215
Database Search
216
Take Action
217
Build Reply
218
OUTPUTS

Fig. 21

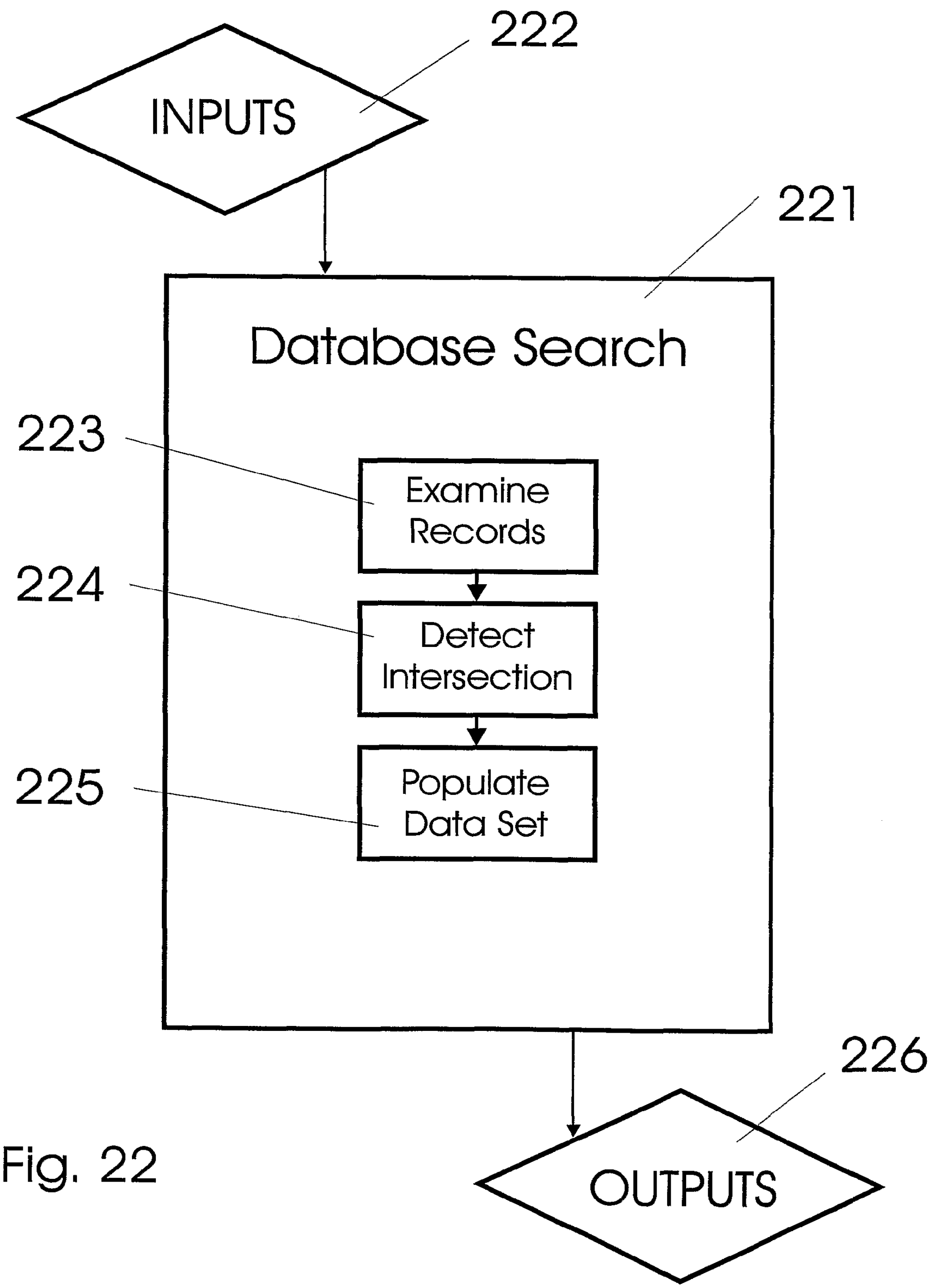

222
INPUTS
221
Database Search
223
Examine Records
224
Detect Intersection
225
Populate Data Set
226
OUTPUTS

Fig. 22

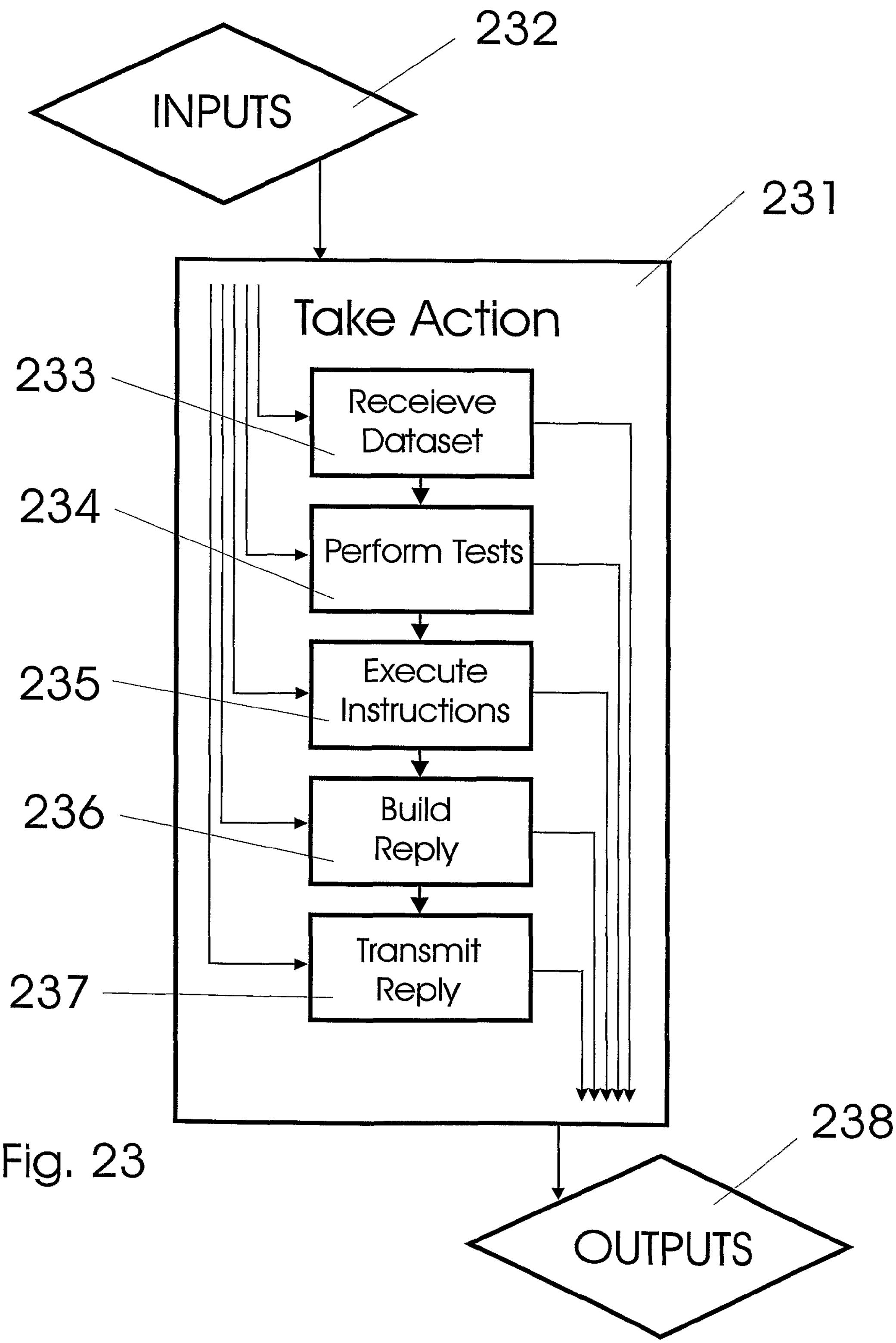

232
INPUTS
231
Take Action
233
Receieve Dataset
234
Perform Tests
235
Execute Instructions
236
Build Reply
237
Transmit Reply
238
OUTPUTS

Fig. 23

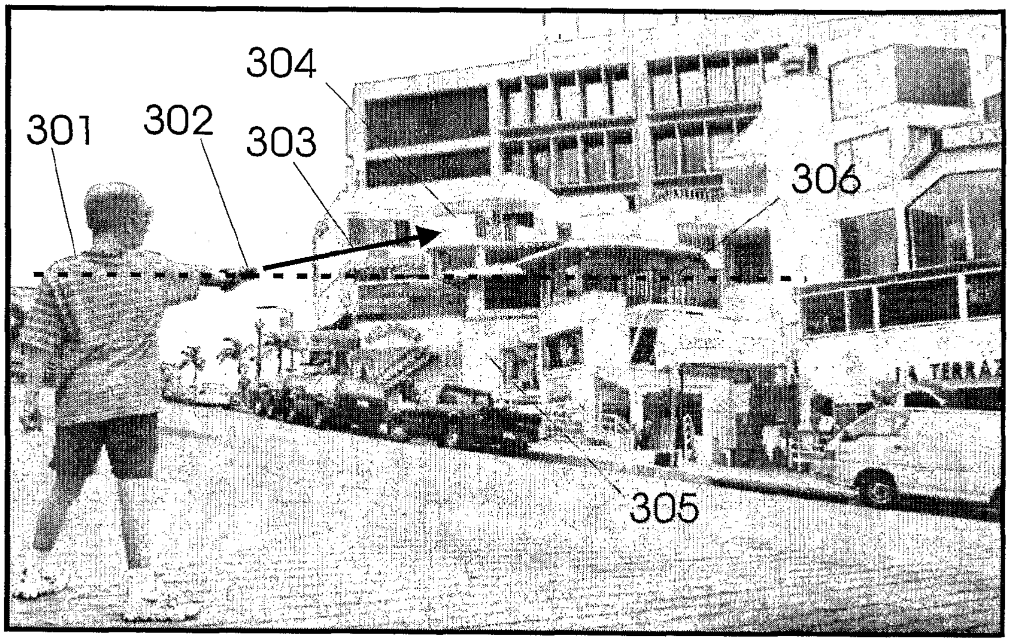


Fig 30

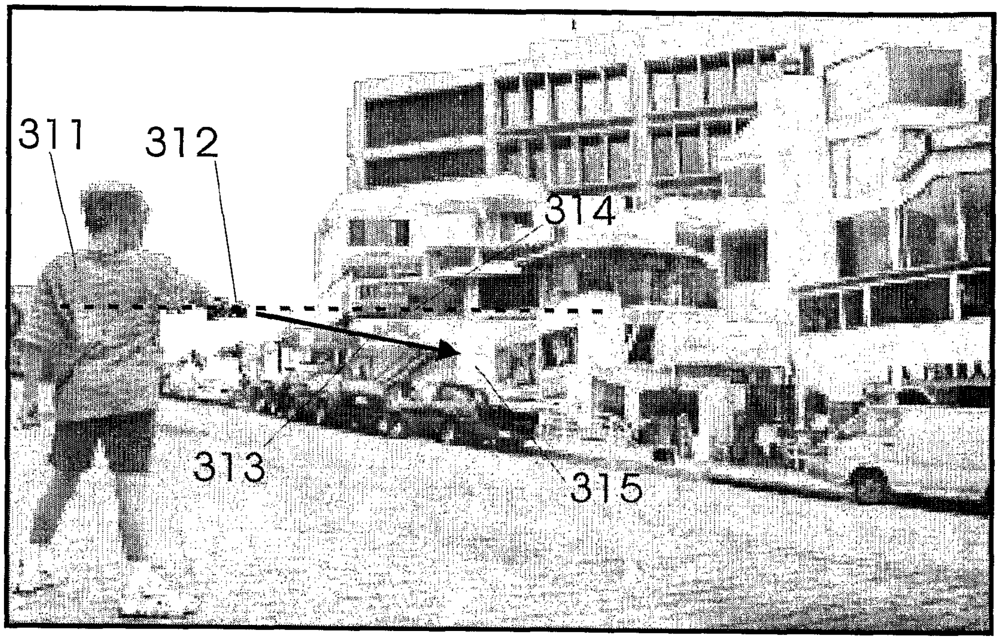


Fig 31

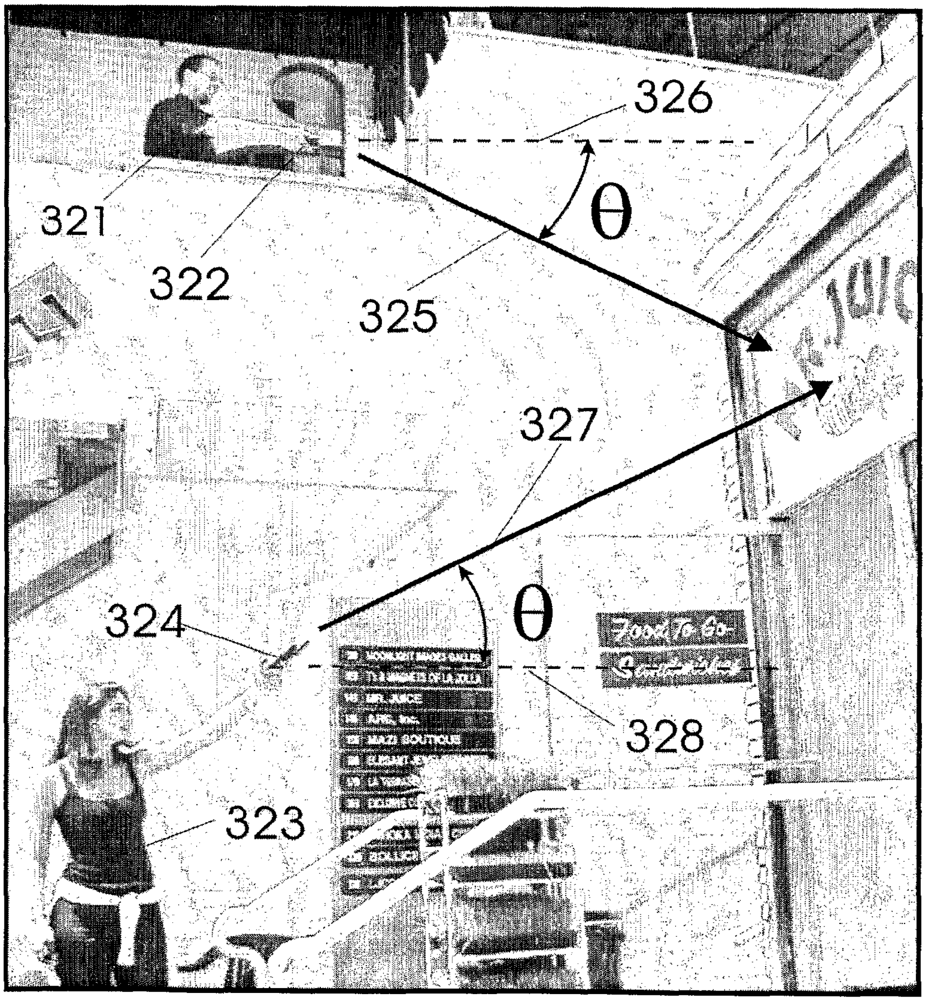

326
θ
321
322
325
327
324
θ
328
323
Food To Go
MR. JUICE
A.R.E. Inc.
MAZI BOUTIQUE

Fig. 32

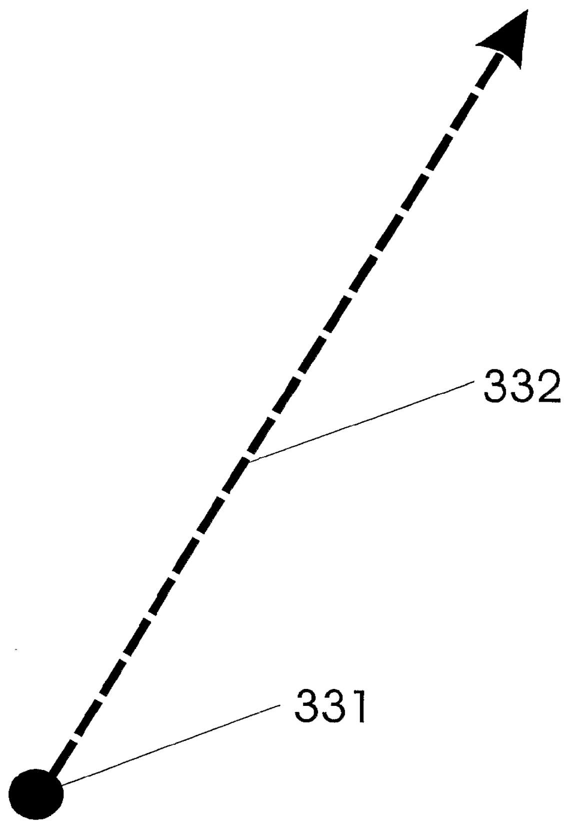


Fig. 33

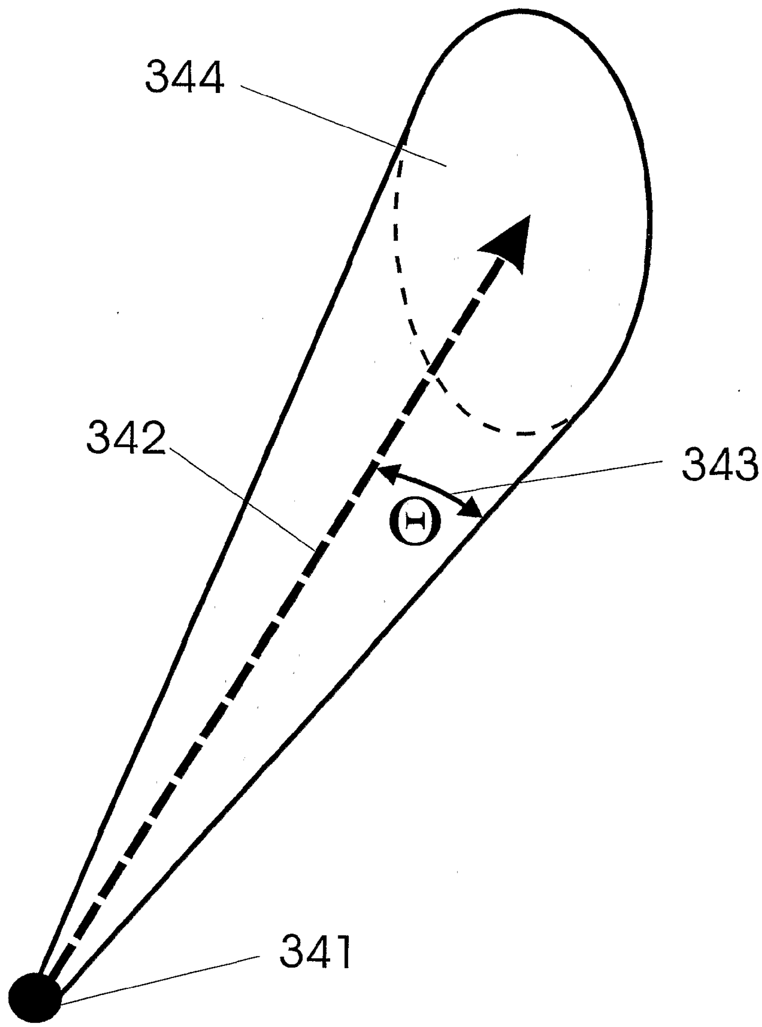


Fig. 34

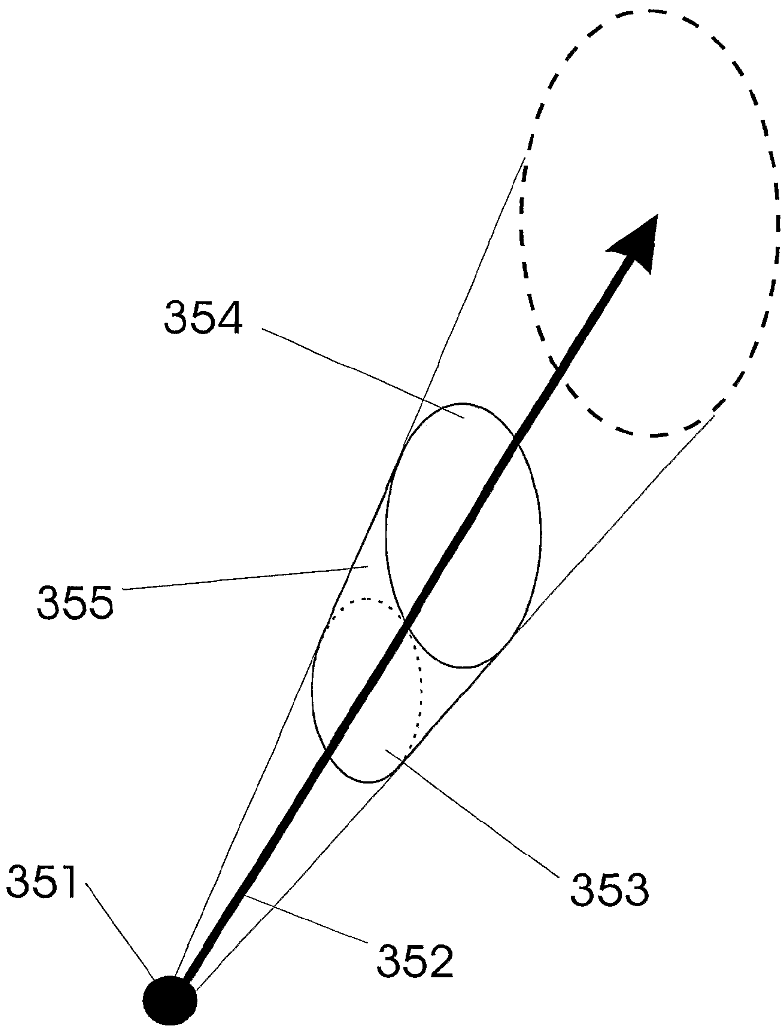


Fig. 35

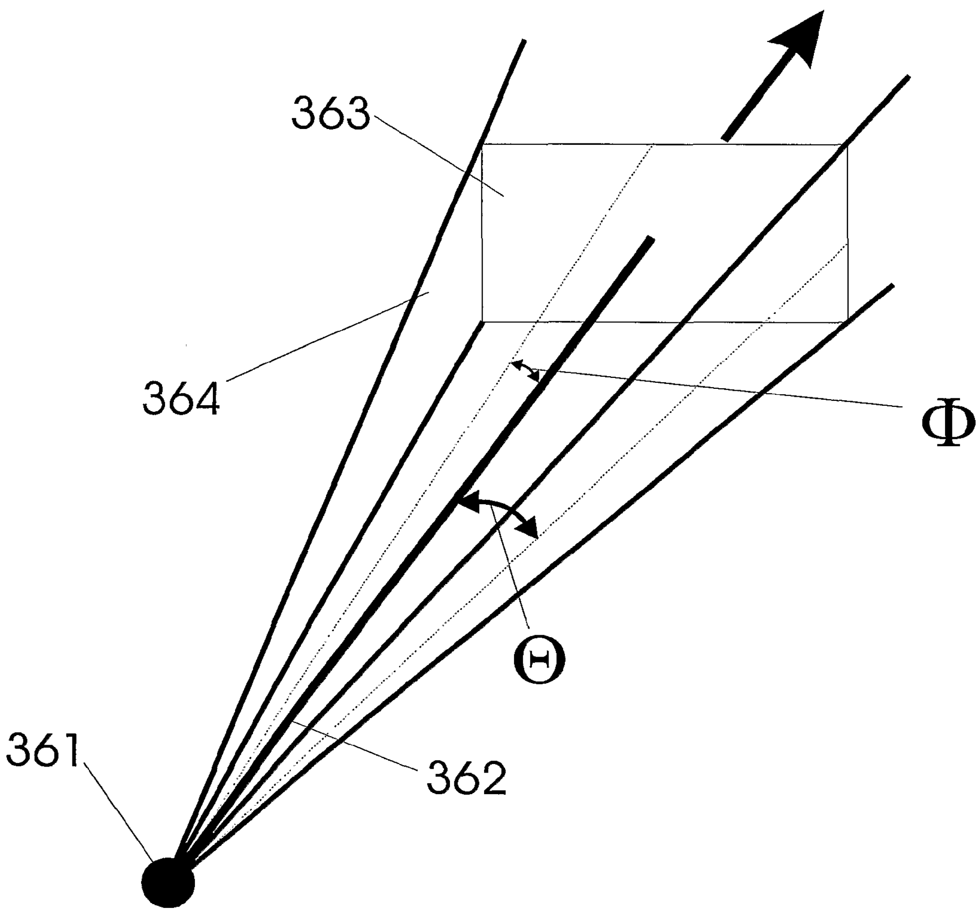


Fig. 36

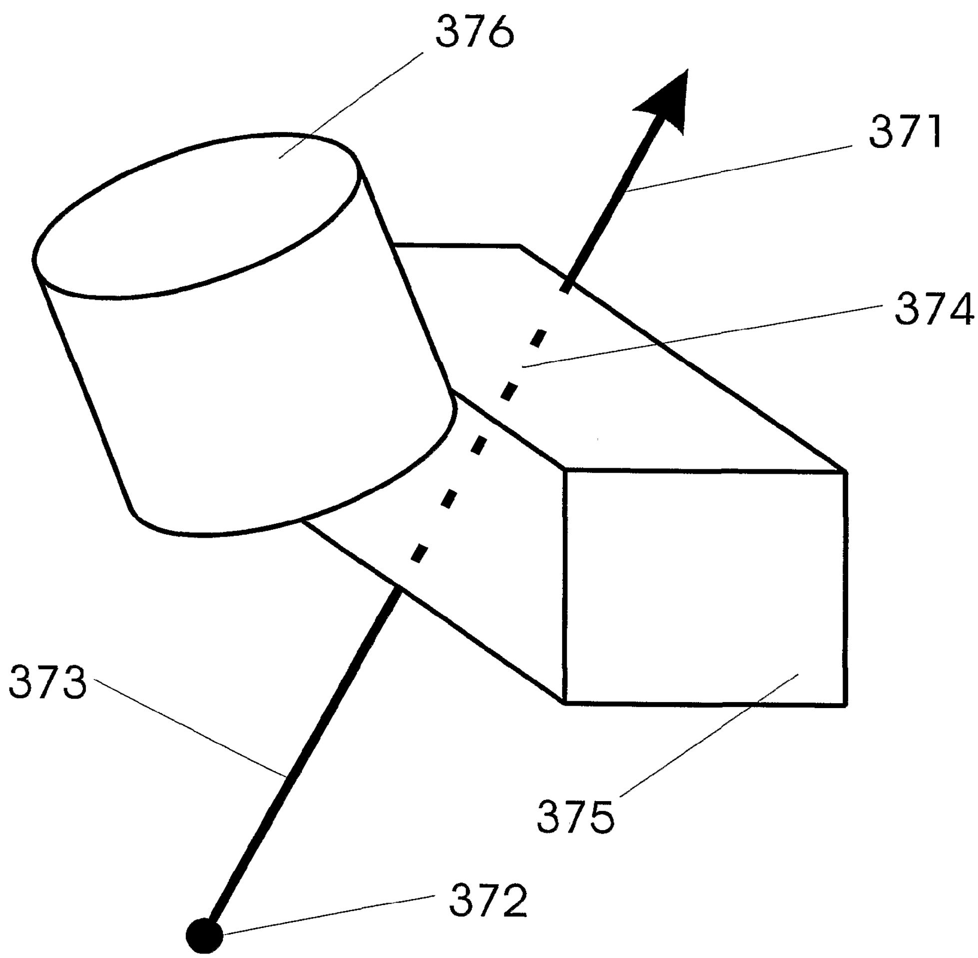


Fig. 37

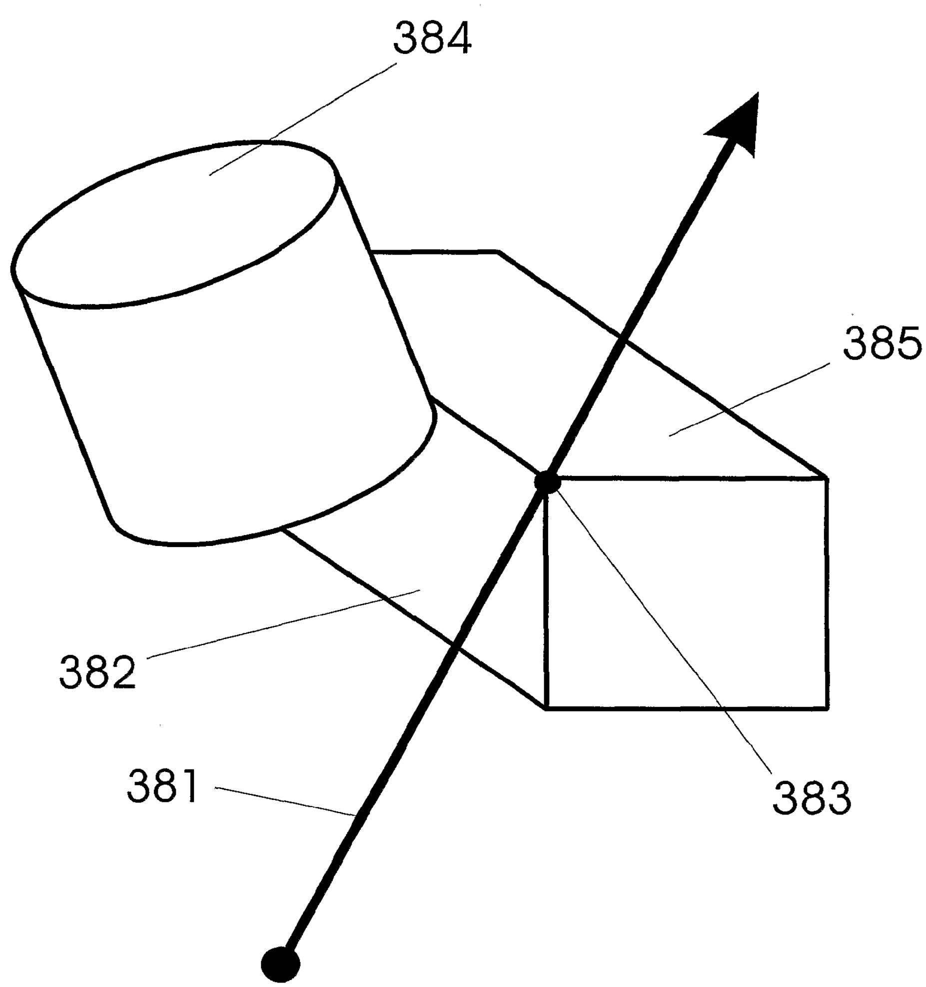


Fig. 38

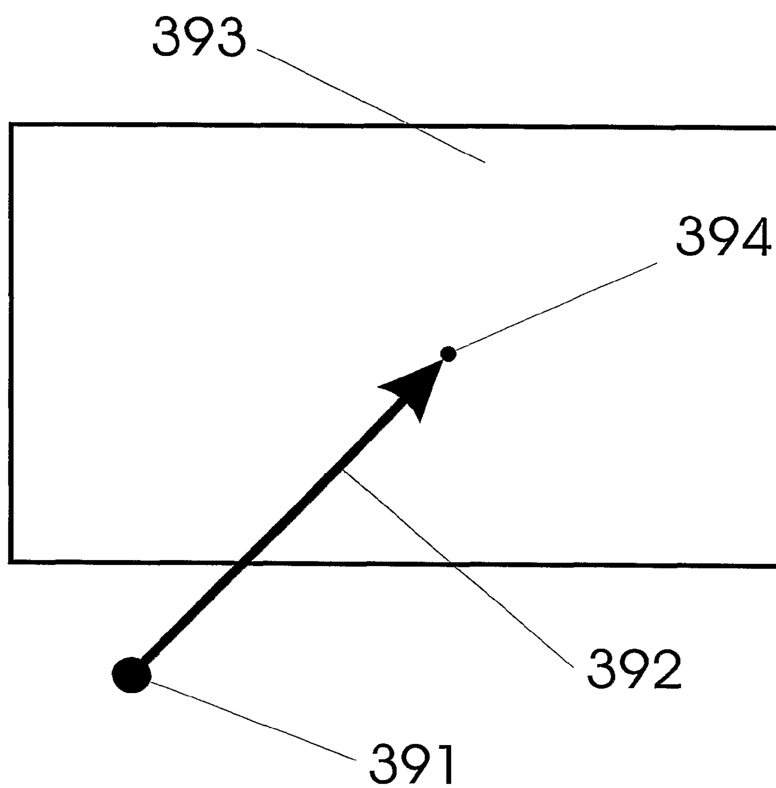


Fig. 39

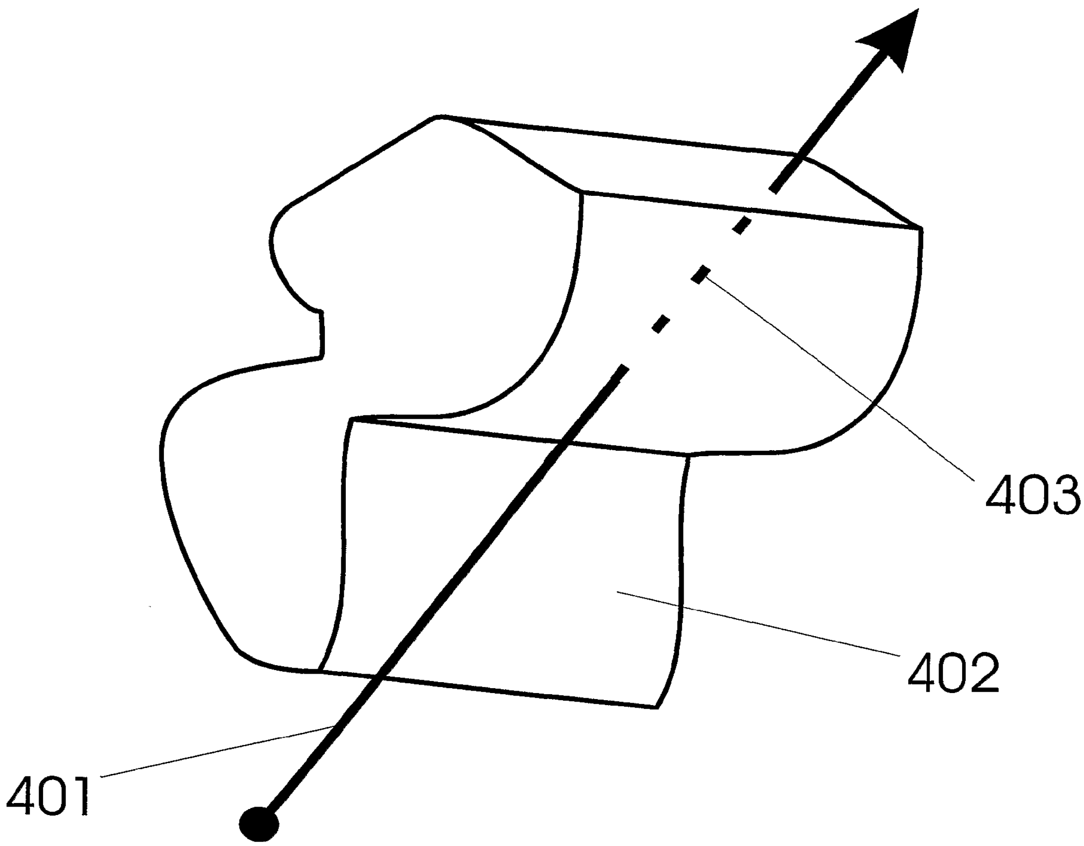


Fig. 40

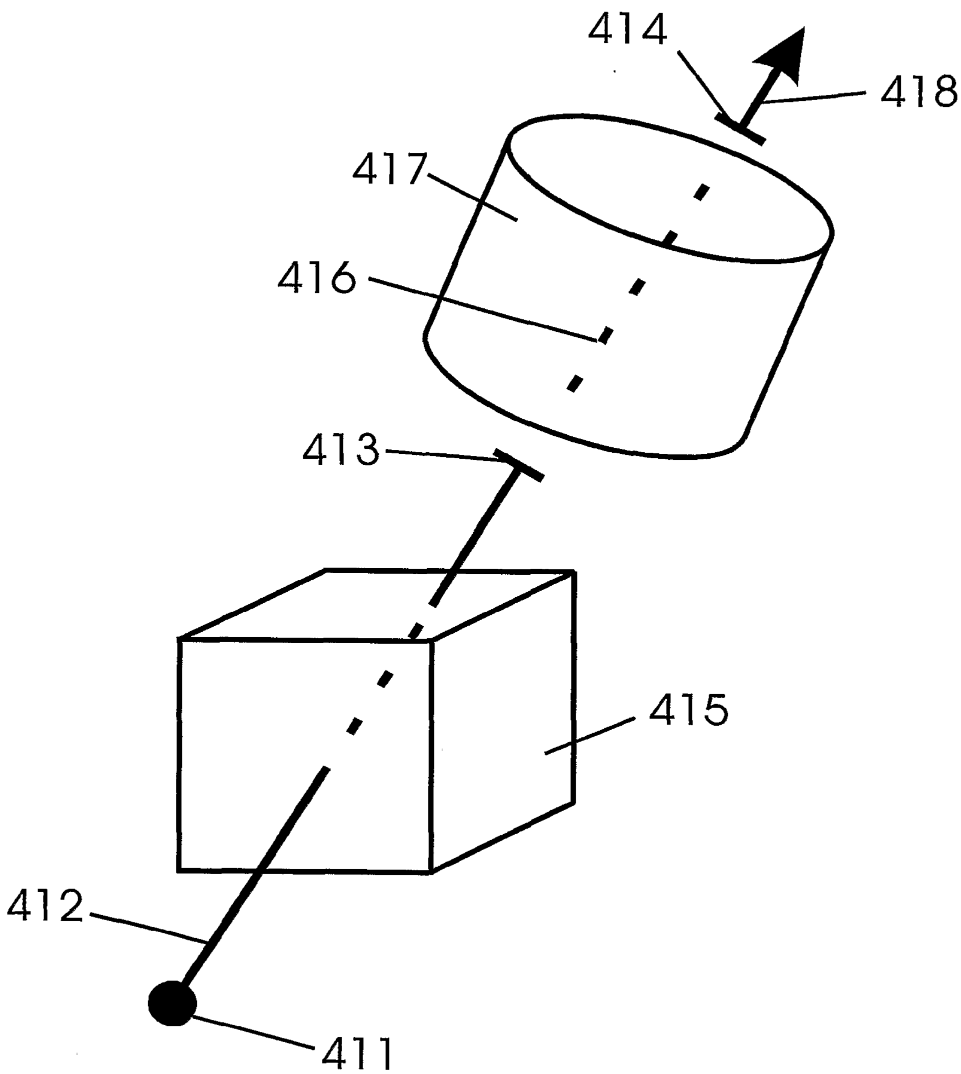


Fig. 41

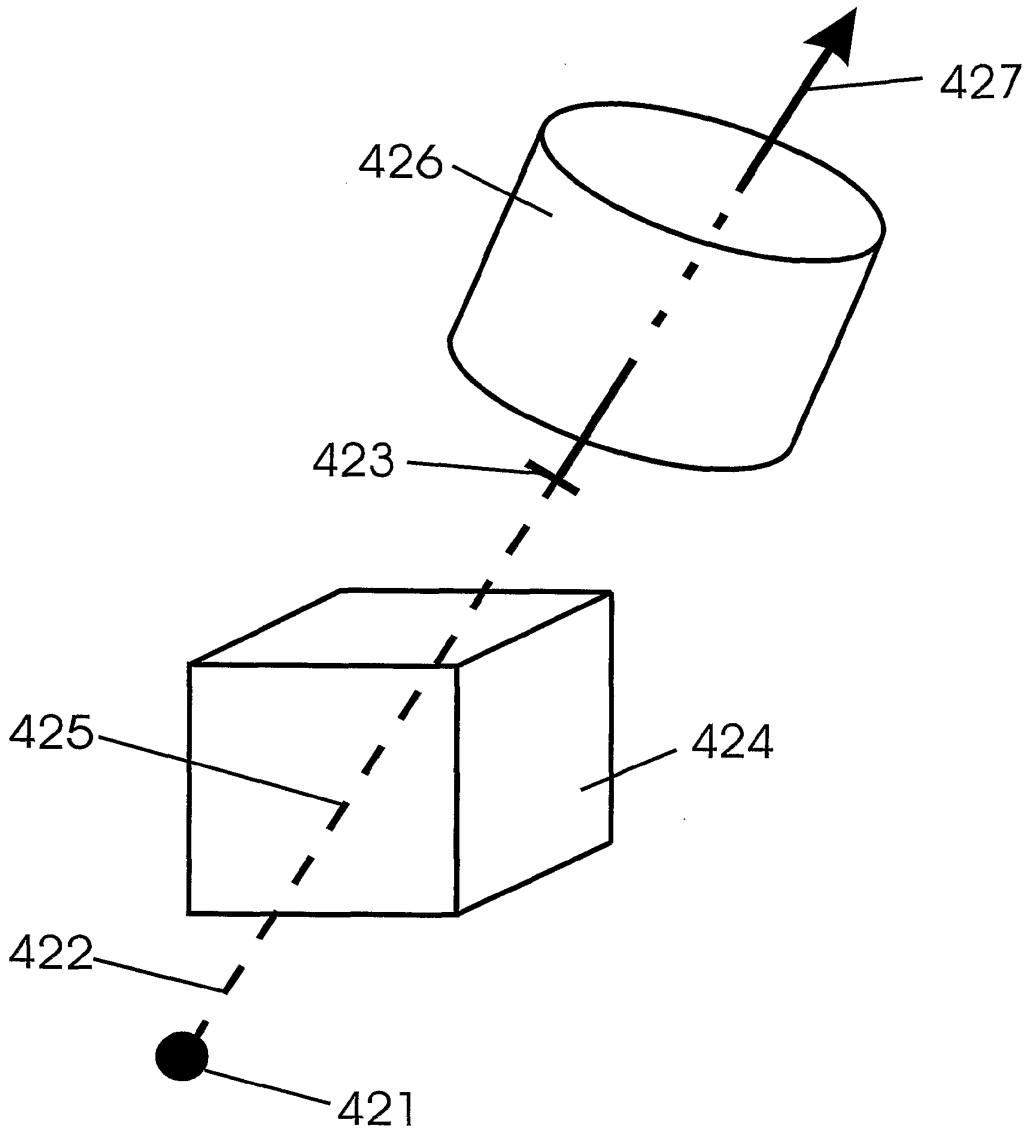


Fig. 42

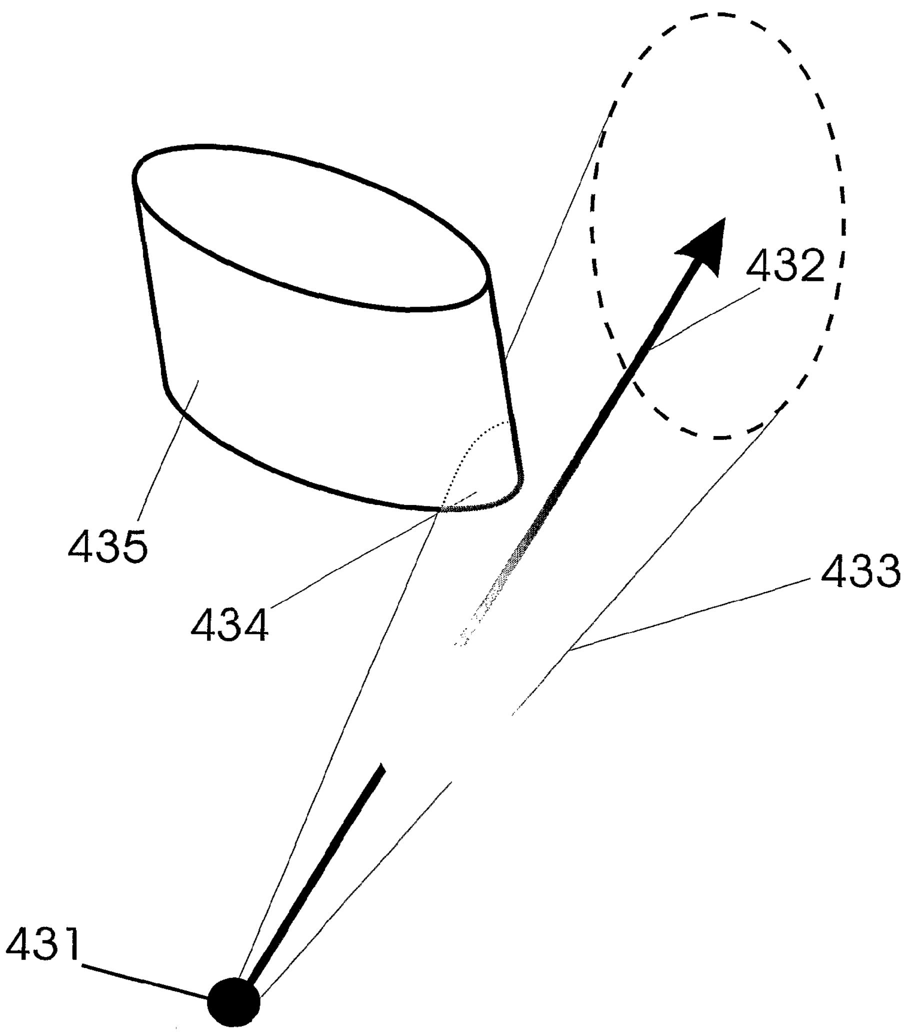


Fig. 43

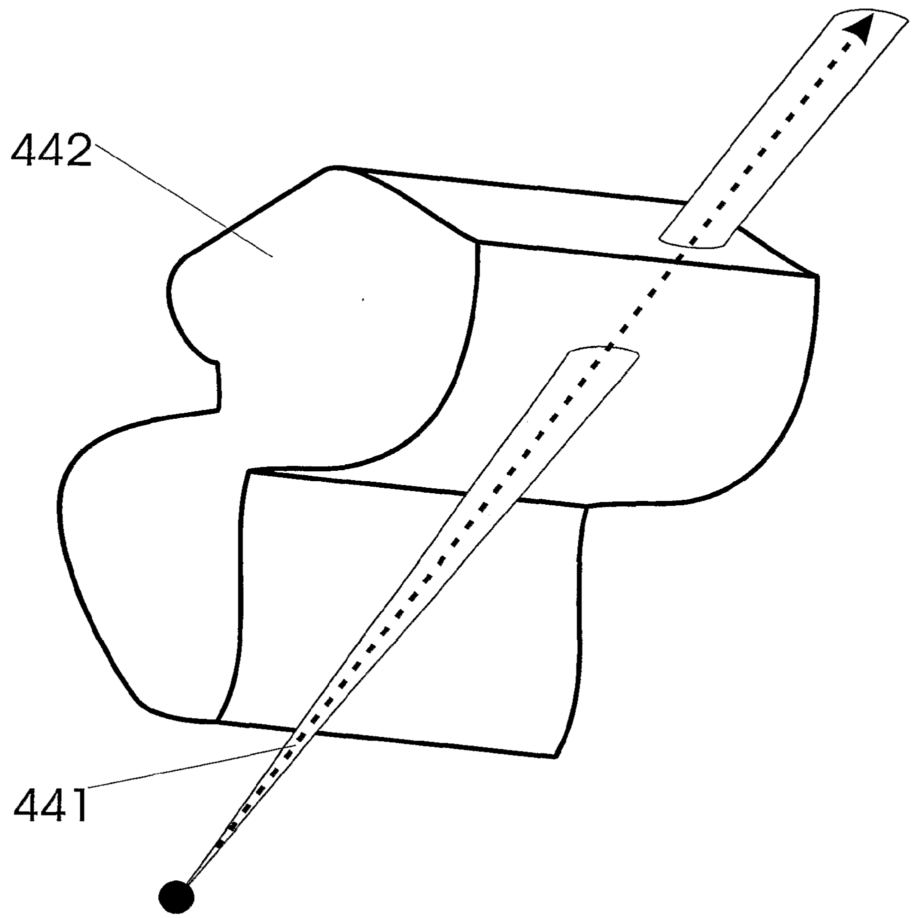


Fig. 44

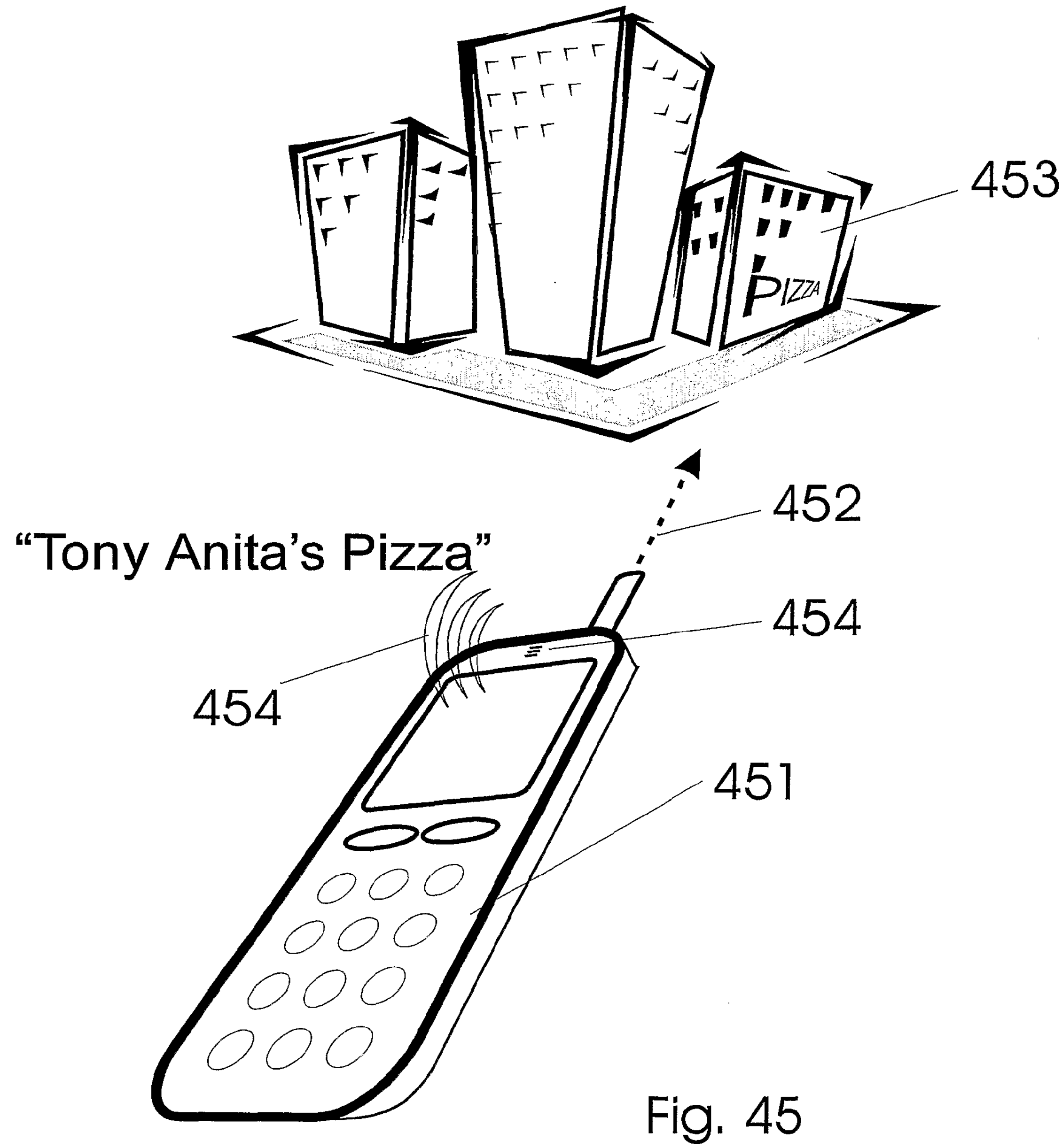


Fig. 45

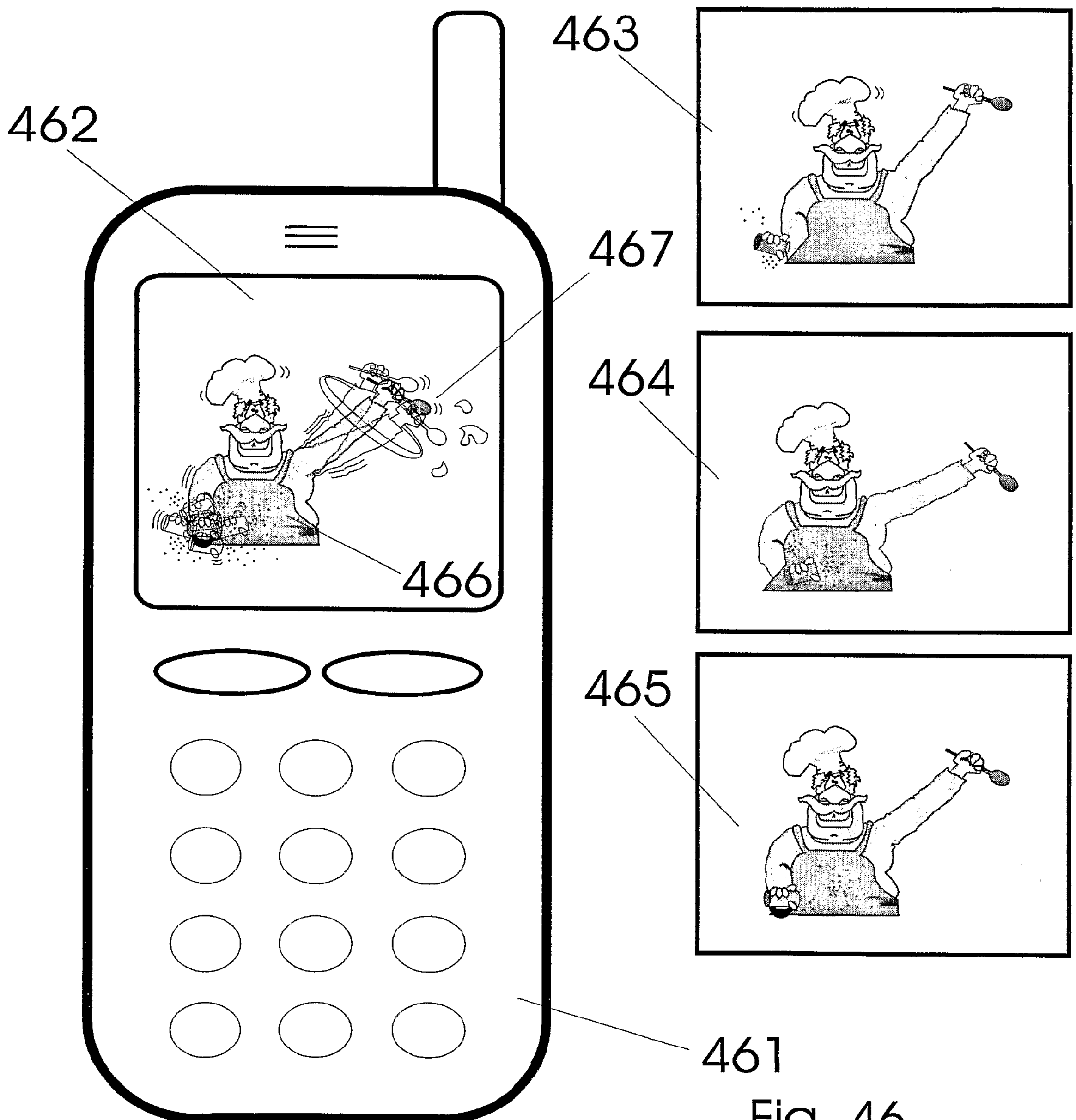


Fig. 46

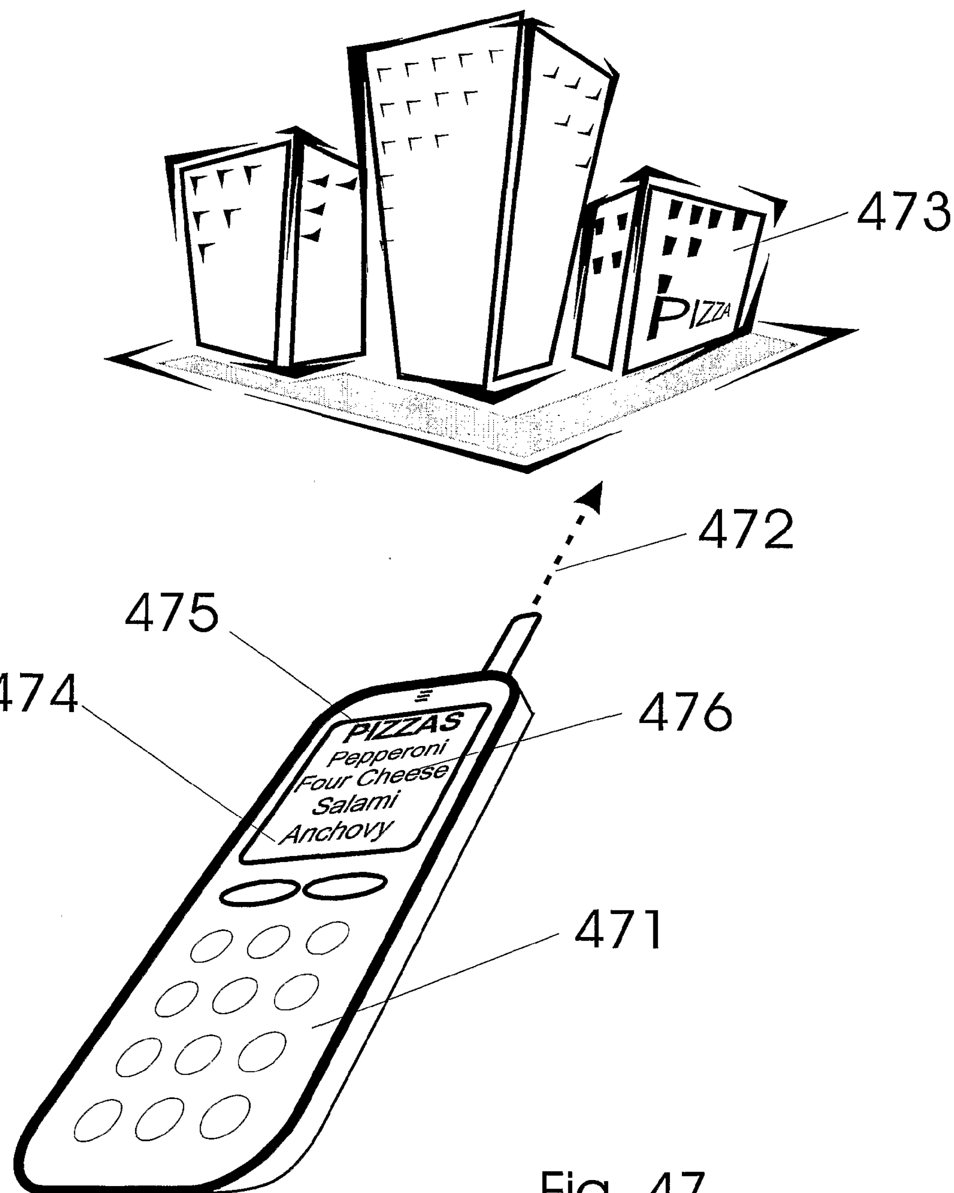

473
PIZZA
472
475
474
476
PIZZAS
Pepperoni
Four Cheese
Salami
Anchovy
471

Fig. 47

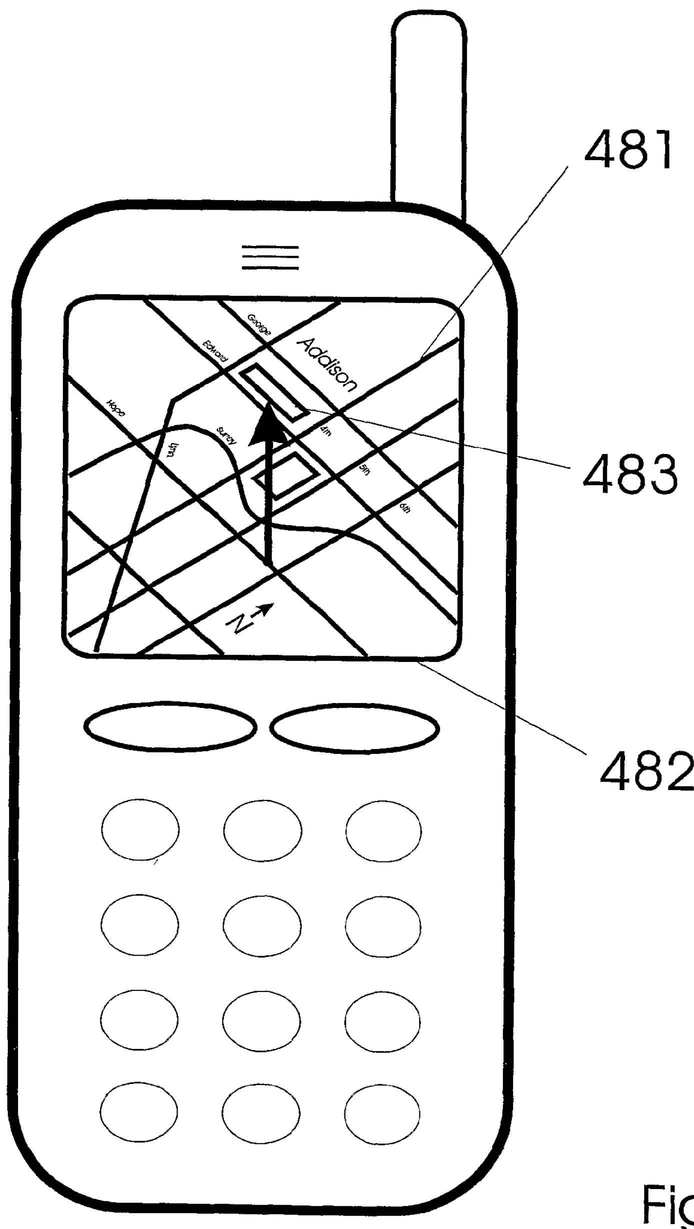


Fig. 48

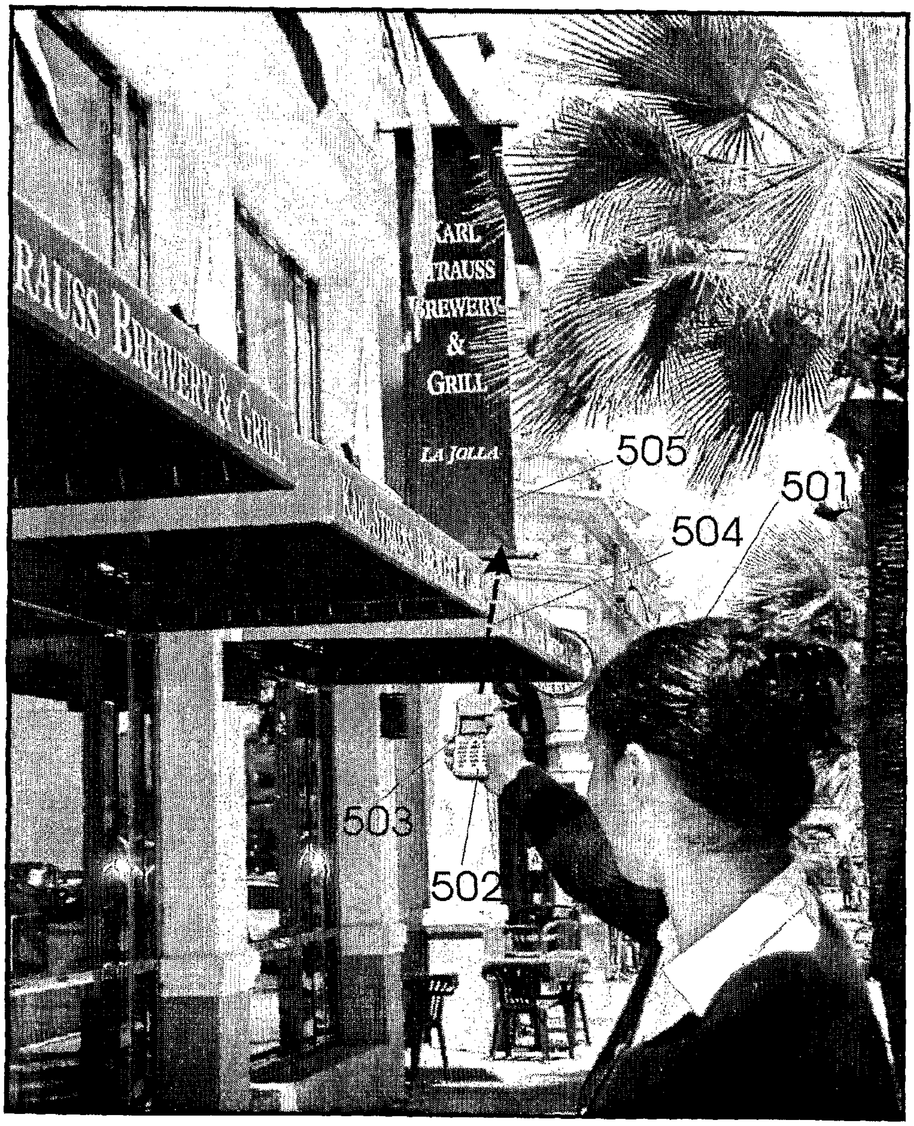

KARL
STRAUSS
BREWERY
&
GRILL
LA JOLLA
RAUSS BREWERY & GRILL
505
501
504
503
502

Fig. 50

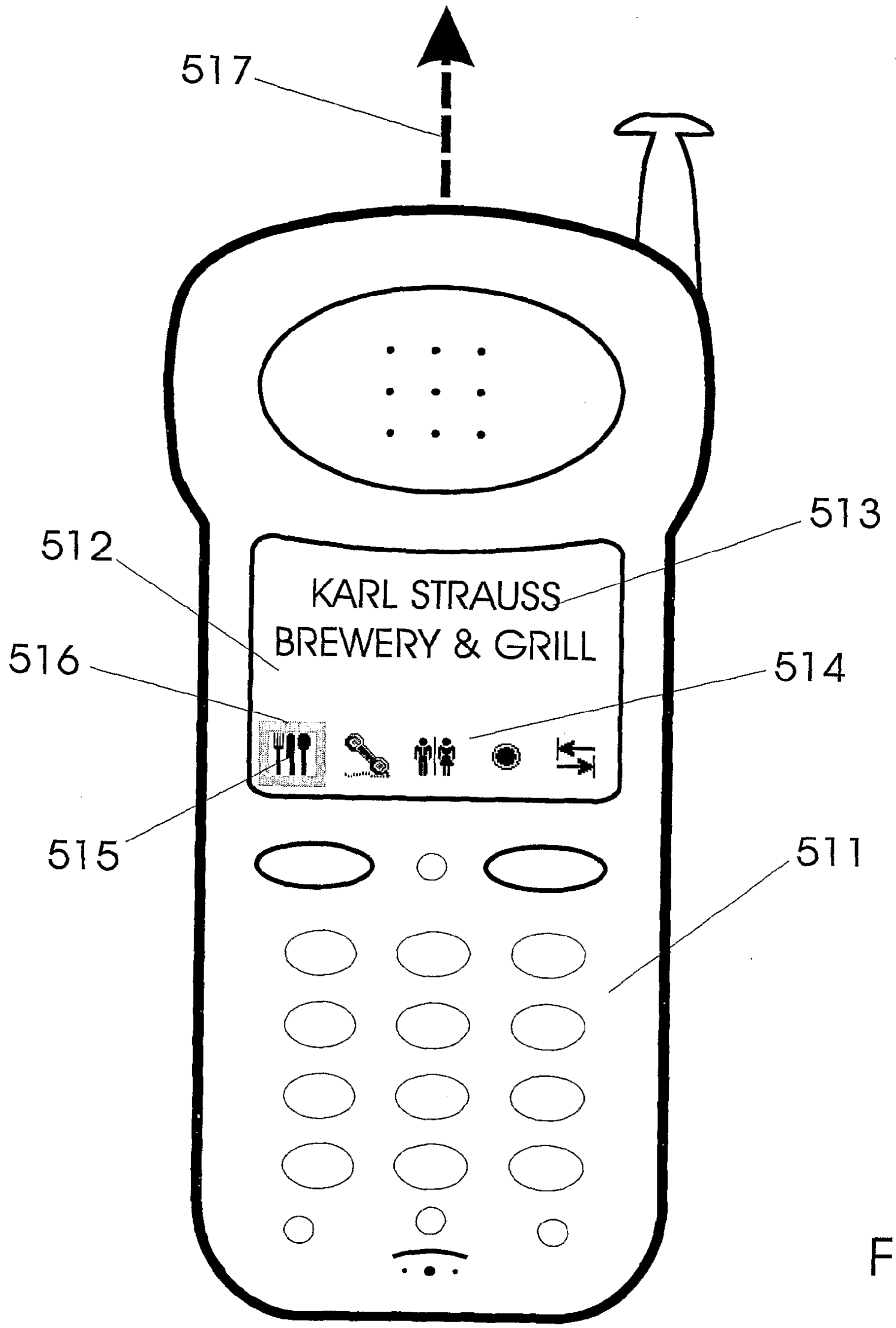


Fig. 51

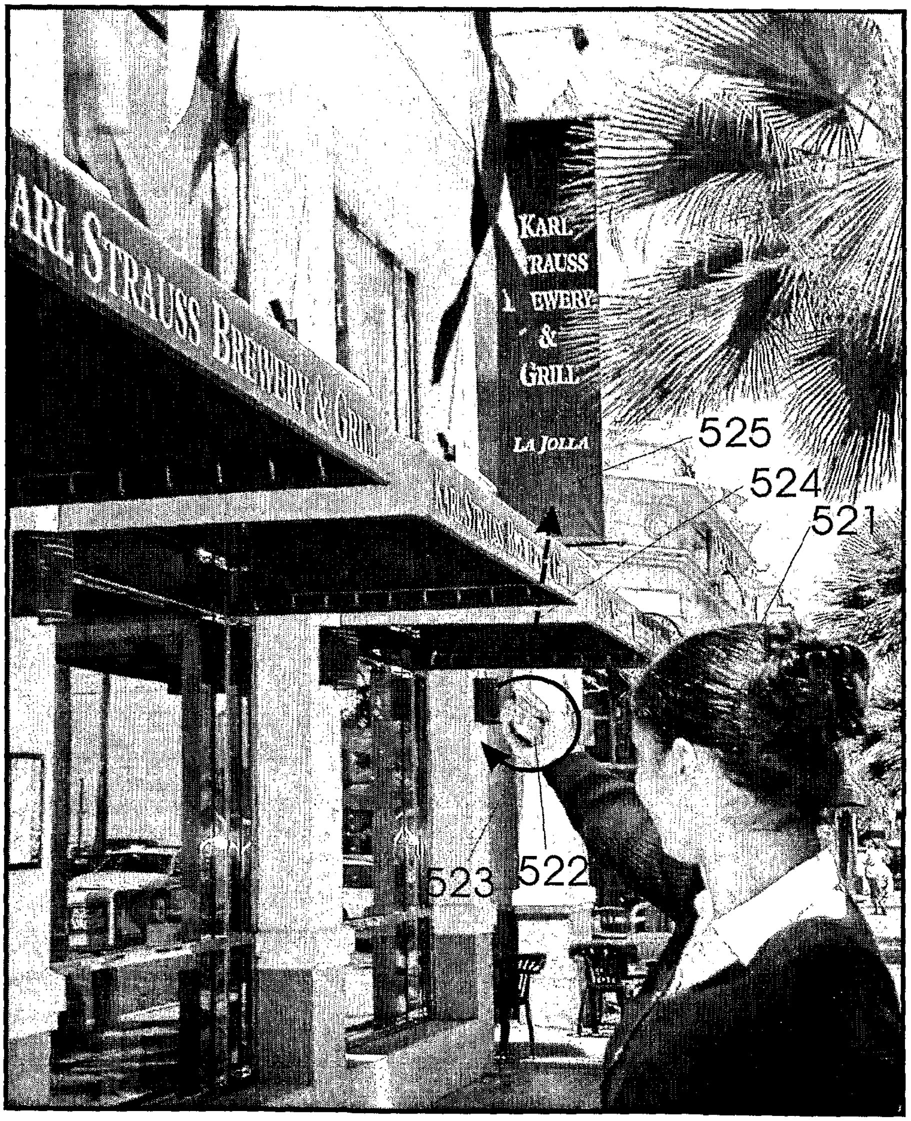

KARL STRAUSS BREWERY & GRILL
KARL
TRAUSS
EWERY
&
GRILL
LA JOLLA
525
524
521
523
522

Fig. 52

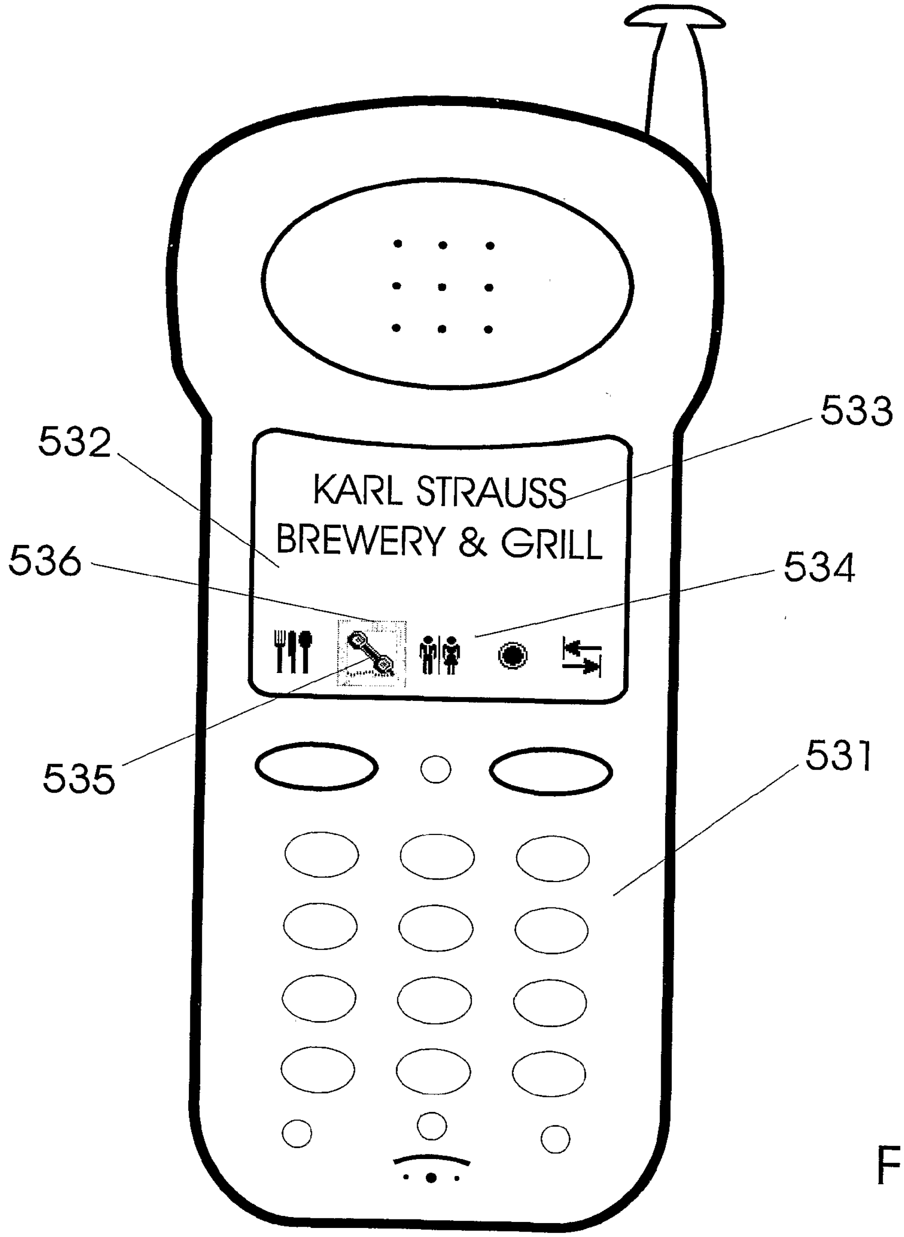


Fig. 53

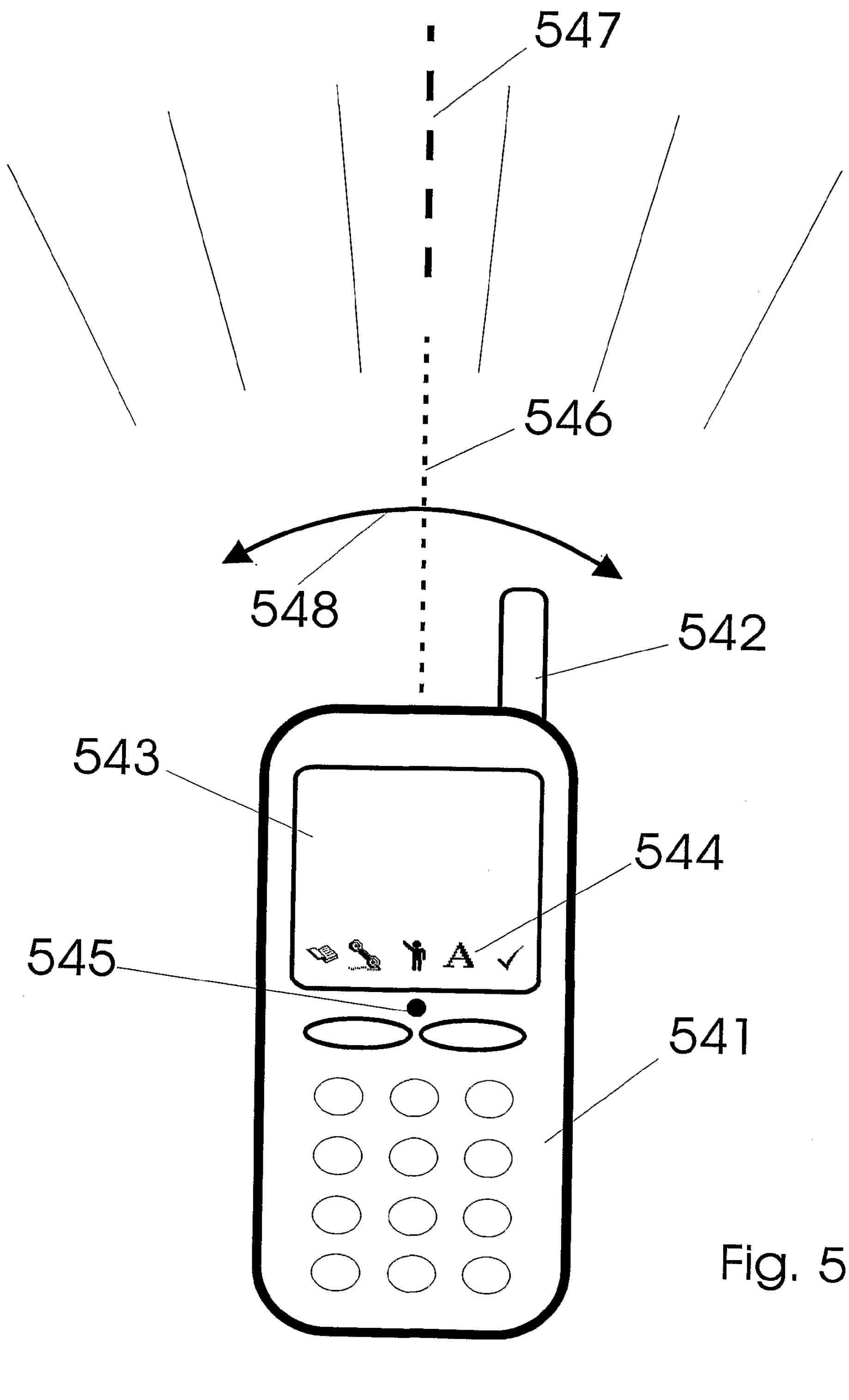


Fig. 54

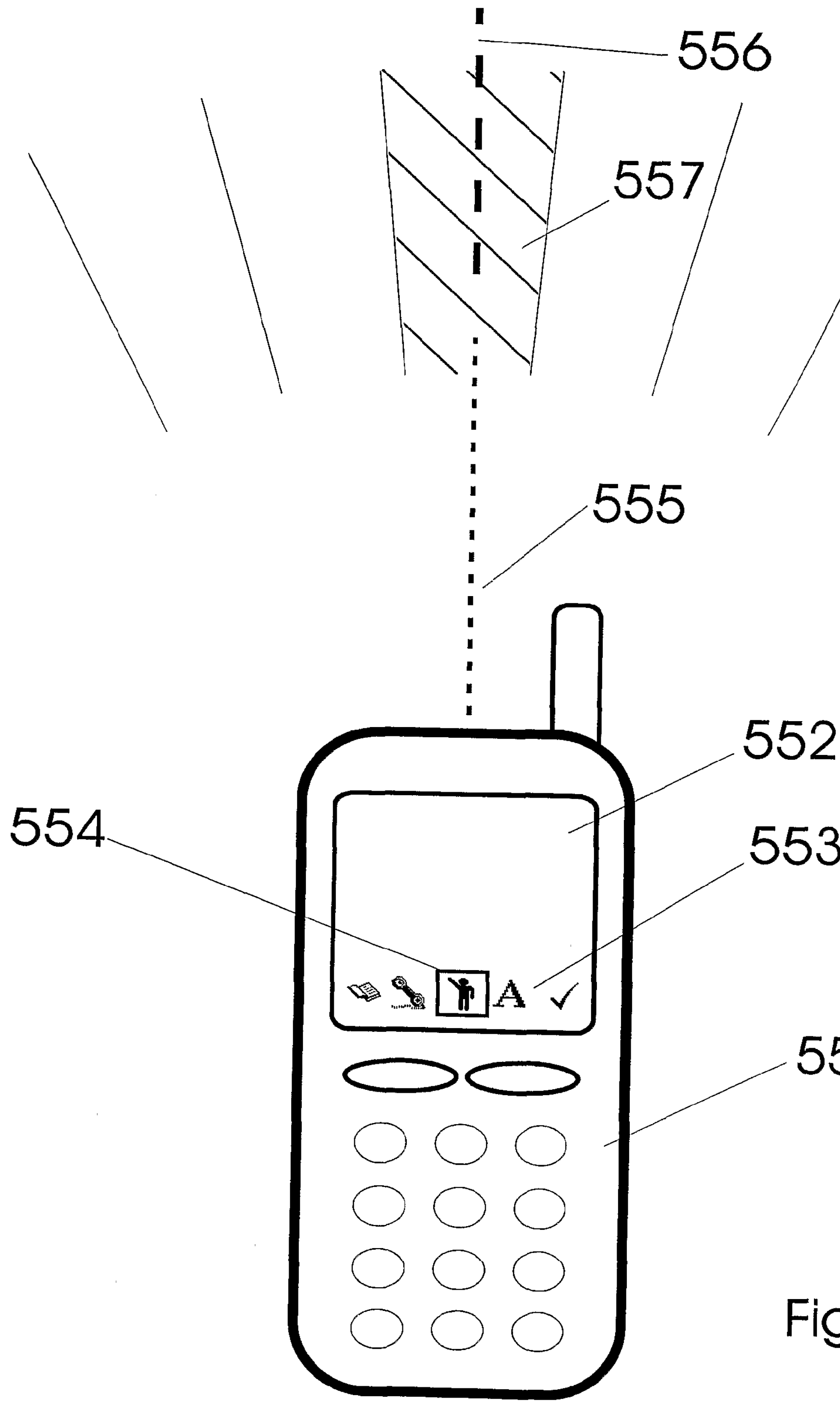


Fig. 55

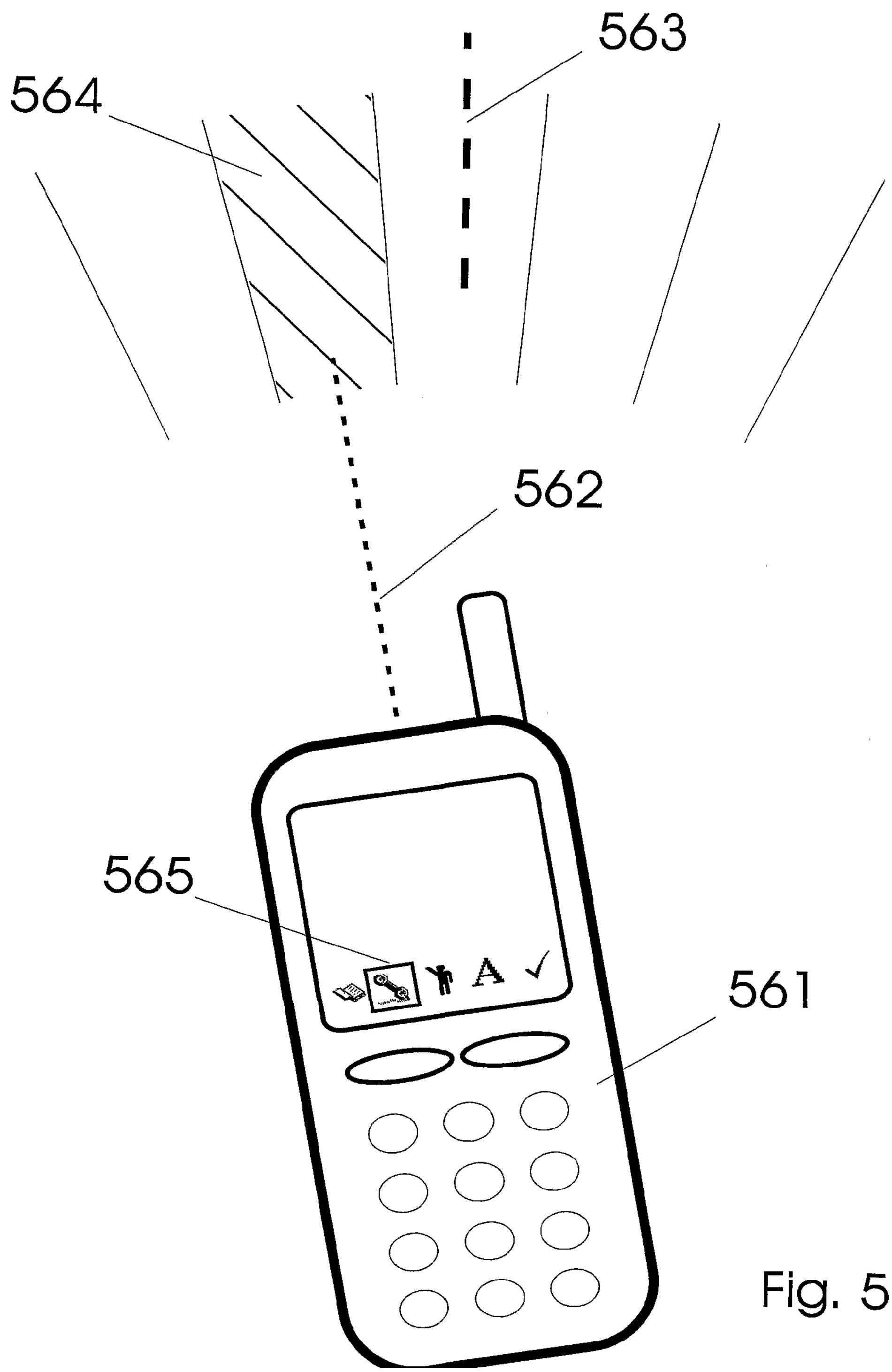


Fig. 56

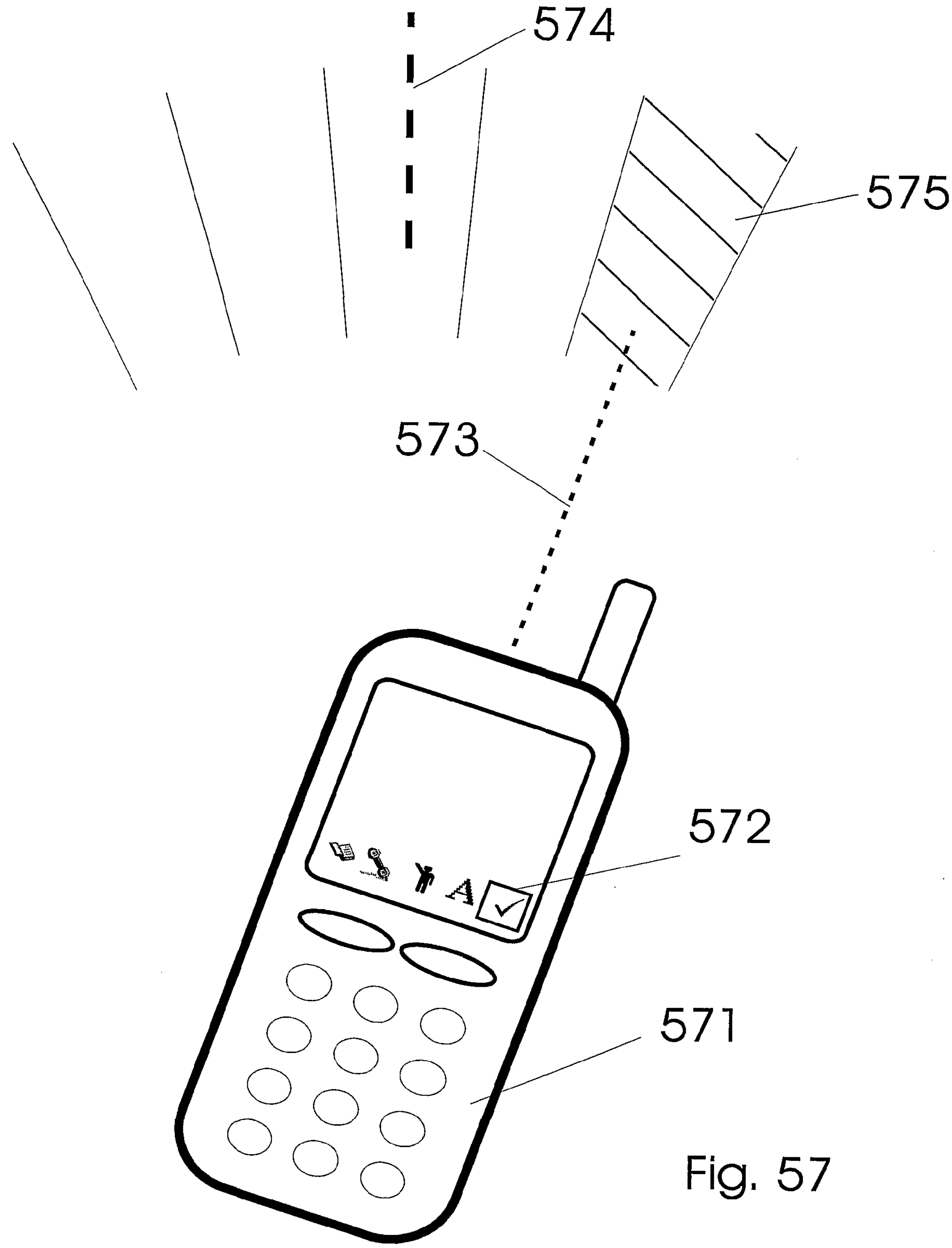


Fig. 57

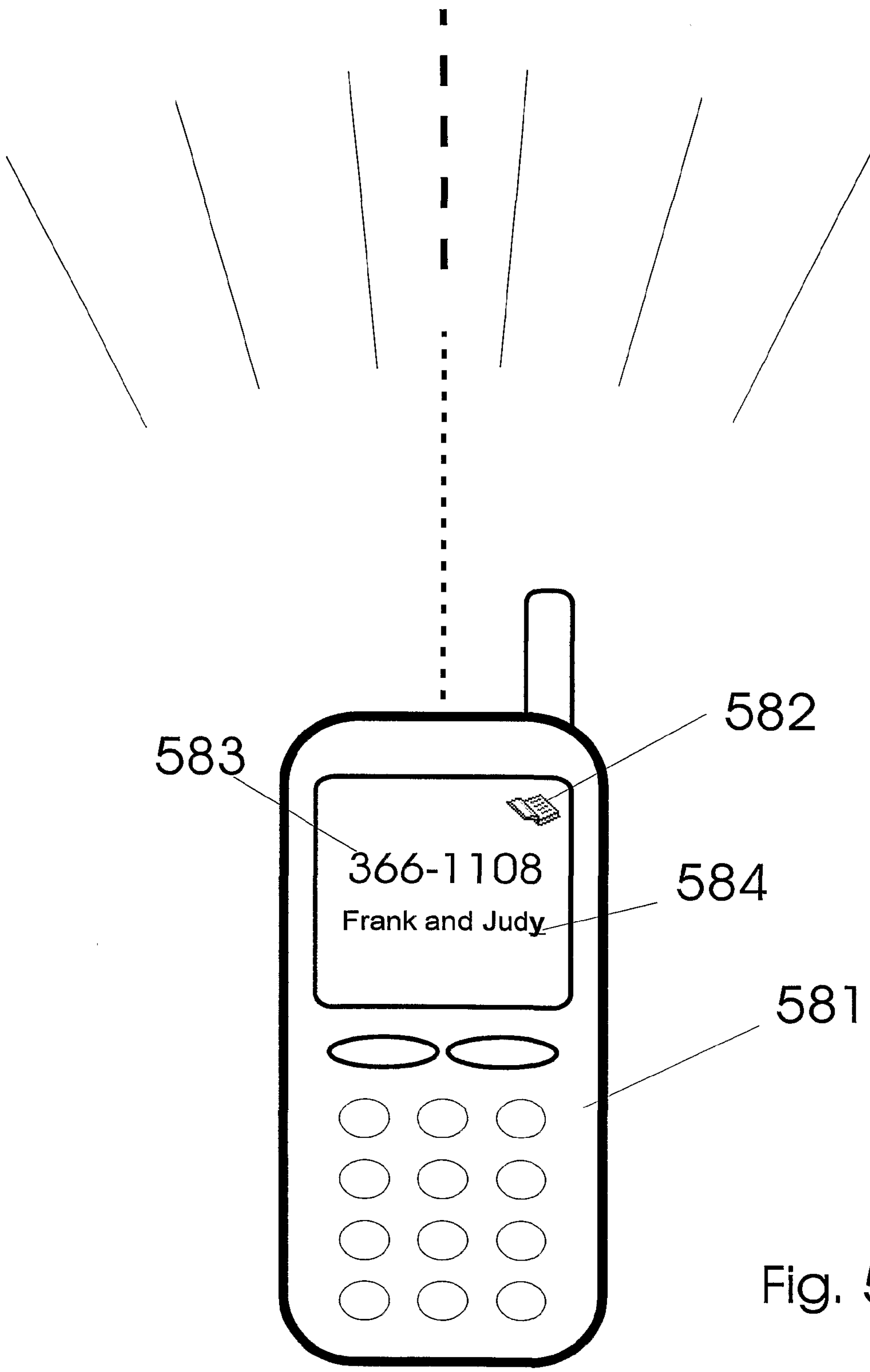


Fig. 58

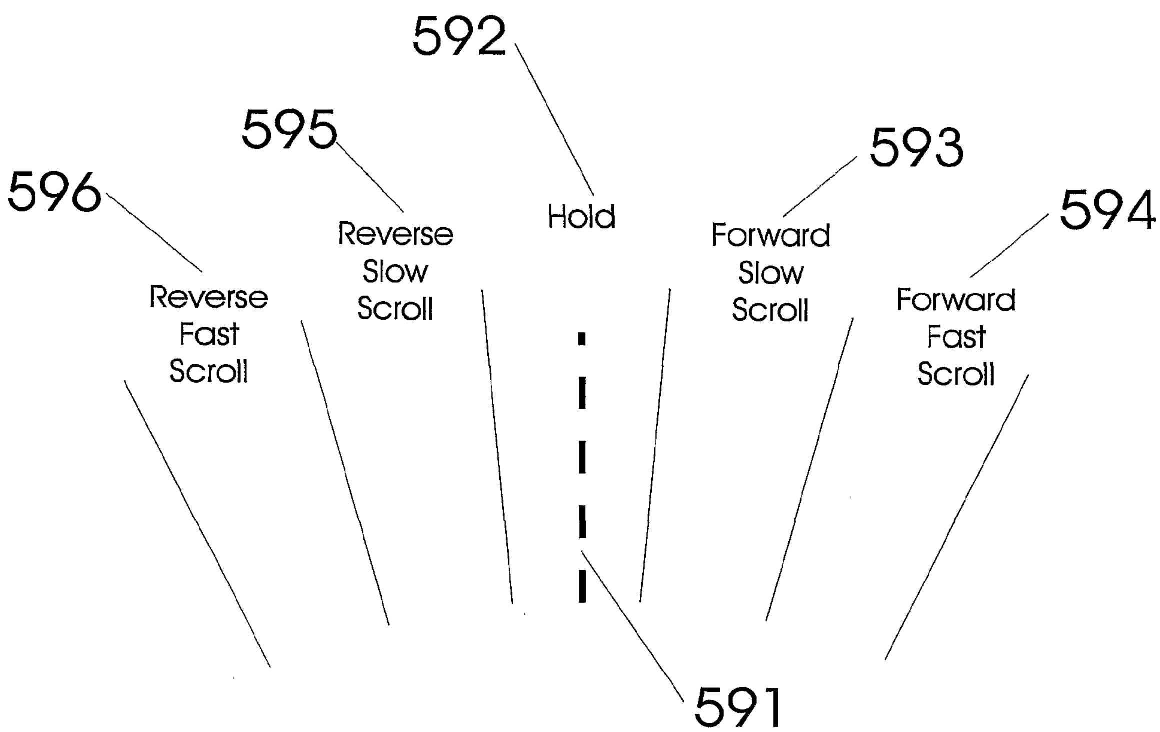

592
595
596
593
594
Hold
Reverse Slow Scroll
Reverse Fast Scroll
Forward Slow Scroll
Forward Fast Scroll
591

FIG. 59

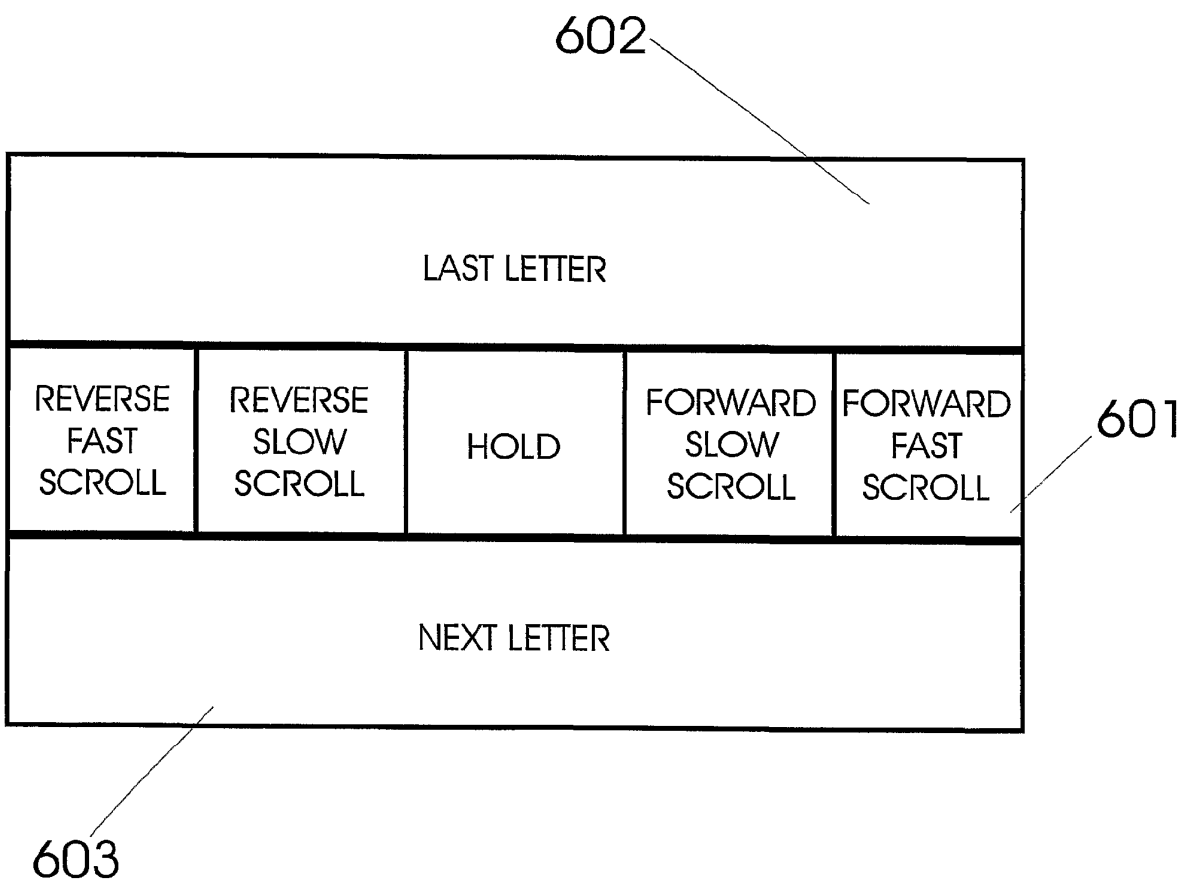

602
LAST LETTER
REVERSE FAST SCROLL
REVERSE SLOW SCROLL
HOLD
FORWARD SLOW SCROLL
FORWARD FAST SCROLL
601
NEXT LETTER
603

FIG. 60

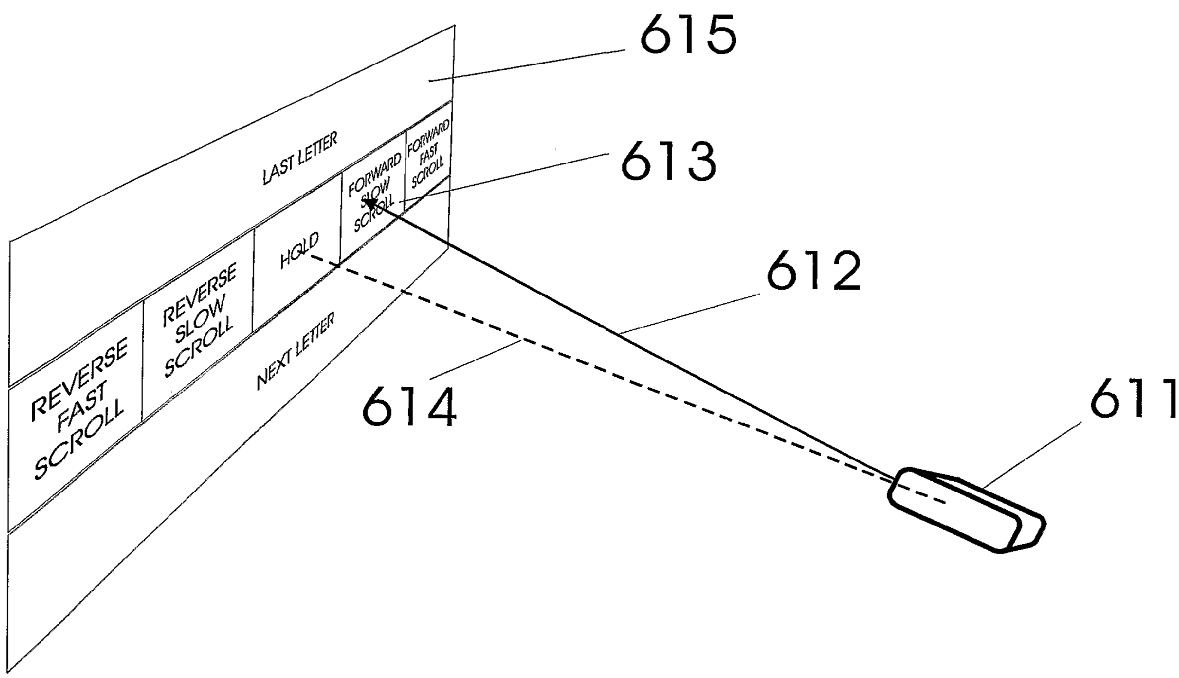

615
613
612
614
611
LAST LETTER
FORWARD FAST SCROLL
FORWARD SLOW SCROLL
HOLD
REVERSE SLOW SCROLL
REVERSE FAST SCROLL
NEXT LETTER

FIG. 61

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 September 2002 (19.09.2002)

PCT

(10) International Publication Number
WO 02/073818 A1

(51) International Patent Classification[7]: H04B 1/38

(21) International Application Number: PCT/US01/51087

(22) International Filing Date: 29 October 2001 (29.10.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/805,421 13 March 2001 (13.03.2001) US

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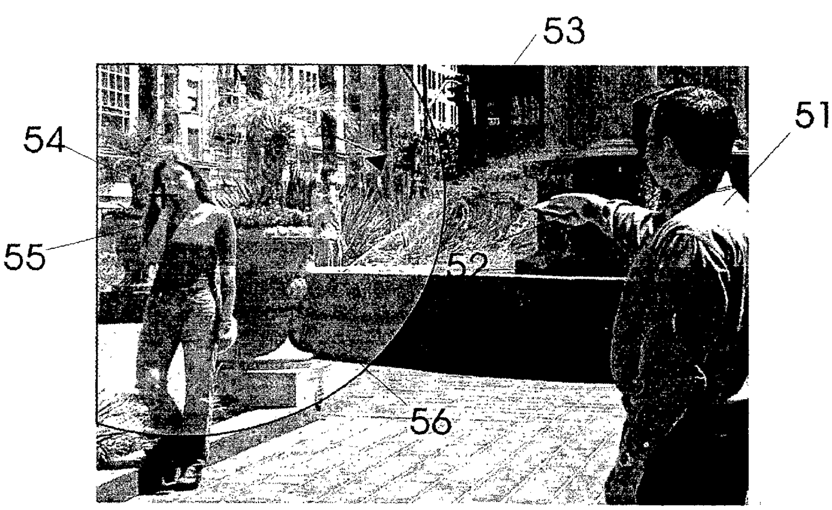
(81) Designated States *(national)*: AU, CA, FI, JP, KP, NZ.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SYSTEMS FOR PROVIDING POINT-TO-CALL FUNCTIONALITY



(57) Abstract: Highly functional pointing systems (Fig. 5) which operate with regard to objects being addressed (54) by the systems as defined by an intersection between an address indicator and a geometric descriptor enable 'point-to-call' functionality. A mobile unit (52) preferably in the form of a mobile telephone handset is configured to receive information relating to objects being addressed via a pointing action (53). The information received may contain telephone contact information, i.e. telephone numbers of various entities which may relate to or have authority over the objects. Activation of a point-to-call function causes telephone connection to be initiated for the requested number. A user may merely point a click a telephone to cause a call to be placed to a desired entity.

WO 02/073818 A1

In the United States Patent and Trademark Office

Title: Systems for Providing Point-to-Call Functionality

Specification for a Letters Patent

BACKGROUND OF THE INVENTIONS

Field

The following invention disclosure is generally concerned with mobile telecommunications and specifically concerned with mobile apparatus arranged for addressing an object and initiating a telephone connection.

Presently, when a person wishes to contact someone by telephone it is a requirement that a numeric address, or 'telephone number', be entered in order that the call be routed properly to the desired recipient. Without a telephone number, it is impossible to connect a call in a telephone network. To get the correct telephone number, a user may employ the services of a directory assistance at extra costs, both money and time, to the caller. In addition, it requires the sometimes difficult step of explaining to an operator the correct title of the intended recipient which is not always known precisely to the caller. Alternatively, a user may search his personal phonebook with frequently used numbers of friends and acquaintances therein. However, it is not always the case that a personal phone book has a listing for all numbers of entities which may become desirable to contact. Due to these difficulties, among others, processes of looking up phone numbers are quite unpopular and cumbersome.

Mobile systems arranged to receive information relating to objects being addressed are being introduced as modern telecommunication technologies. Particularly, technologies introduced by the present inventors in recent US patent # 6,173,239. These systems teach how a mobile unit can receive information relating to an object towards which the mobile unit is pointed. Information is passed, from a database which 'knows' the addressed object, to the requesting client. Those systems do not perfectly teach new and exciting function explained here. In particular, Those systems are not set up to cause a telephone call to be placed thereby connecting the requesting client with an object being addressed to more precisely identified that document.

A United States Patent application filed under Express Mail Label number EL 651531976 US by the same inventors here in January 2001, having the title "Pointing Systems for Addressing Objects" is an important disclosure which relates and introduces these inventions. Accordingly, that document is hereby incorporated by reference in its entirety. This application will be amended as soon as that application receives a serial number assignment.

SUMMARY OF THE INVENTIONS

Comes now, Thomas Ellenby, Peter Ellenby, John Ellenby, Jeffrey Alan Jay, and Joseph Page with inventions of systems for addressing moving objects including devices and methods relating to mobile telecommunications and advanced information exchange.

Devices of these inventions are arranged to operate with automatic features known herein as a 'point-to-call' function. In response to merely pointing a device towards a desired call recipient, the device identifies the intended recipient and attempts telephonic contact. A caller's telephone is equipped with position and attitude measurement devices which allows the phone to 'know' which targets are being addressed via a database of stored information. The database of stored information gets frequent updates from all participants of the program including those who may become intended recipients of calls. Thus a system database maintains a current position parameter for participants as well as other related information.

A better understanding can be had with reference to detailed description of preferred embodiments and with reference to appended drawings. Embodiments presented are particular ways to realize the invention and are not inclusive of all ways possible. Therefore, embodiments may exist which do not deviate from the spirit and scope of this disclosure as set forth by the claims, but do not appear here as specific examples. It will be appreciated that a great plurality of alternative versions are possible.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims and drawings where:

Figure 1 is a simple block diagram to illustrate the two major steps of methods of these inventions;

Figure 2 is a detailed block diagram which follows from Figure 1 with more precision;

Figure 3 includes a modified block from Figure 2 with added features illustrated;

Figure 4 is an illustration of a gentleman caller attempting to contact a lady via wireless telephone link;

Figure 5 shows a graphical representation of an important geometric construct associated with the recipient's telephone;

Figure 6 shows a display response in connection with an attempt to make telephone contact; and

Figure 7 illustrates a similar positive response at a telephone display.

PREFERRED EMBODIMENTS OF THE INVENTIONS

In accordance with each of the preferred embodiments of the invention, there is provided apparatus for and methods of addressing objects in a manner to cause telephonic contact. It will be appreciated that each of the embodiments described include both apparatus and method and that the apparatus and method of one preferred embodiment may be different than the apparatus and method of another alternative embodiment.

Point-to-call

Although briefly mentioned in the above referenced application, a 'point-to-call' function can be better understood in view of the following more complete description. Some preferred versions of providing a point-to-call function include devices integrated with a common mobile telephone. Mobile telephones cooperate well with '*point-and-click*' activity whereby a user may simply point a telephone towards a target of interest and trip a tactile switch to provide stimulus to a program running on a computer therein. Thus, a mobile telephone properly arranged with special computing facility, position and attitude determining means is a perfect example of a device of these inventions.

Preferred methods may best be understood in view of Figure 1 which is a simple block diagram directed to two major steps of a preferred method. An 'address object' step 1 suggests that a user causes a mobile telephone to be pointed towards, and thus address, an object of interest. Thereafter, execution of the method passes 2 to a second step where the telephone's computing facility executes a request which relates to the address action. In particular, the request is one for a telephone connection and further a connection to an entity which relates to the object being addressed. Thus, stimulus is provided to the computing facility which is necessarily in communication with a telephone network, which sets it into motion and results in a call being placed.

A mobile telephone having point and direction references, position and attitude determining means allows a pointing action to connect the telephone to certain objects known to the database by way of the mobile unit's (telephone's) address indicator and the addressed object's geometric descriptor. Intersection between these constructs indicates the condition that an object is being addressed; and for these methods indicates that a call is to be placed to a telephone number associated with the addressed object.

Upon a trigger action, the mobile unit determines which objects are being addressed, recalls from the database data relating to those objects including telephone numbers associated therewith, and completes the point-to-call action by initiating a voice connection to either of the telephone numbers via wireless link. The activity remains mostly transparent to the user, who merely has to ***point*** the device and click a switch ***to*** place a ***call.***

Methods are better understood in consideration of more detail. Figure 2 is a detailed block diagram which presents several additional steps which further clarify and perfect methods of these inventions. These methods may be envisaged as including five primary steps as follows: an 'address object' step 21; an 'get targets' step 22; an 'present choices' step 23; an 'user selection' step 24; and an 'initiate call' step 25. Within these steps are further details with presentation herefollowing.

As in the basic method described above, this preferred method begins with an 'address object' step. A user points the phone 26 and selects 27 a point-to-call operational mode if the phone is not already in a point-to-call operation mode. After a phone has been pointed towards a target of interest, a step is run where the computer searches a database of prerecorded information to find the information relating to the objects being addressed in a 'get targets' step. This step may include a substep 28 of applying filters. Information filters may be used when conducting database searches to retrieve information having particular attributes. For example, one may conduct a search of objects where the only objects to be recalled are of the class 'hotel'; further a filter may specify only '3 star hotels'.

After a database search produces results in view of a particular address action, the results may be presented to a user in a 'present choices' 23 step. A graphical user interface such as a display screen may have a drop down menu which is arranged to list the hit targets, i.e. all objects being simultaneously addressed. From this drop down menu, a user may select 29 either target from the list in the 'user selection' step. Further, a user may then select 210 a call type from a secondary menu which may offer a plurality of call types which may be associated with the single object. Finally, a user may trigger 211 the call by a simple click action at a tactile input or via voice command. The computer response thereafter includes the two substeps as follows: transmit request for call 212; and set-up local phone 213. The mobile telephone in communication with a telephone network produces a request for a telephone call and passes the desired telephone number into the network for proper handling there. In addition, the mobile telephone handset is prepared for normal telephone operation, i.e. the speaker and microphone are activated while the rest of the phone is set in call-in-progress mode.

With that detailed description in mind, a full understanding is made better by considering a few examples where point-to-call systems are advantageously enjoyed. First examples are directed to calls which may be placed to entities directly. Further examples are drawn to calls placed to entities *associated* with a target but not directly the target itself.

Direct Point-to-Call

While it is generally preferable to get hotel reservations before traveling, one sometimes nevertheless, finds oneself in a city among many hotels but without a booking at any. Thus in such situations, the task becomes securing a nearby room booking. Without inventions taught here, one must look about for 'Vacancy' signs posted at hotels with rooms remaining, and walking to each to inquire as to prices.

Conversely, persons having a mobile unit telephone taught here merely have to point their device towards a hotel of interest to receive pricing information at the display screen. Further, upon activation of a point-to-call function, a telephone call to the chosen hotel may be initiated.

For example, while visiting Amsterdam a traveler walks from central station to find many hotels on the street Nieuwezijds Voorburgwal. Among the hotels on that street all within line of sight from a sidewalk is the 'Inntel', 'Soifitel' and 'Cok City' hotels. These hotels do not display 'Vacancy' signs but rather a person must walk to each to check prices. Using a mobile telephone prepared and arranged as described, a user can contact either or each of the hotels *after* having checked prices at the telephone display. First a user may point towards the Sofitel to learn that it is a four star hotel with room rates of approximately $225 per night. Looking for a less expensive room, the user may point towards Cok City to learn it is a three star hotel, with rooms available that night. With only a few questions remaining before a decision can be taken, the user desires placing a call to the hotel desk. Indication of such via menu choices offered a user causes the systems of the invention to connect a telephone call to the hotel desk where an operator remains ready to receive inquiries. After learning of further details, the traveler can advise the clerk of her momentary arrival.

Indirect Point-to-Call

Great utility will be realized in systems using a point-to-call function to place a call which *relates* to an addressed object but is not a call directly *to* that object. The following examples are presented to illustrate these special subsets of the point-to-call functionality. In consideration of this presentation, the reader will surely appreciate the benefit society will enjoy as soon as these systems are deployed.

An observant traveler frequently notices conditions of his surroundings which require the attention of certain authorities. In example, city facilities including road signs, safety lamps, park fixtures, et cetera, sometimes become in a condition which is dangerous or otherwise damaged or defective. In such cases, these facilities need to be brought to the attention of the city facilities maintenance office. Users noticing city facilities in disrepair can call to report the condition using the point-to-call function of these inventions. The precise object noticed is automatically documented and information is passed directly to officers in charge in the point-to-call operation.

Likewise, emergency situations are occasioned by an urgent need to contact rescue and assistance teams and further to provide those entities with precise location information so that they are enabled with a quick response plan including directions to the scene of the emergency.

Fire is an emergency whereby the time to alert authorities has a great effect on the overall outcome of the incident. Quick reporting of the location of the building on fire not only saves lives and valuable property, it can make the difference between complete loss and minor annoyance. Since the results of fire are generally severe, early notice and accurate location information cooperate together to give firefighters a big advantage. Armed with devices of the invention, any person who happens to see the start of a fire can report it with ease, speed, and accuracy simply by pointing the mobile unit towards the fire scene. Such does not require special skills on the part of the reporting persons. A fire type point-to-call function produces a telephone call directly to the fire department and transmits position information relating to the exact location where a fire may be. A voice connection may also be activated and a user may give additional information, such as the presence of individuals in need of medical attention which may help a fire rescue team understand the precise nature of the incident and the resources required at the scene.

Finally, a good example of a point-to-call function relating to facilitating business includes the case where an owner of real property offers it for sale. A sales agent not actually co-located with the property can be contacted by telephone connection whenever interested buyers using the point-to-call function directs a special telephone to address the subject real estate and request contact with the agent. In this way, a point-to-call function puts a requesting party in contact with the proper authority in charge of handling sales questions and procedures. Position data may be compared to the agent's database to alert the agent as to which property is being addressed.

It is interesting to note that several types of contacts may be associated with one object. A building on fire may require a point-to-call function to the fire department while the identical building for sale would have business inquiry calls properly routed to a sales agent. In these circumstances, specification of the nature of the call, i.e. emergency, business, et cetera, directs the precise routing of the point-to-call action. These actions may be accounted for as described in the user selection step 24 of Figure 2.

All of the above mentioned events require timely connection to appropriate agencies. Details regarding precise times and places may also be critically important. These necessary details are usually not sufficiently provided by verbal descriptions provided by reporting persons. In view of a forest fire on a remote mountain in a region unfamiliar to reporting party, one can truly understand the dilemma.

In the simple case of a defective traffic light a server causes a report to be logged at a city facilities unit. In the case of a damaged train crossing, the railway operations people are provided an alert at their central office. In the case of a broken damn, forest fire, or traffic accident, authorities appropriate for handling a response to those types of emergencies are contacted.

Each of the above examples illustrates the function whereby a point-and-click action on devices of these inventions results in a server providing a command to execute an action at a remote location where that location is not the object of the address, is not the server, and is not the mobile unit, but rather is a *related*, but remote location. It is easy to understand how impossible it would be to explain all relationships between objects and remote locations; therefore, one should remain mindful that the precise relationship does not make these inventions but rather the mere fact that there exists some relationship yields great utility and novelty in the combinations taught.

Although preceding discussions include great detail as to how general systems may function, the following discussion is directed to particular special arrangements for targets of high mobility; for example, moving persons. While it is easy to see how fixed objects such as hotels and banks may be known to a database and referenced via their geometric descriptors, it is not precisely clear how a person who is free to move about may become a target of a point-to-call operation.

Point-to-Call Mobile

Devices and methods of these inventions are directed to systems having prerecorded information stored in a database. The examples above do not anticipate the case where an object is dynamic in position and has a geometric descriptor which changes in time. Accordingly, those systems are useful for addressing fixed position objects such as buildings, bridges, mountains, but not useful for objects which are highly dynamic in position such as a person walking about a city street or driving down a highway.

Where targets are highly mobile, they have a geometric descriptor whose position is dynamic with respect to time. In this case, the database is continuously updated with current information triggered by an update cycle. Figure 3 explains. The 'get targets' 31 step fits into the scheme of Figure 2 as described above, however, it is modified in the regard that it is attached to a database 33 capable of maintaining data which can be frequently modified. A 'modify stored data' step 34 is taken to adjust the present state of data in the database at frequent intervals. A participating target object, such as a person registered in the point-to-call program, has a mobile telephone capable of determining the phone's position and reporting that position to the database. An 'update position measurement' step 35 can be continuously repeated on the regulation of a clock 36 such that accurate position can be reported 37 to and recorded in the database in real-time. In this way, any time a user addresses a person carrying a registered mobile phone, that person can be addressed by the user wishing to make telephone contact. A more complete and full understanding is easily realized in view of the drawing Figures 4 - 7 herefollowing.

Figure 4 illustrates a gentleman 41 in possession of a device of the invention 42, a mobile telephone equipped with point and direction 43 reference and position and attitude determining means. A pretty lady 45 is also in possession of a mobile telephone 44, that telephone being registered with a point-to-call program service. The gentlemen being interested in the lady points his telephone towards her to indicate to the computer his interest. The computer responds by searching a database of known objects to find information which may be available including the lady's telephone number. Because the lady is a registered point-to-call participant, her position or more accurately her phone's position is known to the system database.

A firm understanding is appreciated in view of Figure 5 which illustrates the lady target with the geometric construct associated with her telephone. The gentleman 51 points his mobile telephone 52 having a reference direction 53 in the general direction of the telephone 54 held by the lady 55. The lady's telephone being registered in the point-to-call program has associated therewith a geometric descriptor. Such a geometric descriptor 56 has a position concurrent with the phone position, and a spatial extent to form a spherical body of a meter or two in radius. In this way, the pointing action of the gentleman forms an intersection with the geometric descriptor associated with the lady's phone. As such, the computer determines that the lady (more precisely, the lady's phone) is being addressed and a telephone call connection is desired. A click action taken by the gentleman whose phone is in a point-to-call operational mode causes a call to be placed via the wireless telephone network to the lady (lady's phone).

Filters

It is recognized and acknowledged that privacy is a major concern with respect to technologies having advanced considerably over the years. Accordingly, these inventions include provisions for locking out unwanted calls.

When a person registers a phone in a point-to-call program as a potential recipient phone, the registration is enabled with an option of setting filter mechanisms. Filtering techniques permit only qualified callers to contact another. Calls made by unqualified callers are rejected.

For example, when a person decides to participate in a 'blind' caller (callers otherwise unknown to them) program, a filter may be designed to sort incoming calls. Criteria which may be important to a person is specified and stored in the database along with the geometric descriptor and association with a recipient telephone. Criteria may vary from one person to another. A person may only wish to receive calls from blind callers having certain attributes: i.e. callers having a formal education; male callers over 5'11 in height; callers associated with a particular industry; et cetera. Persons may only wish to receive calls from people who are residents of a certain part of a city. For example, residents of the North Beach section of San Francisco may be allowed to place calls while persons from Potrero Hill would be excluded in a particular persons personal profile. The list of possible filter criteria is extensive and difficult to fully present here.

Figure 6 illustrates the case where an attempt to contact a person is blocked. The system recognizes the target and identifies it as one which is not open for call access. Requester 61 who is pointing his mobile phone 62 towards 63 an intended recipient 64 is blocked from placing a call. Display label "No Access" 65 indicates the recipient cannot be contacted via telephone call. Menu choice item 66 "Send Msg." permits the caller to send a message which may be allowed despite that fact that calls are blocked. A second menu choice item 67 "Invite call" suggests that an invitation be sent which suggests a reverse point-to-call contact be made; i.e. the call connection is made to the person pointing from the intended recipient who overrides the blocked access if the invitation is accepted.

Alternatively, Figure 7 illustrates the case where caller 71, points phone 72, via reference direction 73 to intended recipient 74. Menu label 75 indicates the "Access Open" condition. Menu list item 76 allows the user to select a 'Place Call' function to stimulate the computer to make the call connection. Menu list item 77 'Capture #' allows the user to simply capture the person's phone number for later use.

Of course use of profiles to drive filter rules naturally invites profile inflation when persons are registering as callers and recipients and forming their caller/recipient profiles. An independent program agency could certify a caller/recipient profiles before allowing persons to participate in the program service. The particular rules for various programs will be further defined by program administrators. The rules presented here are not intended to be a complete set of rules but rather illustrative of those which may form a system of the invention. It is sufficient to say that applying filters fully meets the spirit and design of these inventions taught here without additional elaboration on those rules.

One will now fully appreciate how point-to-call functionality is achieved. Although the present invention has been described in considerable detail with clear and concise language and with reference to certain preferred versions thereof including the best mode anticipated by the inventor, other versions are possible. Therefore, the spirit and scope of the invention should not be limited by the description of the preferred versions contained therein, but rather by the claims appended hereto.

What is claimed is:

1) Methods of initiating a telephone call connection comprising the steps: addressing an object; and triggering a call request action, said 'addressing an object' is further defined as pointing a mobile unit reference direction toward said object, and said 'triggering a call request action' is providing stimulus to a computer in communication with a telephone network and further arranged to place telephone calls to numbers associated with objects being addressed.

2) Methods of claim 1, said 'addressing an object step' further comprising: pointing a mobile telephone having point and direction references towards an object known to a database, said database having telephone information stored therein relating to said addressed object.

3) Methods of claim 1, said 'triggering a call request' is further defined as operating a graphical user interface menu to make a selection and causing a trigger event via a user input to set the computer into action whereby said telephone call connection is initiated with respect to the addressed object.

4) Methods of claim 2, said objects are known to a database via a dynamic position update which allows potential targets to update geometric descriptors associated therewith repeatedly over a predetermined time period.

5) Methods of claim 4, further comprising a search step of searching a database for addressed objects and information relating thereto.

6) Methods of claim 5, said search step includes applying filters to the search to limit the results in view of predetermined criteria.

7) Telephone apparatus configured to execute a request for a telephone connection in response to an addressing action, the telephone apparatus comprising: a point reference; a direction reference; a position determining means; an attitude determining means; a computer processor; and an application server having a database and a point-to-call module, said database comprising a plurality of data

records each including a geometric descriptor, said point-to-call module in communication with a telephone network arranged to initiate telephone calls in response to pointing actions.

8) Telephone apparatus of claim 7, said point-to-call module being responsive to an object address action as defined by an intersection between an address indicator and a geometric descriptor.

9) Systems for addressing mobile objects comprising:

a) at least one **mobile unit**;

b) a **wireless network**; and

c) a **target object**,

said **mobile unit** comprising:

i) a point reference; ii) a direction reference; iii) position determining means; iv) attitude determining means; v) a computer; and vi) a transceiver, said attitude determining means connected to said computer whereby an attitude measure of the direction reference is conveyed to the computer and said position determining means connected to said computer whereby a position measure of the point reference is conveyed to the computer, the computer being connected to the transceiver whereby commands and data may be passed to and from the computer,

said **wireless network** in communication with said mobile unit, the wireless network comprising: i) at least one transceiver; and ii) at least one computer, said at least one transceiver coupled to at least one computer, and

said **target object** in electromagnetic communication with said wireless network, the target object comprising: i) a point reference; ii) position determining means; iii) a computer; and iv) a transceiver, said position determining means is connected to said computer and transceiver whereby a position measure of the target object point reference is conveyed to said wireless network.

10) Systems of claim 9, said mobile unit further comprises a telephone...

target object further comprises a telephone.

11) Systems of claim 9, said wireless network computer comprises an application server and database with data structure including records which include geometric descriptors with position fields frequently updated by a moving target object.

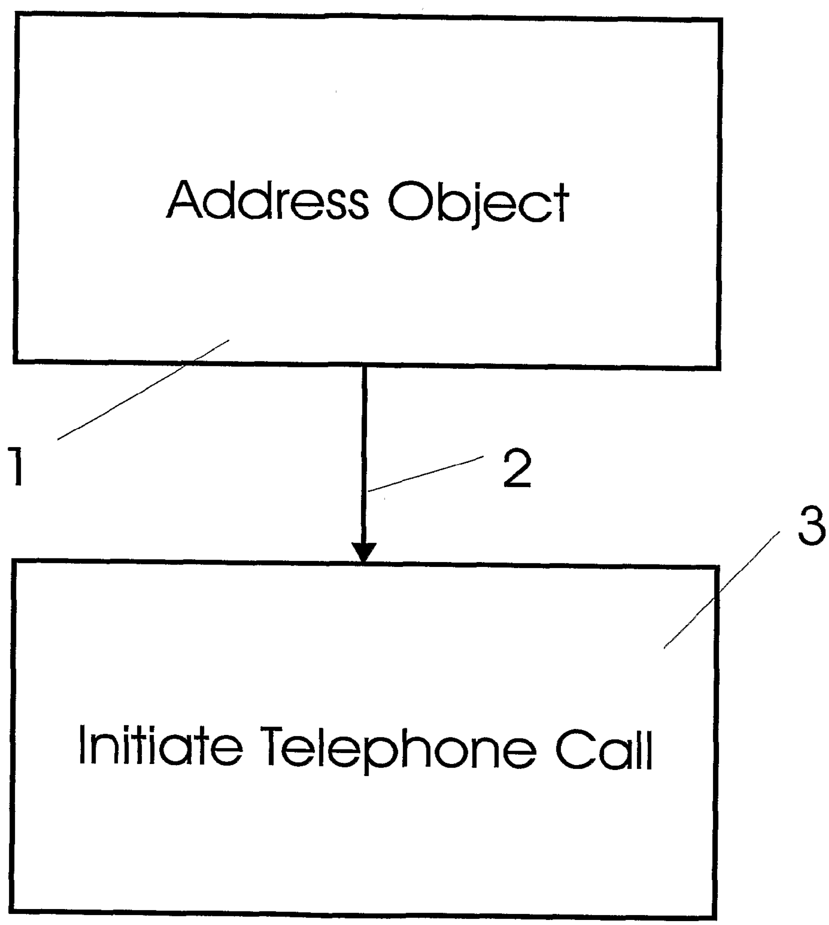


Fig. 1

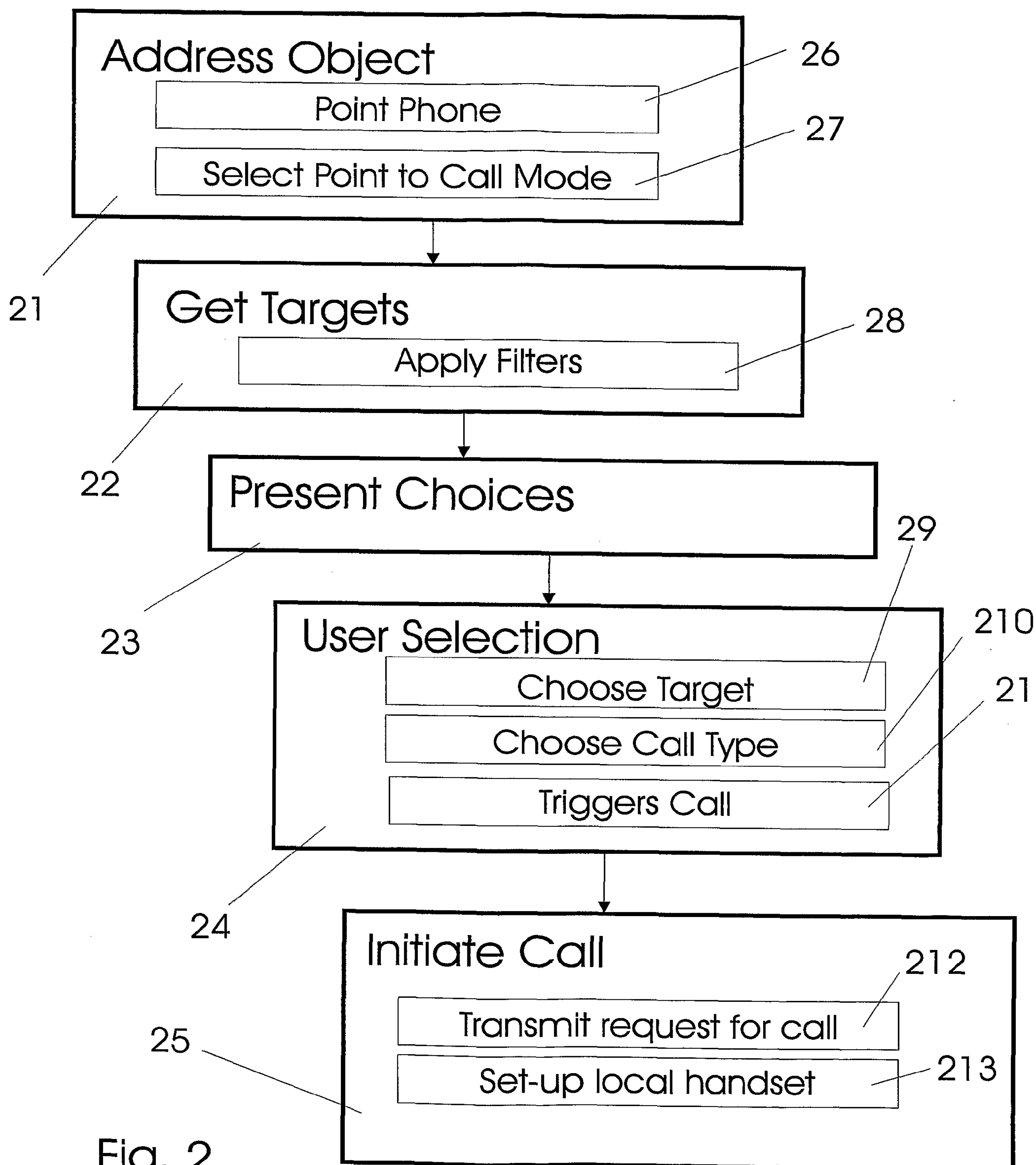

Address Object
Point Phone
Select Point to Call Mode
26
27
21
Get Targets
Apply Filters
28
22
Present Choices
29
23
User Selection
Choose Target
Choose Call Type
Triggers Call
210
21
24
Initiate Call
Transmit request for call
Set-up local handset
212
213
25

Fig. 2

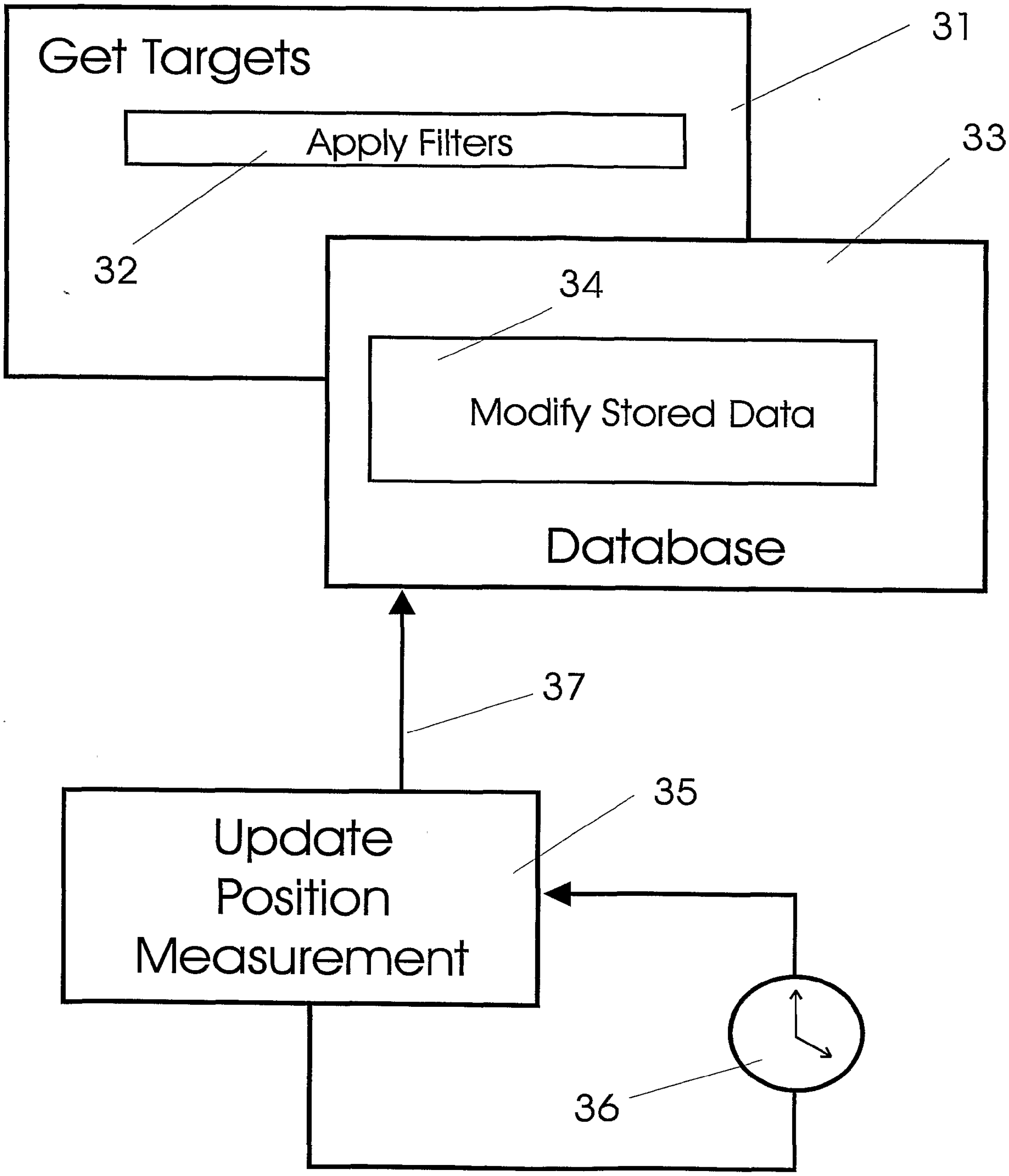

Get Targets
Apply Filters
31
32
33
34
Modify Stored Data
Database
37
35
Update
Position
Measurement
36

Fig. 3

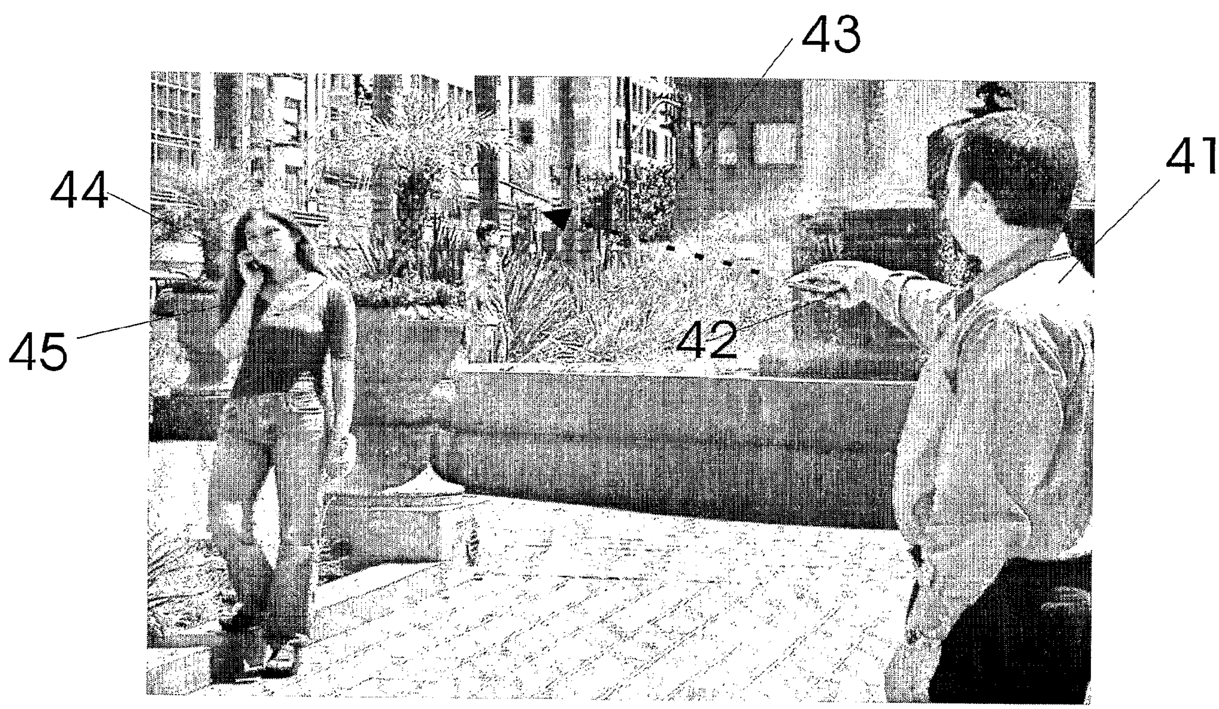


Fig. 4

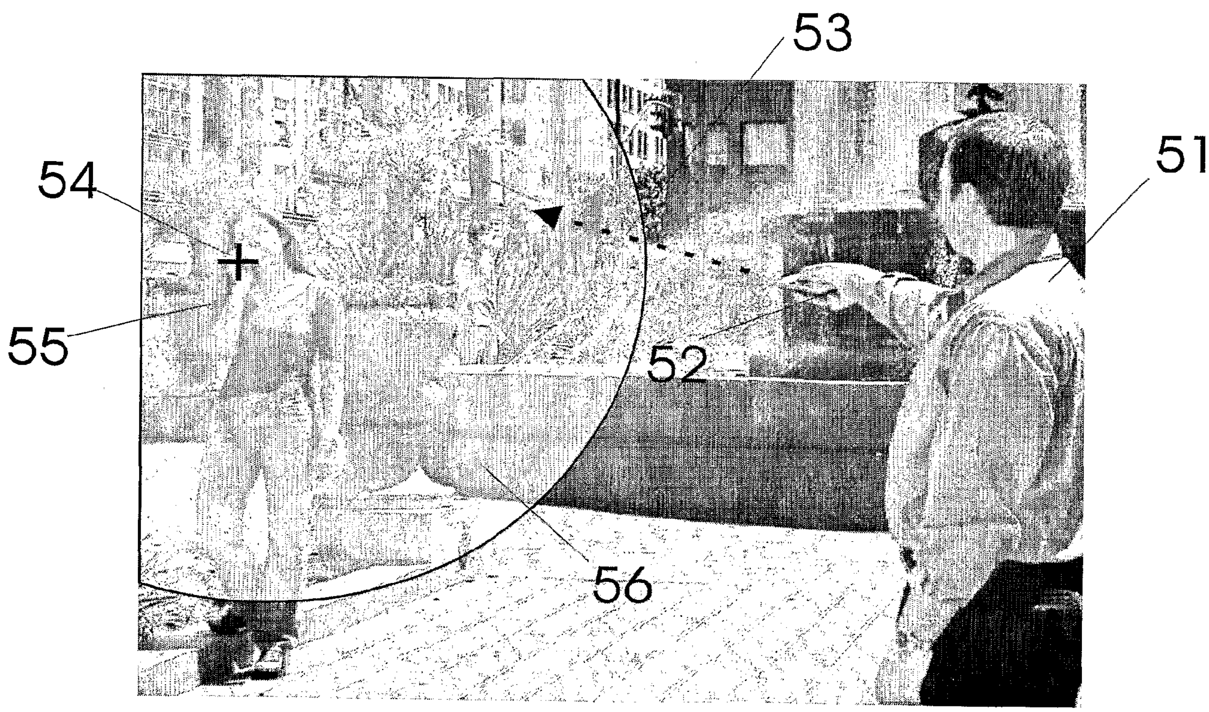


Fig. 5

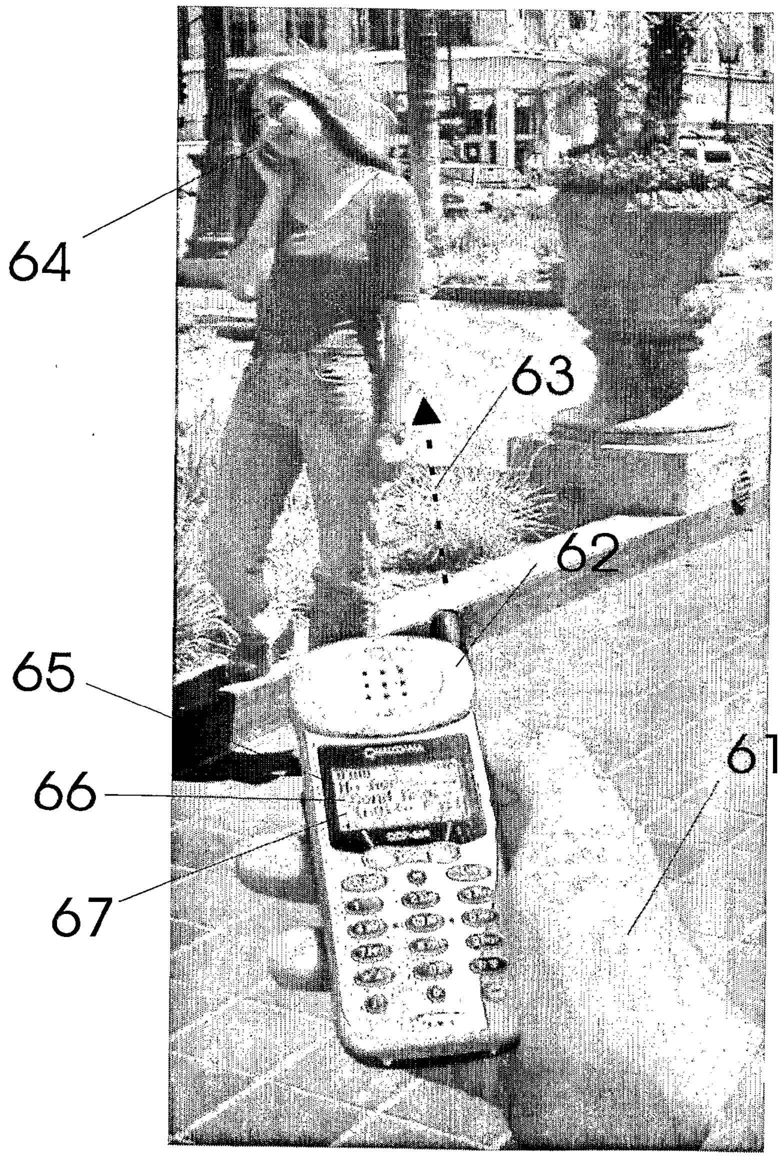


Fig. 6

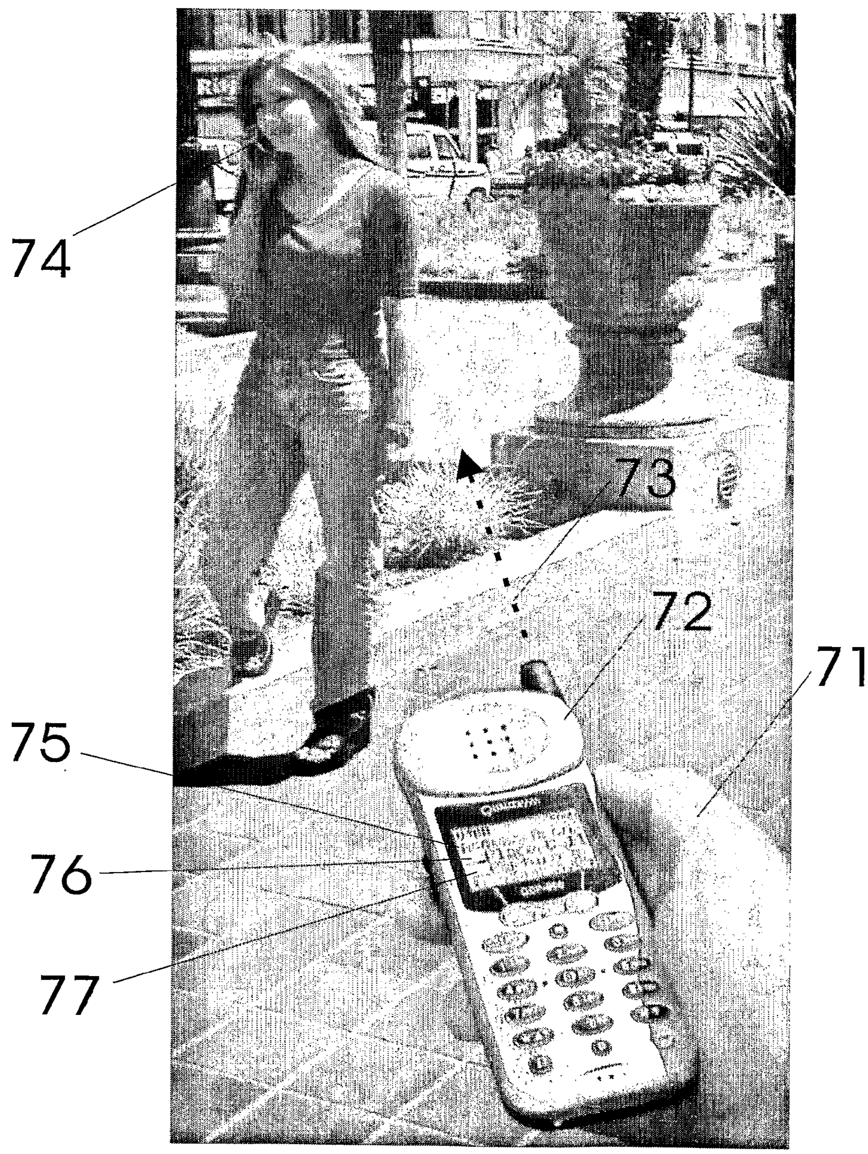


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/51087

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : H04B 1/38
US CL : 455/68,73,88;340/825.54
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 455/68,73,88;340/825.54,825.26

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	WO/93/17504 A1 (HYZIAK) 02 September 1993 (02.09.1993), page 6-14, figures 1-8	1-3,7,9,10 ---------- 4-6,8,11
Y	US 5,646,844 A (GUDAT et al) 08 July 1997 (08.07.1997), col.2, line21-col.4, line17	4-6,8,11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search 01 April 2002 (01.04.2002)	Date of mailing of the international search report 18 APR 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer for WILLIAM TROST Eugenia Logan Telephone No. 703-305-3900

Form PCT/ISA/210 (second sheet) (July 1998)

PCT

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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G06K

A2

(11) International Publication Number: WO 99/42946

(43) International Publication Date: 26 August 1999 (26.08.99)

(21) International Application Number: PCT/US99/03531

(22) International Filing Date: 17 February 1999 (17.02.99)

(30) Priority Data:
60/075,047 18 February 1998 (18.02.98) US

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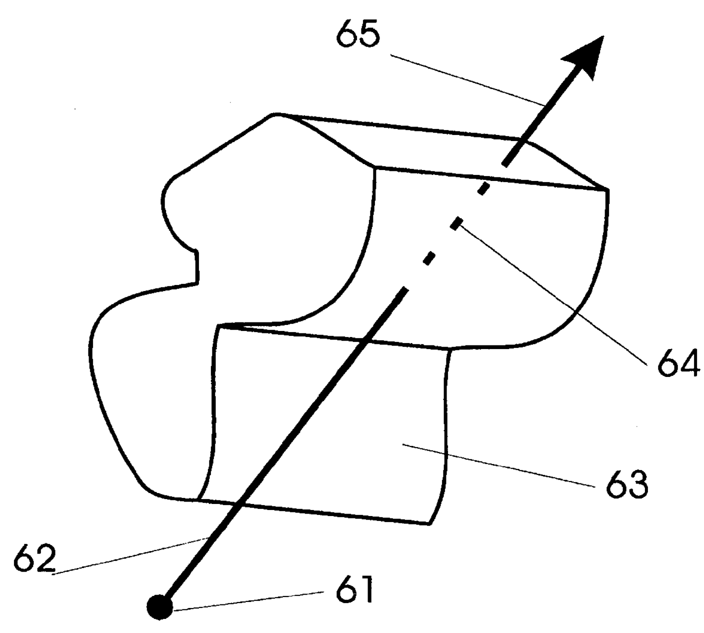
(81) Designated States: AU, CA, CH, CN, JP, KR, NZ, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: APPARATUS AND METHODS FOR PRESENTATION OF INFORMATION RELATING TO OBJECTS BEING ADDRESSED

(57) Abstract

Systems are arranged to provide a user information which relates to objects of interest. A user may point a device toward an object to address it. The device determines which objects are being addressed by reference to an internal database containing preprogrammed information relating to objects. Information relating to objects being addressed can then be presented at a user interface. A device of the system may include a point reference, a direction reference, a position determining means, an attitude determining means, a computer processor and database, and a user interface. A method of the system includes the steps of addressing an object, determining position and attitude, searching a database, and presenting information to a user.



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Title: "Apparatus and Methods for Presentation of Information Relating to Objects Being Addressed"

Specification for a Letters Patent

BACKGROUND OF THE INVENTION

Field

The following invention disclosure is generally concerned with devices and technique for presenting recorded information relating to objects and specifically concerned with presenting recorded information relating to objects having an association with a particular location.

Prior Art

Systems have been devised to display images of objects which may be in the field-of-view of a vision system. Images may be formed in response to a determination of position and attitude of the vision system which locates the field-of-view with respect to objects being addressed. Details may be fully appreciated in consideration of U.S. Patents # 5,625,765; 5,682,332; and 5,742,521.

While these systems are highly useful and sophisticated, they may require complex imaging apparatus and technique forming composite images which are aligned to actual objects.

While the systems and inventions of the prior art are designed to achieve particular goals and objectives, some of those being no less than remarkable, these inventions have limitations which prevent their use in new ways now possible. These prior art inventions are not used and cannot be used to realize the advantages and objectives of the present invention.

SUMMARY OF THE INVENTION

Comes now, Thomas Ellenby with an invention of an information system including devices and methods of presenting information relating to an object being addressed.

The present invention includes devices and methods for presenting information relating to objects having an association with a particular geometry and location. Specifically, devices are arranged with a pointing reference and user interface. A device which is pointed toward an object known to a computer database, responds by determining which objects are being addressed and presenting information which relates to the objects at the interface.

After a device of the invention is pointed towards an object, the device makes a determination of the position and attitude of the device. A reference address indicator associated with the determined position and attitude is defined and used in a search of a database. The database comprised of data elements having identifiers or descriptors associated with position and other spatial definition may form a geometric intersection with the reference address indicator. The search produces output which includes information about objects which are being addressed by the device. The information is presented to a user via a user interface.

Objectives of the Invention

It is a primary objective of the invention to provide systems for presenting information.

It is further an objective to provide systems for addressing an object and presenting information relating to the object.

It is further an objective to provide systems for addressing an object, identifying the object and presenting information relating to the object.

It is further an objective to provide systems for addressing an object, recalling information relating to the object by way of a spatial reference and presenting information relating to the object being addressed.

A better understanding can be had with reference to the detailed description of preferred embodiments and with reference to the appended drawings. These embodiments represent particular ways to realize the invention and are not inclusive of all ways possible. Therefore, there may exist embodiments that do not deviate from the spirit and scope of this disclosure as set forth by the claims, but do not appear here as specific examples. It will be appreciated that a great plurality of alternative versions are possible.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims and drawings where:

Figure 1 is a block diagram illustrating major elements of a device of the invention;
Figure 2 is a block diagram showing the configuration of a database of the invention;
Figure 3 is a geometric construct of interest;
Figure 4 shows a similar geometric construct which illustrates an important geometry;
Figures 5 – 15 similarly show geometries of importance.

PREFERRED EMBODIMENTS OF THE INVENTION

In accordance with each of the preferred embodiments of the invention, there is provided an apparatus for and method of presenting information relating to an object being addressed. It will be appreciated that each of the embodiments described may include both an apparatus and method and that the apparatus and method of one preferred embodiment may be different than the apparatus and method of another embodiment.

Throughout this disclosure, reference is made to some terms which may or may not be defined in popular dictionaries exactly as they are defined here. To provide a more precise disclosure, the following terms are presented with a view to clarity so that the true breadth and scope may be more readily appreciated. Although every attempt is made to be precise and thorough, it is a necessary condition that not all meanings associated with each term can be completely set forth. Accordingly, each term is intended to also include its common meaning which may be derived from general usage within the pertinent arts or by dictionary meaning. For purposes of this disclosure:

A **geometric descriptor** is a mathematical definition of a geometric body. A geometric descriptor of the invention is used in association with an object which may be addressed by systems of the invention.

An **information element** is a database record which relates to a particular object of interest. An information element comprises many forms of multi-media data including but not limited to: text, audio recordings, video streams, pictures, photographs, icons, Java applets, etc. In addition, each information element has associated therewith a geometric descriptor.

Address is a term used herein as a verb, most commonly with the gerund *-ing*, to indicate a relationship between a device of the invention and an object; the object being the subject of the address. A device of the invention which is pointing at an object is said to be 'addressing' the object.

An **address indicator** may be a geometric body, examples include vectors and cones, which has a pointing direction associated therewith. In addition to a reference point and reference pointing direction, some address indicators, for example a cone, subtend a solid angle or otherwise have spatial extent.

A **range gate** is a geometric segment which is a subset of an address indicator having a first endpoint or planar region at some minimum distance from a point reference and a second endpoint or planar region at some maximum distance from the same point reference.

objects refer to any element which may be of interest to a user. An object may be a real tangible object or may be a figurative element in space. The term 'object' should be read in a liberal sense. Although buildings and mountains suggest concrete forms of objects, objects for purposes of this disclosure include abstract forms as well. For example, the region of airspace over an airport which may be restricted is considered an 'object'. Indeed any region of space may considered an object whether is actually contains a tangible object therein or not.

In simplest versions of the invention, apparatus include the following elements as described herefollowing.

Geometric References

Devices of the invention include a point reference and a directional reference. These may be mere structural constructs. The actual point and directional references may or may not correspond to any tangible object or element of the device. Alternatively, they may be collocated with actual physical elements of the device. In either case, an important relationship is made between them and a position and attitude determining means which are also included in devices of the invention.

Position Determining Means

A position determining means is arranged to measure the position of the point reference. Since in many embodiments of the invention the position determining means is a global positioning system GPS receiver, the point reference lies at the center of the sphere which is defined by the resolution limits of the positioning system. For practical purposes, a handheld receiver which includes a GPS antenna may be said to have the point reference within the handheld unit. The position determining means therefore measures the position of the handheld unit. Many forms of alternate positioning systems may be used to accomplish the identical task. The particular positioning system employed may be chosen for a specific task at hand, for example a global positioning system would not be appropriate for a small space such as a warehouse so a radio triangulation technique may be preferred. The essence of the invention is not changed by the particular choice of positioning system. Therefore versions of the invention should not be limited to one particular type of positioning system. The limitation described by 'position determining means' is met when the position of the point reference is measured and made available to a computer processor. Therefore, by use of the term "position determining means" it is meant that any conceivable means for determining the position of a point reference and making that position known to a computer is anticipated. Experts will recognize that there are many thousands of possible ways of determining position and it will not serve a further understanding of the invention to attempt to catalogue them here. The reader will appreciate that the broadest possible definition of "positioning determining means" is intended here.

Attitude Determining Means

Systems of the invention also include an attitude determining means. An attitude determining means is arranged to determine the pointing direction or orientation of a directional reference. In simple versions, an electronic compass will serve as an attitude determining means. More sophisticated versions will include an attitude determining means which is operable for measuring inclination as well as direction in a horizontal plane. Although an electronic flux gate compass or laser gyroscope system may be used in certain versions of the invention, it does not improve the description to limit the attitude determining means to any particular device. Similar to the position determining means described above, the limitation described as 'attitude determining means' is fully met by any device or systems which may be used to determine the attitude of a directional reference and make that information known to a computer processor.

User Interface

A user interface of the invention serves to convey information to a user of the device. A simple speaker driven by computer audio systems is operational for producing audio information and description to a user. Similarly, a display screen driven by video systems of a computer functions to present video or graphic information to a user. Although a display screen and speakers are preferred devices for interfacing with a user, other systems include non-display type visual systems such as simple light emitting diodes, or non-speaker audio systems such as buzzers, tactile outputs such as vibrating systems, et cetera. In all cases, a user interface includes a transducer which is electronically driven by the computer which produces some physical disturbance which can be detected by a user's senses.

Computer Processor

In addition, systems of the invention include a computer programmed to execute specific routines. In particular, a computer is arranged to receive inputs from the position and attitude determining means. From these inputs, the computer defines a geometric body as an address indicator in association with the device reference point and pointing direction. From this geometric body definition, the computer performs a database search and determines if any of the geometric objects described in the information element geometric descriptors intersects the address indicator. Information elements which are determined to intersect said address indicator has data associated therewith which may be recalled and played back to the user interface as appropriate and in agreement with other criteria which may be selected.

Database

In systems of the invention a database is arranged to accommodate data relating to objects of interest. Data relating to objects is prepared and stored in a predetermined and well organized fashion. The data may be stored in many formats and configurations and may be of the nature sometimes referred to as 'multi-media'. A database of the invention is comprised of a plurality of information elements. Each information element relates to a particular object which may be of interest to users of devices of the invention. Each information element contains a descriptor which describes a geometry and location relating to the object for which the stored information pertains.

A geometric descriptor is a definition set for a specific geometry including position. For example, in a Cartesian coordinate system, a sphere may have its center at a point (X, Y, Z) = (2, 5, 9) while having a radius of 7 units. Thus the sphere and all of the points within the sphere's boundary are completely described. A geometric descriptor may describe a geometry which includes: a single point; alternatively, a polygon; which defines a planar region; a solid such as a sphere; or even a three dimensional object of arbitrary shape. Thus the rules which perfectly describe those geometries which are well known in the sciences are used in geometric descriptors of the invention. In all cases, a geometric descriptor includes at least one point and more frequently includes a set of many points.

Methods of the invention are best described as being comprised of the follows steps.

In a first step, an object is addressed. To address an object, the device pointing reference is merely pointed toward the object. The device is necessarily pointing in some direction at all times. Although it is not a necessity that the device be pointing to an object known to the database, the device is always pointing at something and thus it is said that it is "addressing" something at all times.

In a step to be performed after the first step, the position of the device reference point is determined. A GPS employed locally at the device operates to measure the global position of the reference point. Although convenient measurement units might be latitude, longitude and altitude, others similarly provide workable solutions. Data from the position determining step is passed to the computer processor.

In a further step to be performed after the first step, the attitude of the device directional reference is determined. A compass may be used to determine which direction the device pointing reference is being pointed. Data from the attitude determining step is similarly passed to the computer processor.

Data received at the computer processor from the position and attitude determining means is used to define an address indicator. A search of database information elements is commenced. A search operation reads database geometric descriptors and performs a coincidence test to see if an address indicator intersects any of the points in a geometry described. Items meeting that criteria are recalled for further processing and presentation at a user interface.

A more complete understanding can be realized in consideration of the drawing figures with reference numerals as follows. Figure 1 illustrates a block diagram of major components of devices of the invention. A point reference 1 is a geometric construct to which measurements of position are directed. The point may correspond to an actual device such as a GPS antenna or may alternatively be merely a point in space having a convenient location within a physical device. A directional reference 2 similarly forms a geometric construct at a device of the invention but is otherwise arbitrary with respect to any physical element or part of a device of the invention. A position determining means 3 is in communication with the point reference and is arranged to measure its position. The position determining means is further in communication with a computer. The position measurement is made without regard to any particular coordinate system in various versions of the invention but some versions using GPS devices preferably use a latitude, longitude and altitude scheme which allows one to define position anywhere on or above the Earth's surface. Determination of position within a coordinate system is the essence of the function performed by the device without regard for any coordinate system chosen for convenience.

An attitude determining means 4 is arranged in communication with a directional reference 2 and with a computer. The attitude determining means measures the pointing direction of the directional reference and reports that information to the computer processor.

A computer processor 5 is coupled to and receives measurement data from position and attitude determining means. The computer is further connected to a user interface 6 and presents information to a user by way of the interface. The computer includes a database 7 which may contain preprogrammed information.

Now, with reference to Figure 2 the database may be more precisely defined. A database 21 of the invention has a special construction. The database may include a great plurality of basic units each referred herethroughout as an information element 22. An information element may contain stored information in various formats 23. Each information element contains a descriptor 24 which defines a geometric body of interest. Additional information elements 25, each having their own descriptors and stored information, further make up the database. The database is comprised of any number of information elements the last element being the N^{th} element 26.

The above described elements, when assembled as directed, form a device of the invention which is preferably integrated into a small handheld machine. A sturdy case formed of durable plastic operates to contain the assembly and allows a user easy access to functions associated therewith.

In consideration of the above described arrangement and the following procedural description with reference to additional drawings, one will now better appreciate operation of some preferred devices of the invention. Drawing Figure 3 illustrates a simple geometric construction showing a point reference 31, a directional reference 32, a rectangular cylinder 33 and a circular cylinder 34. A portion of space 35 indicated by a dotted line is shared by the rectangular cylinder and an address indicator 36. The address indicator, in this case a simple vector, has an endpoint coincident with the point reference and colinear with the direction reference. Having full geometric definition of the vector, and the cylindrical objects, a computer routine is executed to determine which objects are intersected by the vector and which are not. In the case of Figure 3, the square cylinder is intersected by the vector but the circular cylinder is not. A device having a reference point 31 and directional reference 32 is said to be addressing the square cylinder. A computer having programmed information as to the location and shape of the cylinders can tell when a vector is intersecting the space of interest and when it is not. This fact depends on the condition that the cylinders remain stationary after the computer is programmed. The computer only needs the preprogrammed information and a measurement of the device point and direction references. The computer does not require input from any real object which may be associated with the space of interest and does not need to detect or probe it in any way.

For example if the square cylinder 33 is associated with a hotel known by the computer, the hotel is implicitly addressed whenever the device addresses the square cylindrical space. If a construction crew removes the hotel and the computer is not updated, the computer still assumes the presence of the building because it is a necessity that the space defined by the information element (hotel) geometric descriptor remain despite the actual presence, or lack of presence, of the building therein.

Accordingly, devices of the invention merely determine what space is being addressed and imply that particular objects are being addressed by way of the association of objects to spatial definitions or geometric descriptors. The mere fact that information contained in the database is accurate suggests and implies the presence of the hotel. It is the geometric descriptor which is preprogrammed into the computer which dictates if an intersection exists or not. The actual presence of an object does not affect whether the device is addressing it or not. It is useful to point out that one may generally rely on a hotel remaining in its set position.

One may rely on this technique for most items of interest. For example, the Empire State Building presently occupies a space which is well defined. It is a very reliable fact that the Empire State Building will similarly occupy that same space tomorrow. A device of the invention which is pointed at the Empire State Building, the position of the device and attitude being measured and defining an address vector, can reasonably deduce that the building is there. In this way, devices of the invention 'know' what they are addressing simply by measuring their own position and attitude and comparing that information with information in a database.

For purposes of this disclosure, an intersection of only one point is sufficient to have the address vector be coincident or to have an intersection with the geometric object. Figure 4 illustrates a scheme whereby the vector defined by the reference point 41 and the reference direction 42 is coincident with the square cylinder 43 at a single point 44. The circular cylinder 45 is not intersected by the vector and is not said to be coincident therewith.

It is not a requirement that an object be three dimensional; quite contrarily, a two dimensional or single dimensional object forms perfect basis for an intersection with an address indicator in the form of a vector. Figure 5 illustrates a point reference 51 and a direction reference 52 forming a vector which intersects a plane 53 at a single point 54. One might envisage every advertising billboard as a plane having position information associated with it. When programmed properly, these geometric definitions allow a device of the invention to know of any billboard anywhere. When pointed at a billboard the device can identify the advertiser and be made to respond by playing back information such as a product jingle, text information, video clips, et cetera. The connection between the billboard (object) and the geometric descriptor is made via the database where real objects are associated with geometric descriptors in preprogrammed data storage schemes.

The shape does not necessarily have to be regular or "well-behaved". A geometric description is available for a complexly shaped element as well as those more readily described in simple terms. Figure 6 shows a reference point 61 and reference direction 62 which define an address indicator in the form of a vector having an intersection with a spatial element 63 at line segment 64.

A geometric descriptor used in devices of the invention to associate object data with position and shape may change in time. Although the trains in Japan are moving objects, they move in a highly reliable way in accordance with a rigid schedule. Therefore, a geometric descriptor might include information about changes of position with respect to time. When a device of the invention is pointed at a moving train, inquiry to the database may yield an intersection with a 'moving' spatial element, i.e. an object having a position descriptor which is dynamic with respect to time.

Figure 7 shows an additional construction of interest. Although the term 'vector' implies a line segment with infinite extent in one direction, in some cases only a certain portion of the vector is of interest. Some operations described hereafter will refer to a "range gate". A range gate has two delimiters which define a portion of the vector which is of particular importance. Figure 7 shows a reference point 71, a reference direction 72, a first delimiter 73 a second delimiter 74, a cube body 75, a line segment 76, a circular cylinder 77, and a vector 78. Although the vector 78 intersects and passes through both the cube body and the circular cylinder, only a portion of the vector in the range gate, i.e. that portion between delimiters 73 and 74, forms an intersection with the cube body. Thus, in some instances, a range gate is created to designate which portions of the vector are of greatest interest. Thus a user interface may present information regarding the cylinder and the cube but where information relating to the cube is presented with priority.

Figure 8 shows another important range gate. A range gate may include all the points along a vector from the reference point to a selected maximum distance. For example a user may specify all targets "within fifty meters of the device". Objects which are greater than fifty meters away from the user are not included in any recall effort. Figure 8 illustrates this concept. A reference point 81 and line segment 82 form basis for a system having a range gate starting at the reference point and ending 83 at some predetermined distance from the reference point. A cubic object 84 has a portion 85 of the vector passing through it. Similarly, circular cylindrical object 86 also has a portion of the vector intersecting that object. Of course, the vector 87 continues on without limit. The difference between the cubic object and the circular cylindrical object is that the cubic object lies within the range gate region of the address indicator and the circular cylindrical object does not. A computer search engine arranged to be responsive to criteria describing such a rate gate is useful in restricting objects which are presented.

It is entirely possible that two objects fall within the limits of a particular range gate. Figure 9 illustrates a reference point 91 and a direction vector 92 which passes through 93 a first object, continues through space 94 and passes through a second object 95. In this case, both objects a cubic object 96 and a circular cylindrical object 97 form an intersection with the vector and lie with a range which lies on the address indicator somewhere past the point indicated as 98. A search engine therefore identifies both objects as being addressed by the system. A display can handle this occurrence by listing all objects being addressed simultaneously. A list may include a scheme whereby closer objects are listed first while more distant objects appear nearer the end of the list. A user may select from the list an object of particular interest and request from the computer more information relating to that object.

Although the previous examples primarily use a vector for an address indicator, it is not necessary that an address indicator be in vector form. An address indicator may be any geometric construct including but not limited to: a point; a line; a vector; a line segment; a plane; a planar section; a cone; a conic section; et cetera. To determine intersection with objects of interest, the search criteria may simple determine if any point of an address indicator is shared with any point described in an information elements geometric descriptor.

With reference to drawing Figure 10, one will appreciate an address indicator which is in the shape of a cone. Reference point 100, is joined by a surface 101 which describes a cone having an axis 102. The conic axis may be arranged to be colinear with the system reference pointing direction. Although a cone may extend in space without limit, ellipse 103 is useful to indicate a cross section of the cone. The careful observer might argue that the "cone" shown is not truly a cone in the sense that it is wider in one dimension that in an orthogonal dimension. This loose interpretation of a cone is intended to illustrate that the geometric shape of an address vector may be of complex form.

In some systems of the invention, it is useful to have an address vector which is adjustable. Figure 11 shows a conic shape similar to that of Figure 10 whereby the extent of the limiting surface has been increased. Reference point 110 forms the apex of a cone having a surface 111 which is quite portly in comparison to the cone of Figure 10. The conic axis 112 is associated with the system pointing direction. Devices of the invention may include an adjustment setting which can be set by a user to alter the shape and size of an address indicator.

Such adjustment may be used to configure the address indicator to take a shape having a width which is greater in extent than its height. Figure 12 shows a reference point 120 and address indicator surface 121 symmetric about pointing reference 122. One will readily appreciate the aspect ratio is different than those shown in prior figures.

Figure 13 shows how an address vector may be said to be intersecting an object. Reference point 130 is the apex of a conic address indicator having a surface 131 and a reference pointing direction 132 and cross section 133. Cylindrical object 134 contains spatial extent 135 which is shared with the address indicator. In this regard, it is said that a device of the invention having a conic address indicator as shown is addressing the object. One will appreciate that it is not necessary that the reference pointing direction be intersecting the object, but that any portion of the address indicator is sufficient to form an intersection. The database search can be made to be responsive to this condition.

Range gates cooperate with address indicators having spatial extent. Figure 14 shows a reference point 140, conic surface 141, pointing reference 142 and cross section 143. A conic section having cross sections 144 and 145 form a range gate which may be used to limit database searches.

It is not necessary that a reference pointing direction be aligned with the geometric axis of an address indicator. Figure 15 shows an example where a system reference pointing direction is not colinear with the axis of an address indicator. Reference point 150 is coupled with conic surface 151, axis 152, and cross section 153 to form a conic shaped address indicator. A system reference direction 154 on the surface of the cone may be used for system attitude measurements.

Of course with geometric shapes one might be quite liberal in devising various useful shapes. To be a valid address indicator, a geometric shape must merely have a reference point and reference pointing direction associated therewith.

One will now fully appreciate how a system which measures position and attitude may present information relating to objects having an association with a particular geometry and location. Although the present invention has been described in considerable detail with clear and concise language and with reference to certain preferred versions thereof including the best mode anticipated by the inventor, other versions are possible. Therefore, the spirit and scope of the invention should not be limited by the description of the preferred versions contained therein, but rather by the claims appended hereto.

CLAIMS

1) An apparatus for the presentation of information relating to an object being addressed, the apparatus comprising:

a directional reference;

a point reference;

a position determining means;

an attitude determining means;

a computer processor; and

a user interface,

said position determining means being arranged to determine the position of the point reference and convey position information to said computer processor;

said attitude determining means being arranged to determine the orientation of the directional reference and convey attitude information to said computer processor; and

said user interface being in electronic communication with said computer processor.

2) An apparatus of claim 1, said object being addressed being an object having information relating thereto stored in the computer.

3) An apparatus of claim 2, said object being addressed being an object having associated therewith, a geometric descriptor.

4) An apparatus of claim 3, said geometric descriptor being a definition of a geometric body which may form an intersection with the directional reference.

5) An apparatus of claim 1, said position determining means being a global positioning system receiver.

6) An apparatus of claim 1, said position determining means being a radio signal triangulation position determining system.

7) An apparatus of claim 1, said attitude determining means being a triaxial magnetometer.

8) An apparatus of claim 1, said attitude determining means being a laser gyroscope.

9) An apparatus of claim 1, said user interface being a transducer electronically driven by signals from the computer to create a physical disturbance which is perceptible via human senses.

10) An apparatus of claim 9, said user interface is a display screen operable for forming images and graphical forms.

11) An apparatus of claim 9, said user interface includes a speaker.

12) An apparatus of claim 9, said user interface includes tactile output.

13) An apparatus of claim 1, the apparatus further comprising a plurality of information elements stored in the computer in a database, each information element comprising stored information relating to an object which may be addressed by the apparatus.

14) An apparatus of claim 13, each of said information elements further comprising a geometric descriptor being a definition of a geometric body which may be associated with an object which may be addressed by the apparatus.

15) An apparatus of claim 13, said apparatus further comprising an address indicator, said address indicator being a definition of a geometric body being associated with said directional reference and point reference, whereby said address indicator may be caused to form an intersection with one or more geometric descriptors.

16) An apparatus of claim 15, said geometric body being a cone.

17) An apparatus of claim 15, said geometric body being a conic section.

18) An apparatus of claim 15, said geometric body being a conic section is arranged in accordance with a range gate definition.

19) A method of presenting information relating to an object being addressed, the method comprising the acts:

addressing an object;

determining position;

determining attitude;

searching a database; and

presenting information,

said addressing an object being further defined as causing a reference pointing direction to be aligned towards an object;

said determining position further defined as measuring the position of a point reference;

said determining attitude further defined as measuring the orientation of a directional reference;

said searching a database further defined as comparing an address indicator against a geometric descriptor of an information element; and

said presenting information further defined as reporting results of a search where correlation is found.

20) A method of claim 19, said presenting information including information relating to an object being addressed in the addressing an object step.

21) A method of claim 19, said geometric descriptor being associated with an object which is an object being addressed in the addressing an object step.

22) A method of claim 19, said address indicator being associated with said reference pointing direction and said point reference.

23) A method of claim 19, said determining position step includes principles used in global positioning systems.

24) A method of claim 19, said determining position step includes principles used in radio signal triangulation systems.

25) A method of claim 19, said attitude determining step includes principles used in accordance with triaxial magnetometer systems.

26) A method of claim 19, said attitude determining step includes principles used in accordance with laser gyroscope systems.

27) A method of claim 19, said presenting information step further including presenting information at a transducer operable for creating a physical disturbance which may be perceived by a human operator.

28) A method of claim 27, said presenting information step further including presenting information on a display screen in image and graphical form.

29) A method of claim 27, said presenting information step further including presenting information on an audio speaker.

30) A method of claim 27, said presenting information step further including presenting information on a transducer which produces a tactile output.

31) A method of claim 19, said searching a database step further comprising recalling information stored in information elements, each information element

comprising stored information relating to an object which is the object being addressed.

32) A method of claim 31, said information elements further comprising a geometric descriptor which is a definition of a geometric body and which is associated with an object that is an object being addressed.

33) A method of claim 19 said address indicator being a geometric body which is associated with said directional reference pointing direction and said point reference.

34) A method of claim 33, said geometric body being a cone.

35) A method of claim 33, said geometric body being a conic section.

36) A method of claim 33, said geometric body being a conic section arranged in accordance with a range gate.

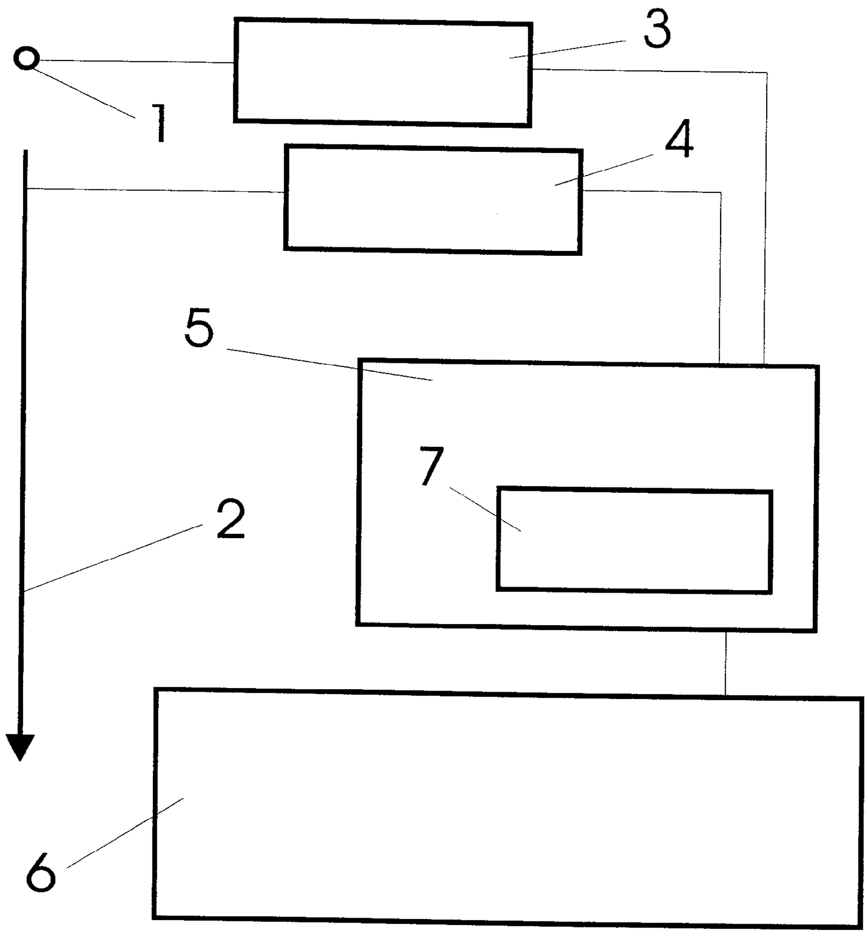
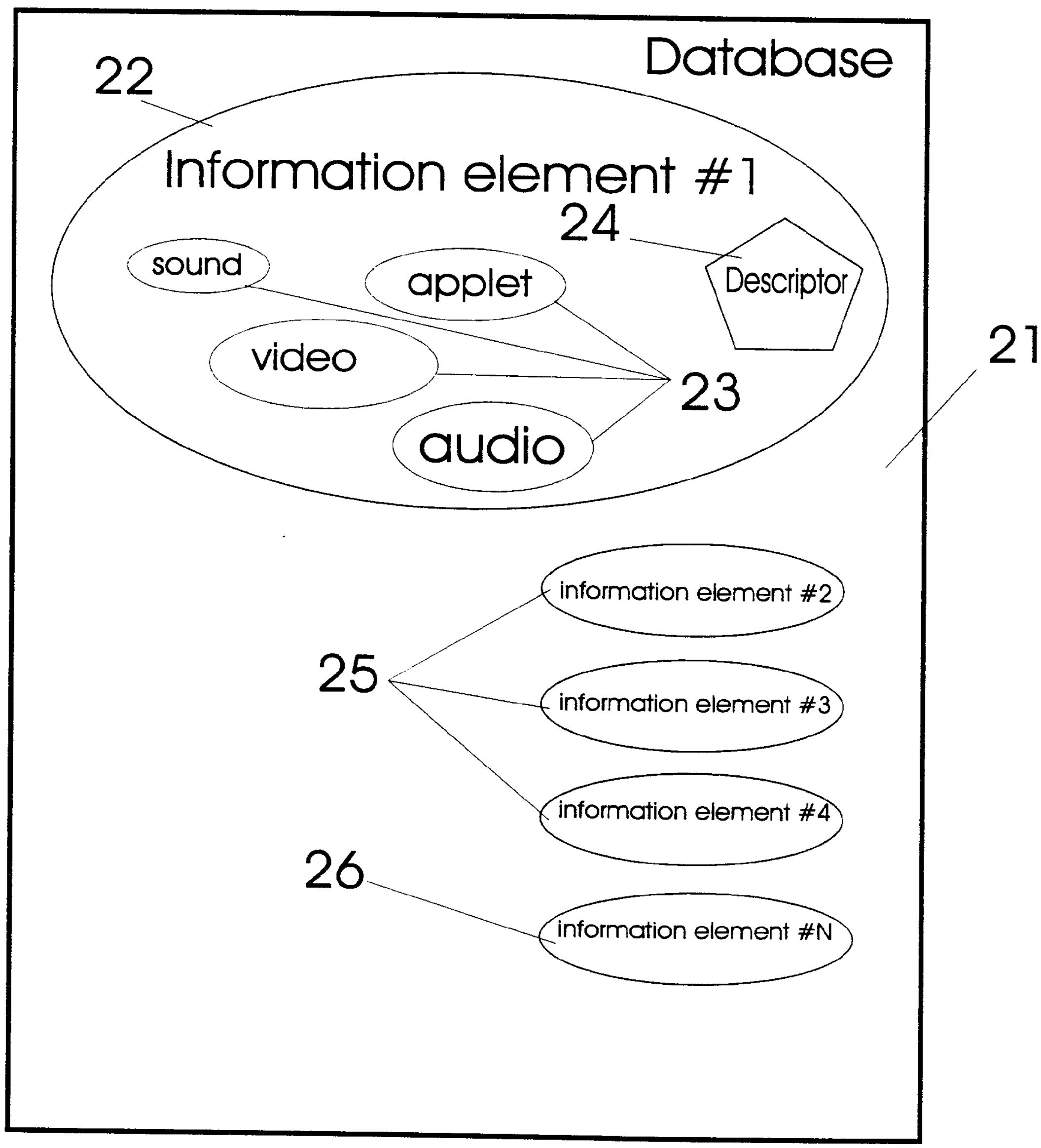


Fig. 1


Database
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Information element #1
24
Descriptor
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applet
video
audio
23
21
information element #2
25
information element #3
information element #4
26
information element #N

Fig. 2

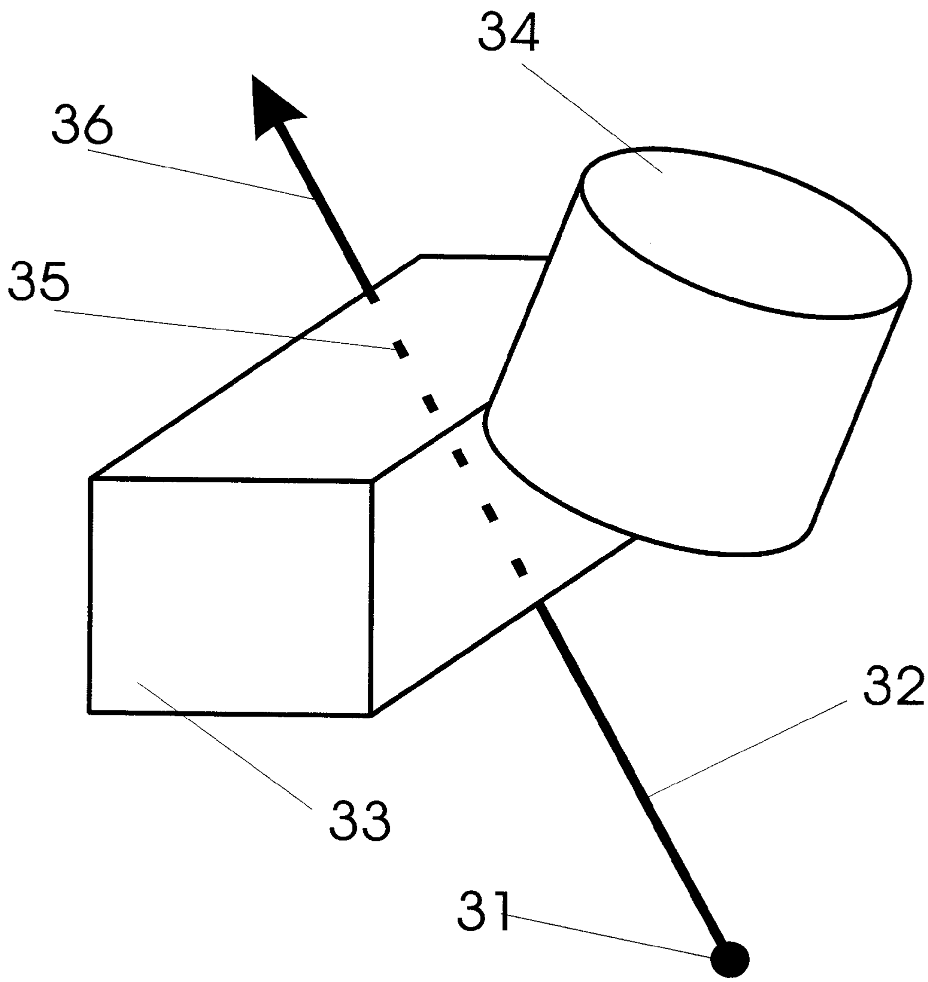

Fig. 3

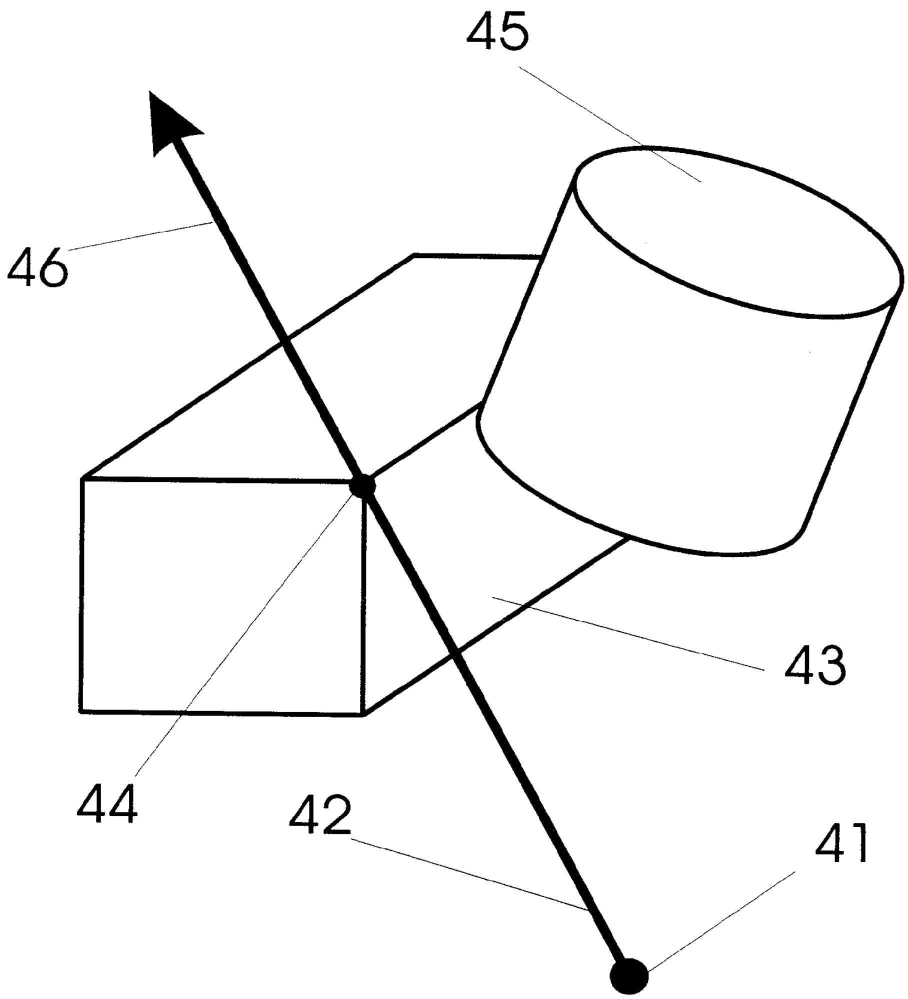

Fig. 4

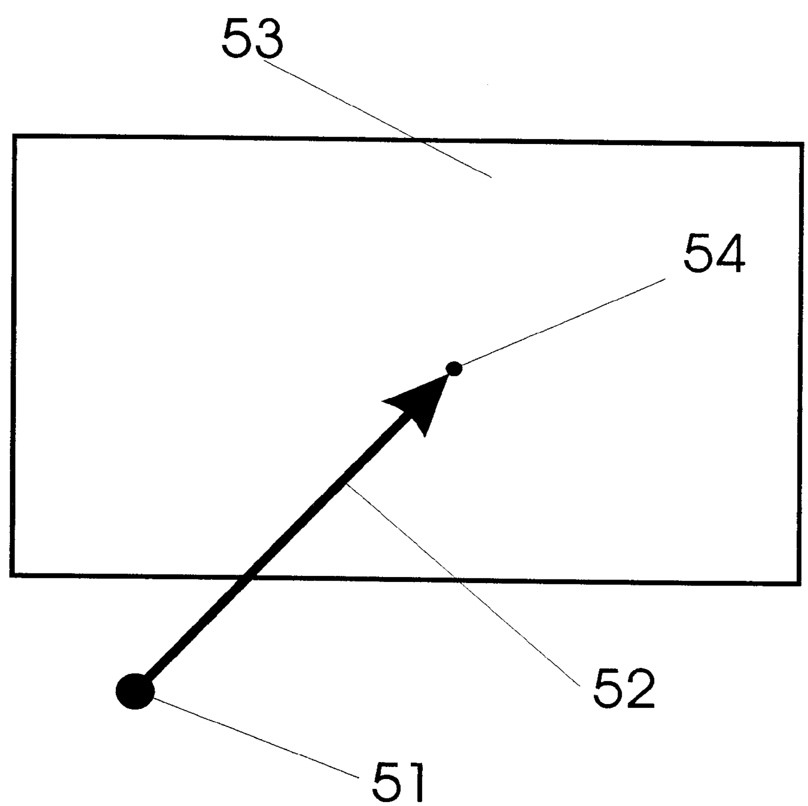

Fig. 5

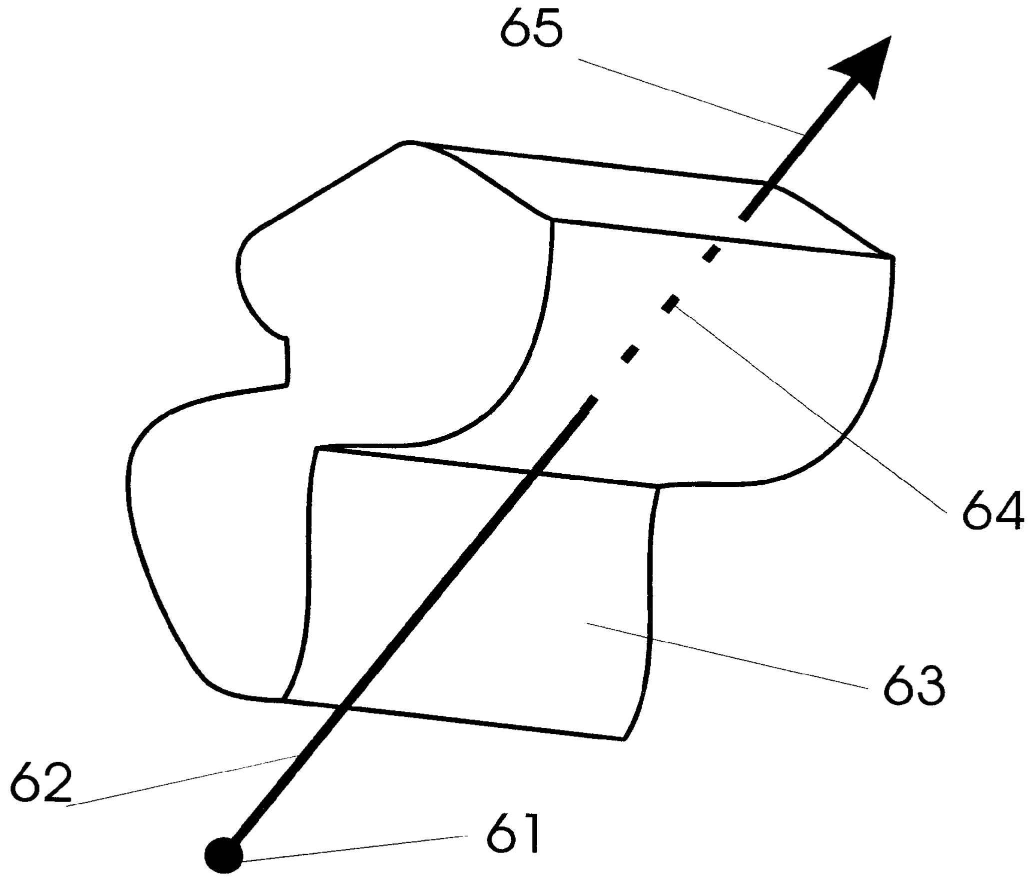

Fig. 6

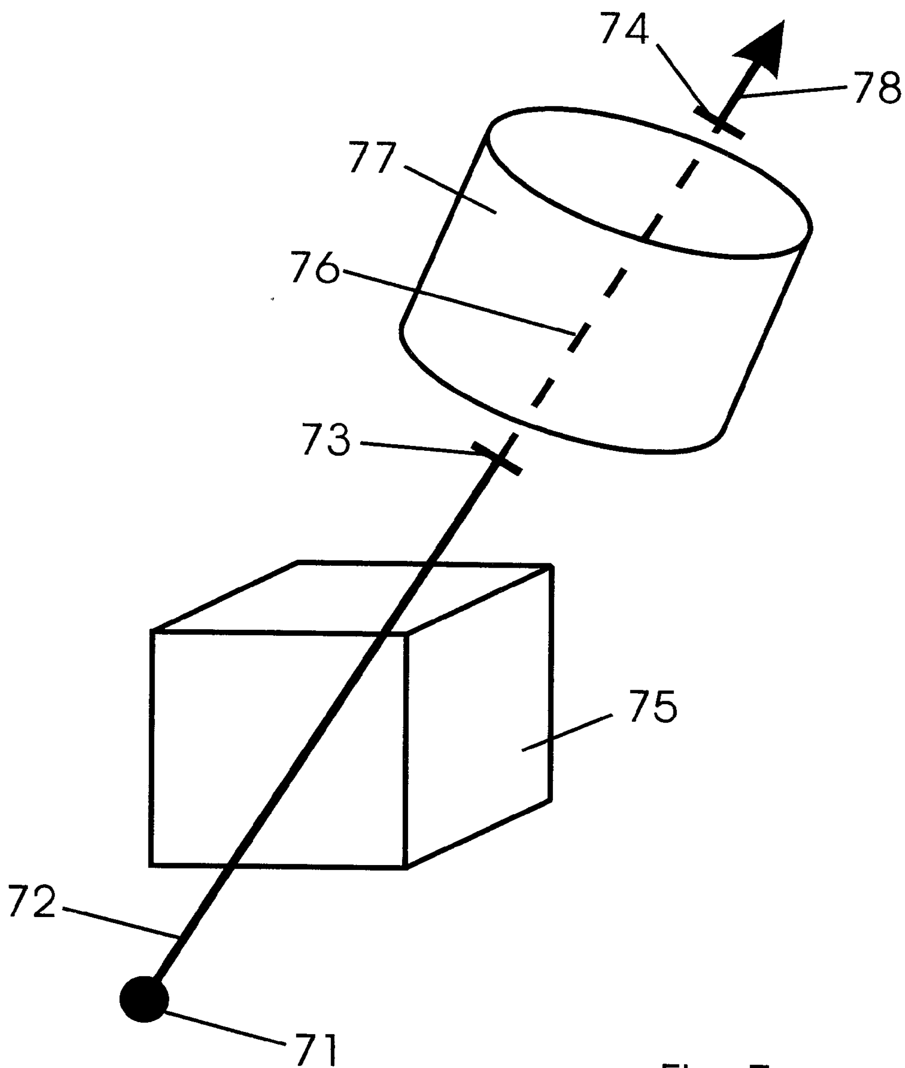

Fig. 7

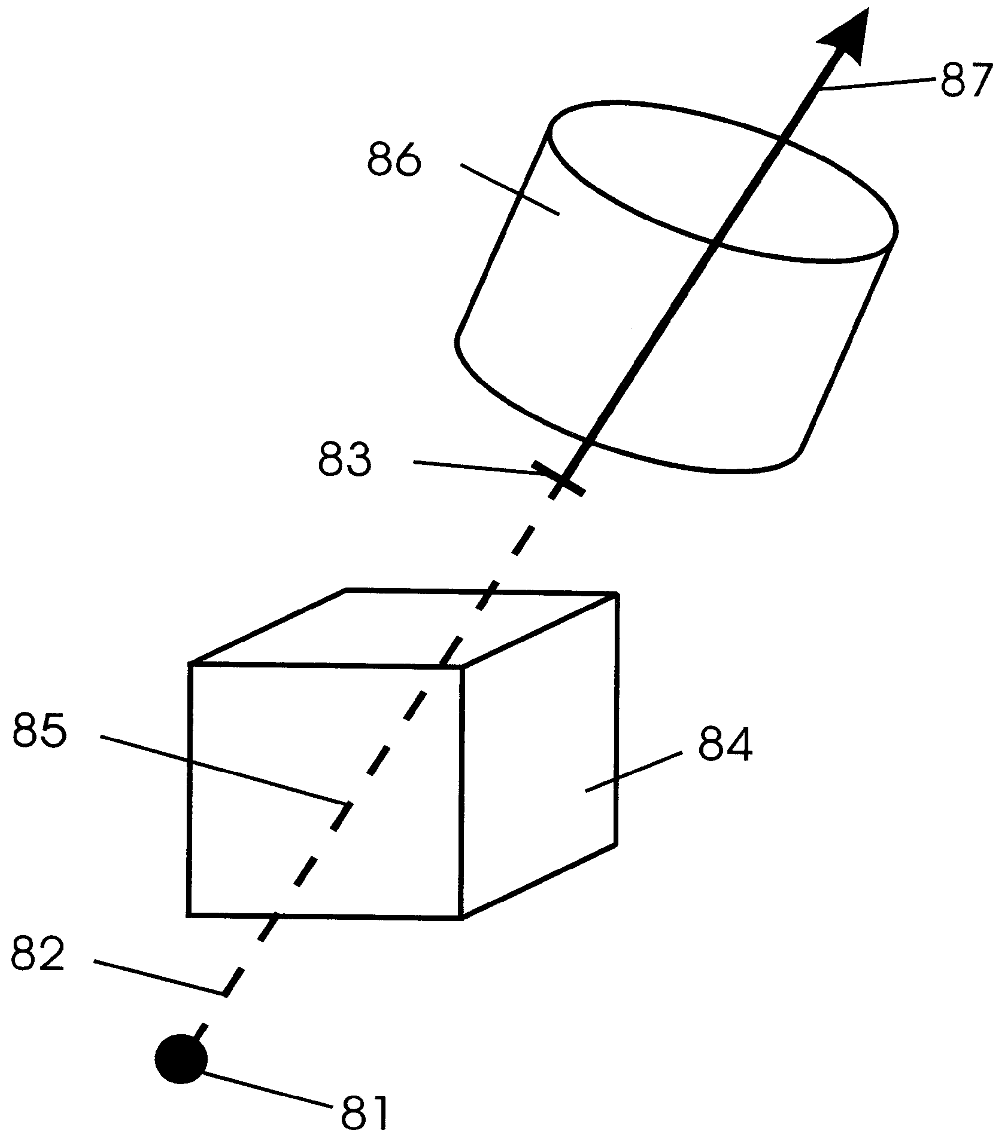

Fig. 8

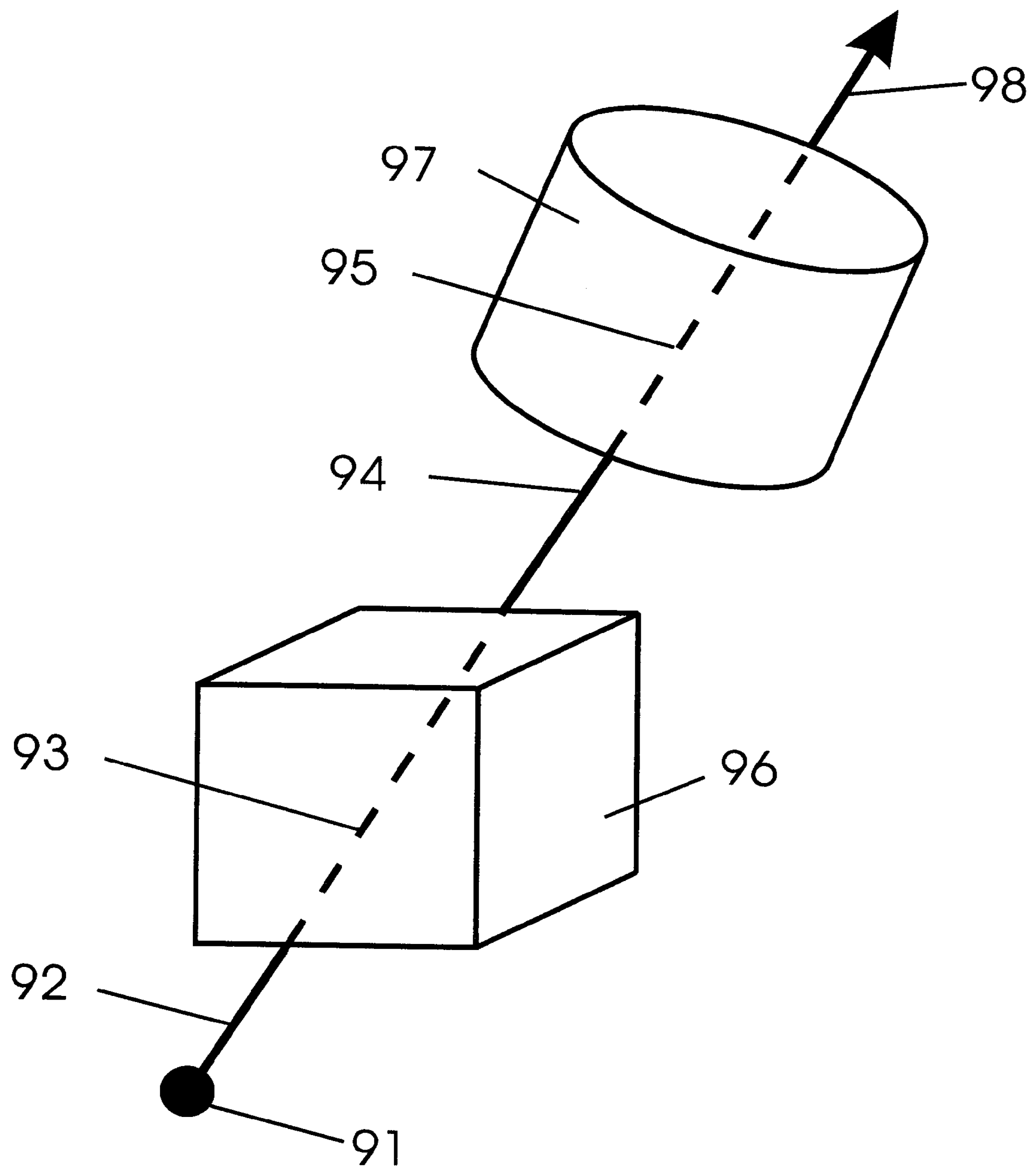

Fig. 9

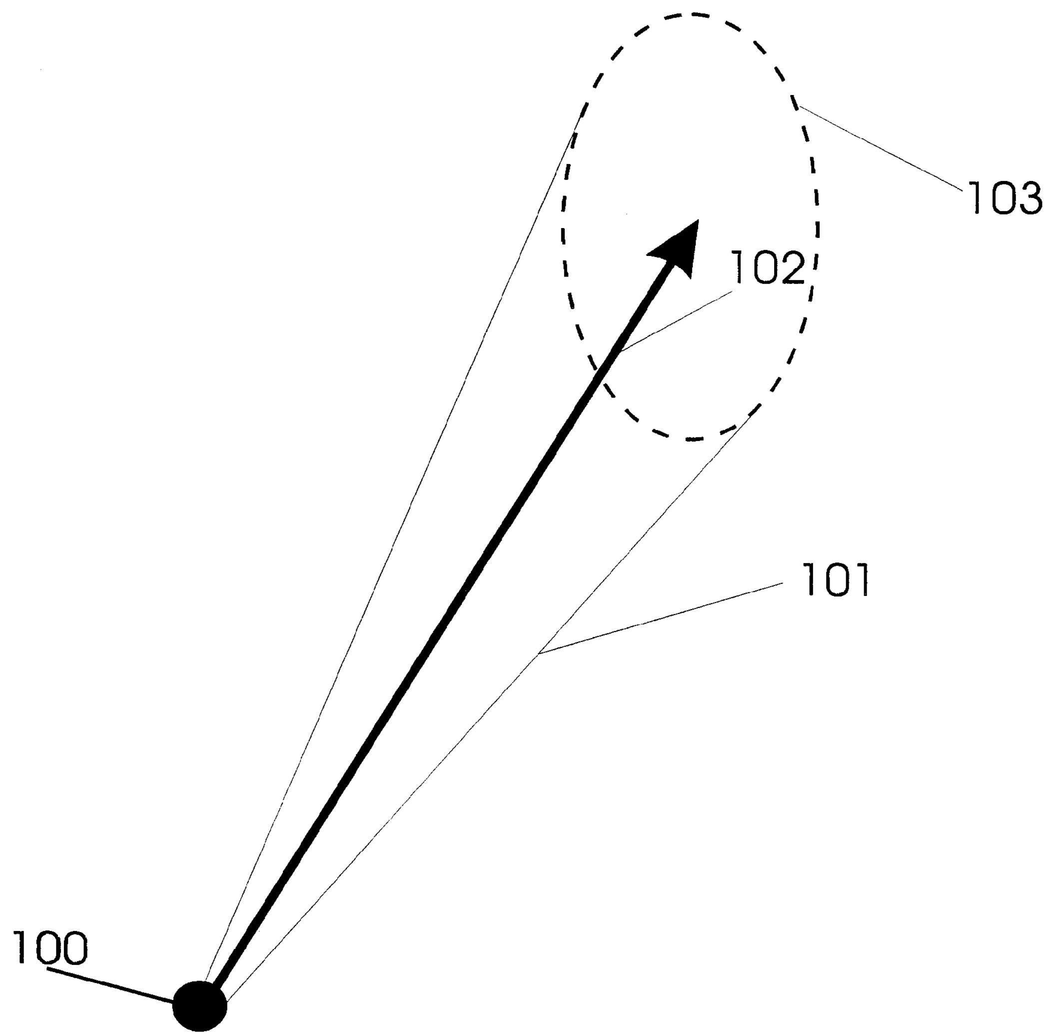

Fig. 10

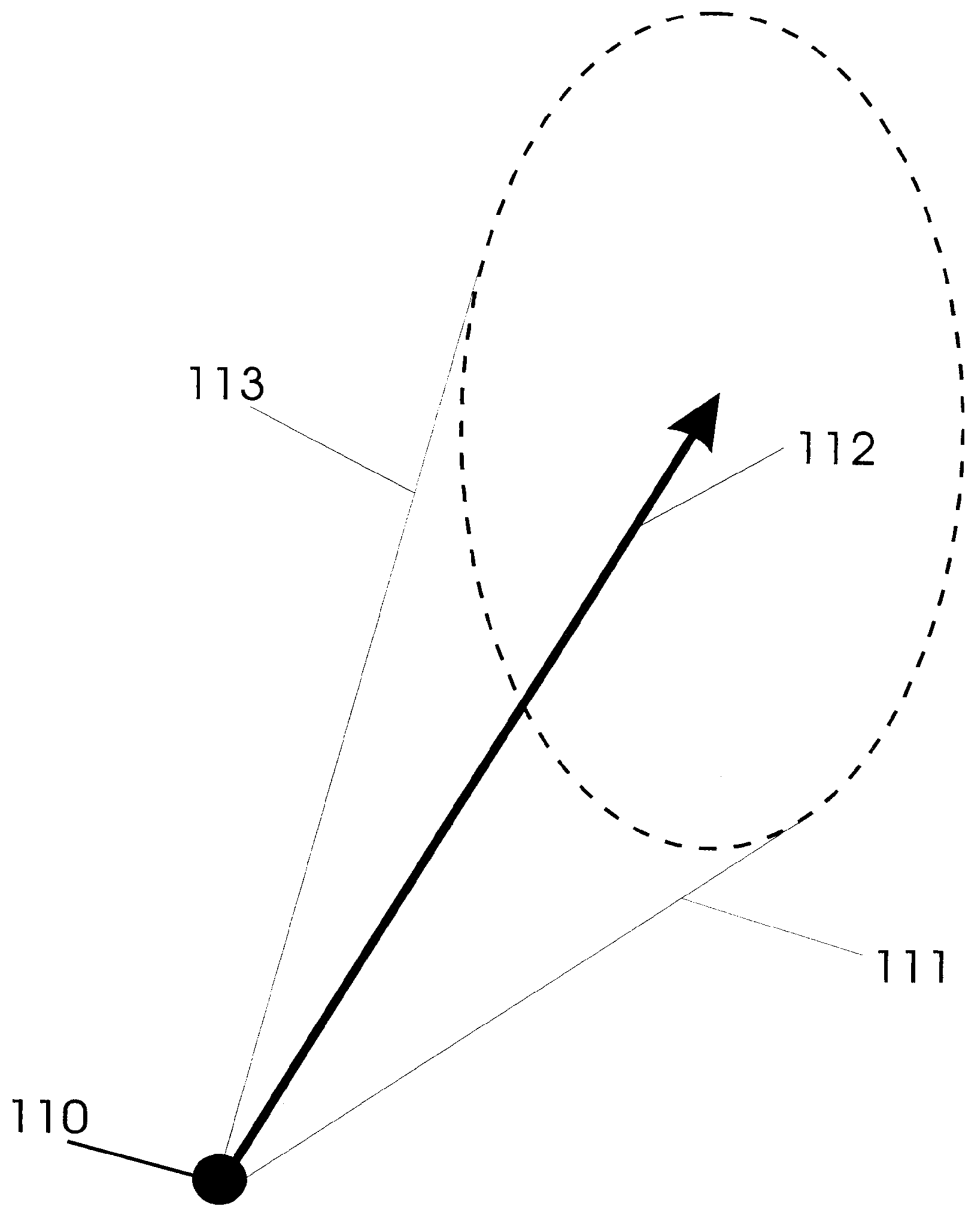

Fig. 11

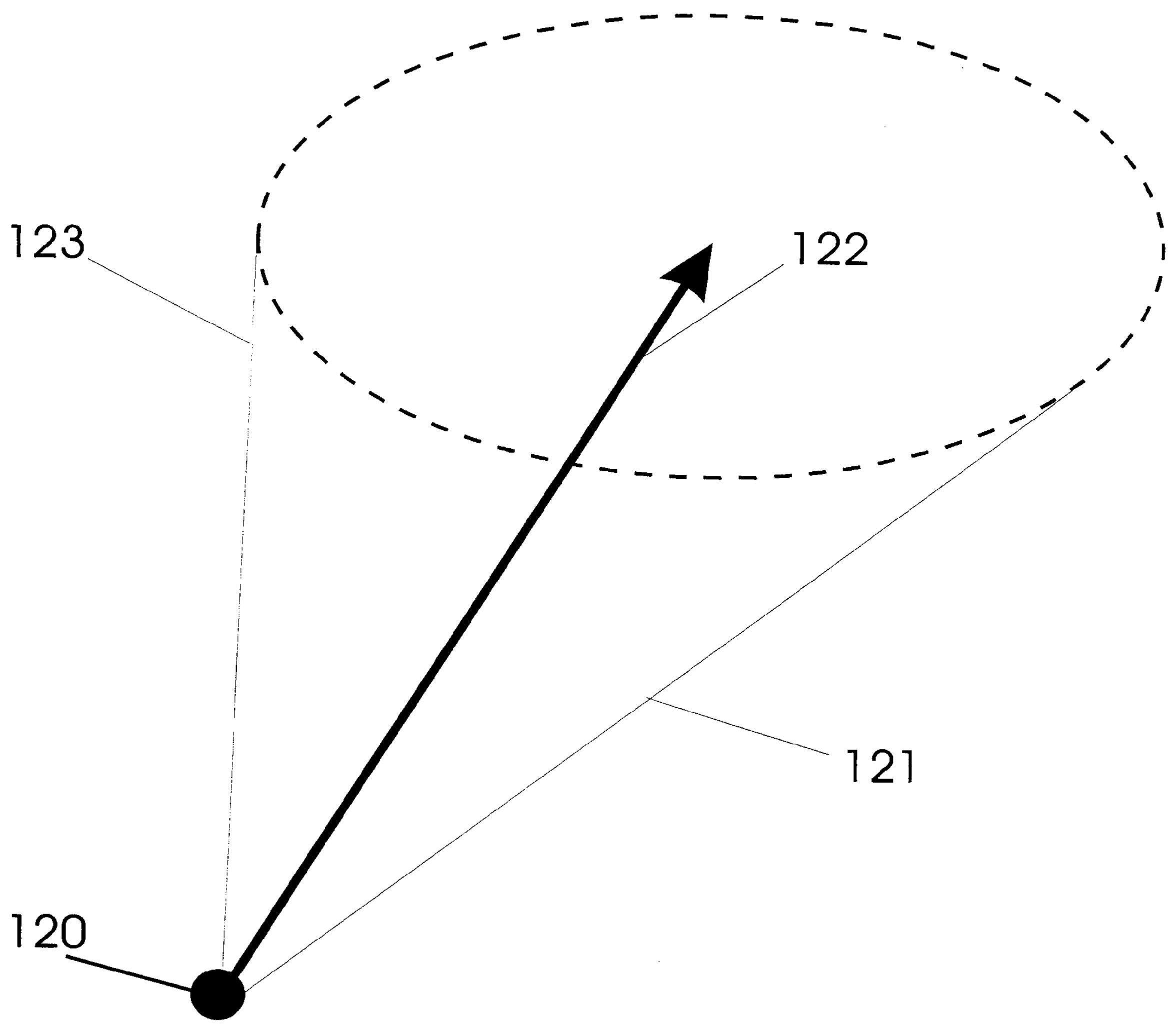

Fig. 12

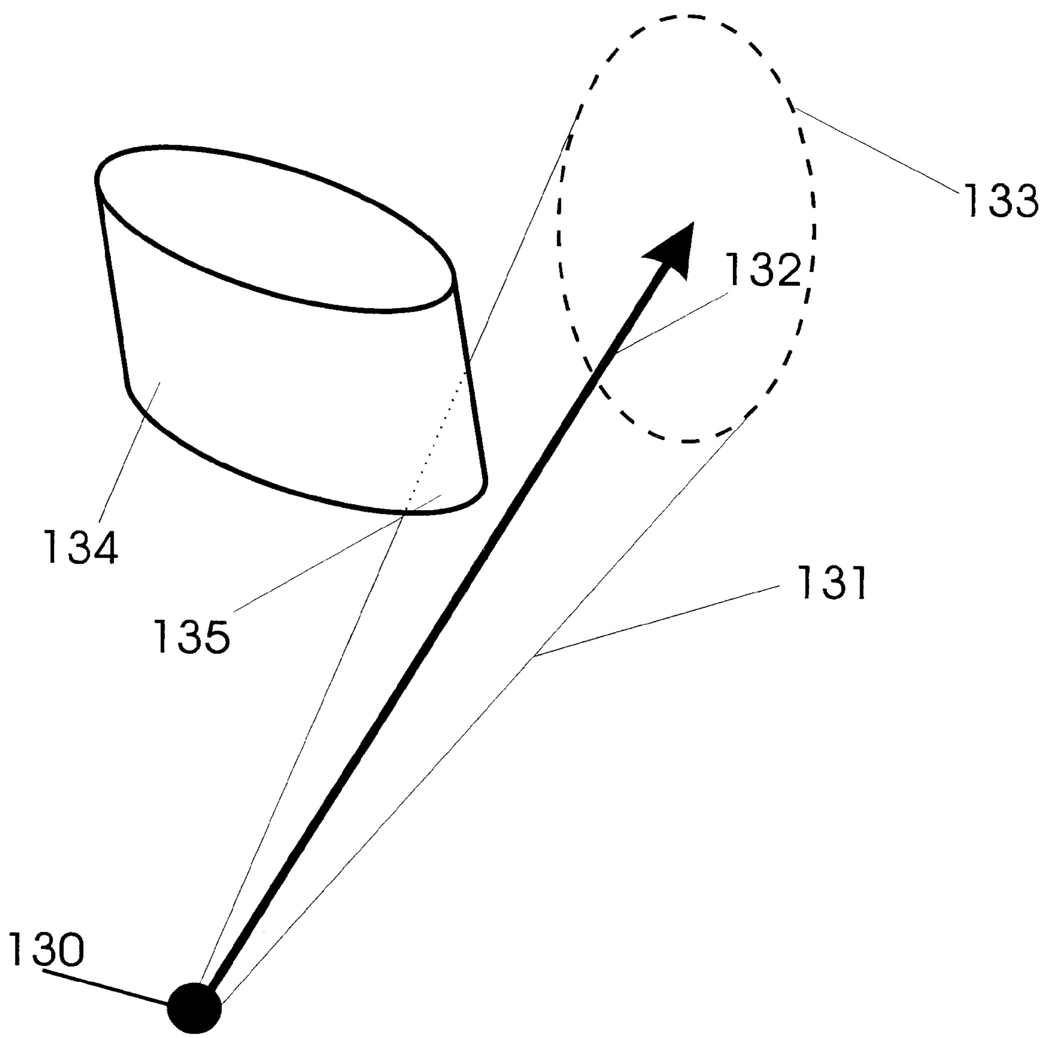

Fig. 13

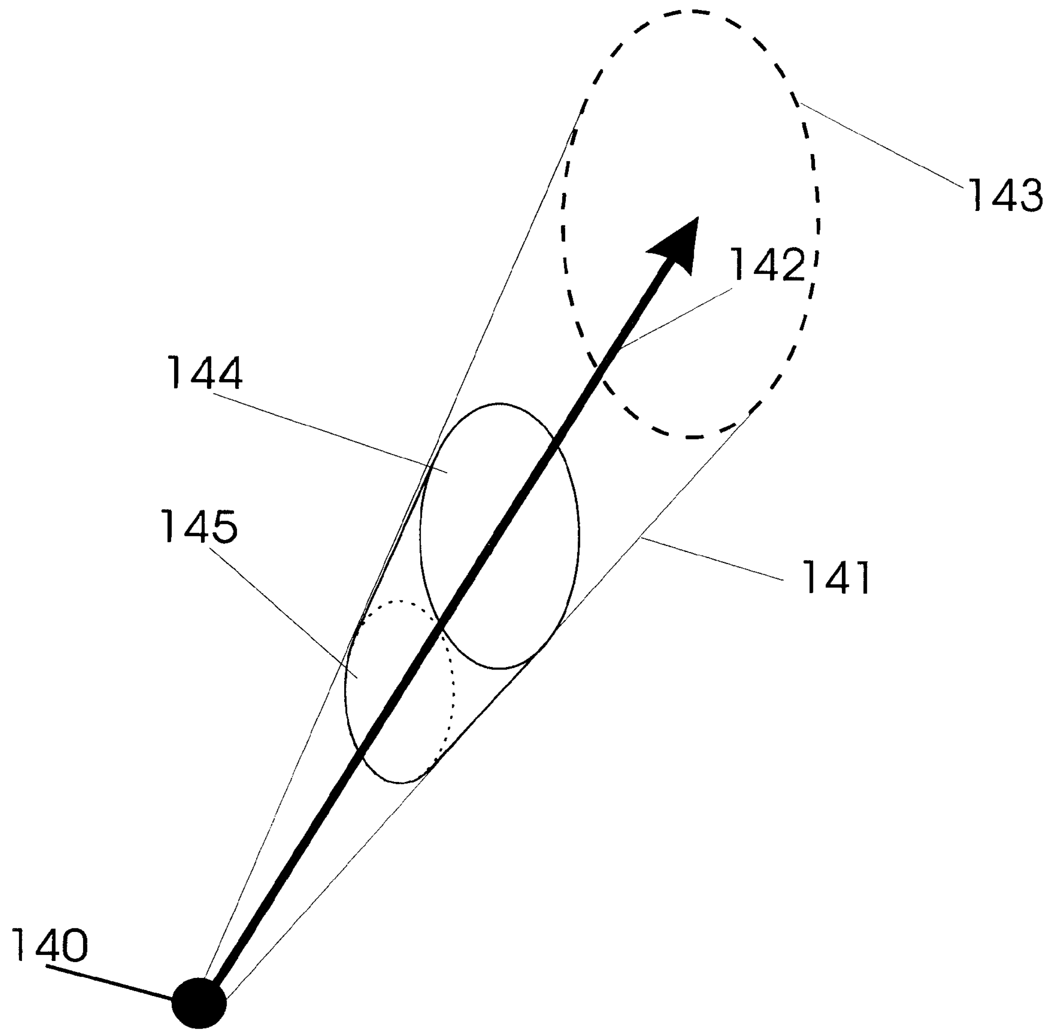

Fig. 14

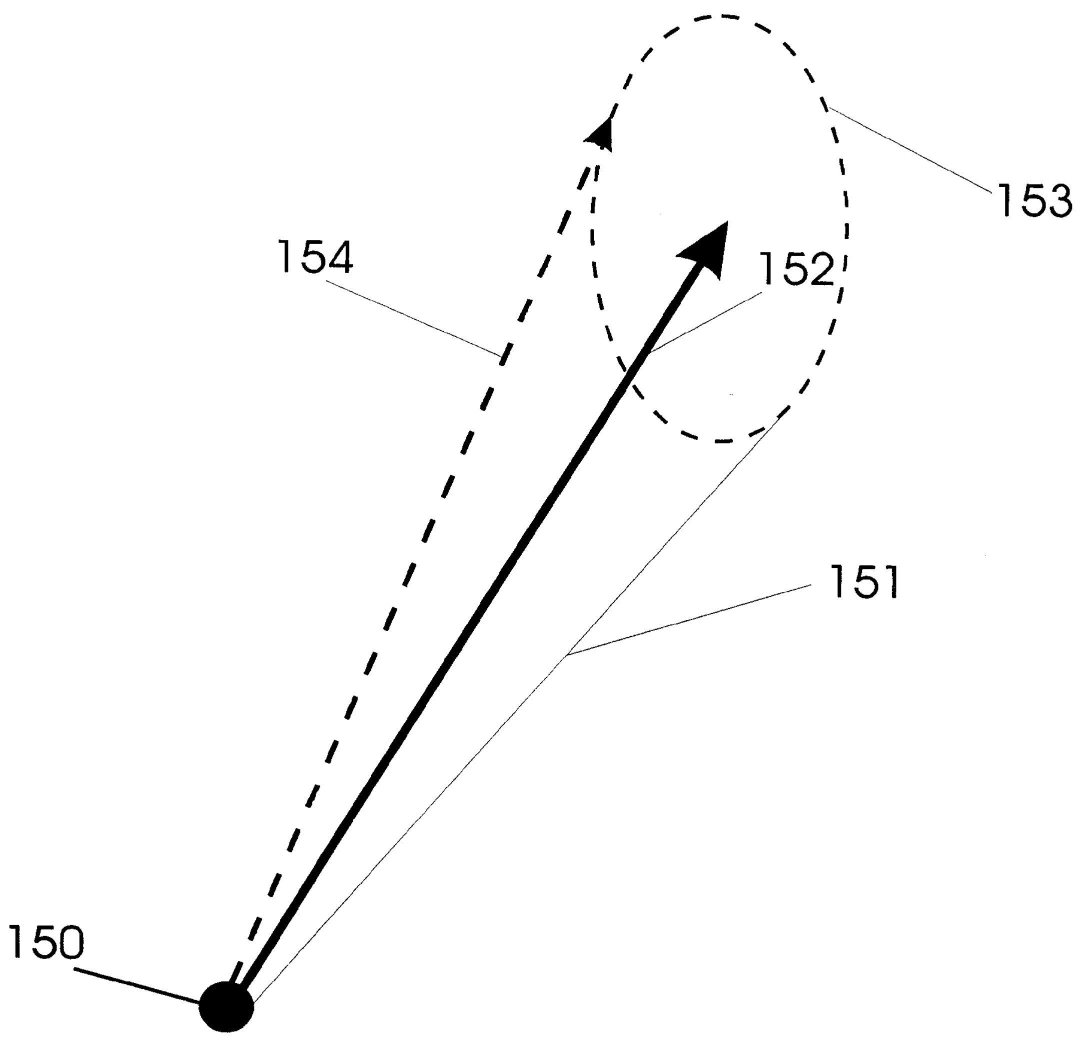

Fig. 15

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) **International Patent Classification** 6 : **G06K** — A2

(11) **International Publication Number:** **WO 99/42947**

(43) **International Publication Date:** 26 August 1999 (26.08.99)

(21) **International Application Number:** PCT/US99/03688

(22) **International Filing Date:** 17 February 1999 (17.02.99)

(30) **Priority Data:**
60/075,047 18 February 1998 (18.02.98) US

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(81) **Designated States:** AU, CA, CH, CN, JP, KR, NZ, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
Without international search report and to be republished upon receipt of that report.

(54) **Title:** APPARATUS AND METHODS FOR PRESENTATION OF INFORMATION RELATING TO OBJECTS BEING ADDRESSED

(57) **Abstract**

Systems are arranged to provide a user information which relates to objects of interest. A user may point a device toward an object to address it. The device determines which objects are being addressed by reference to an internal database containing preprogrammed information relating to objects. Information relating to objects being addressed can then be presented at a user interface. A device of the system may include a point reference, a direction reference, a position determining means, an attitude determining means, a computer processor and database, and a user interface. A method of the system includes the steps of addressing an object, determining position and attitude, searching a database, and presenting information to a user.

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Title: "Apparatus and Methods for Presentation of Information Relating to Objects Being Addressed"

Specification for a Letters Patent

BACKGROUND OF THE INVENTION

This application claims benefit of provisional application no. 60/075,047 entitled "Apparatus and Methods For Acquiring and Displaying Geo-Coded Information Based Upon the Position and Attitude of the Apparatus", filed February 18, 1998 by inventor Thomas W. Ellenby. Provisional patent application no. is hereby incorporated herein by this reference.

Field

The following invention disclosure is generally concerned with devices and technique for presenting recorded information relating to objects and specifically concerned with presenting recorded information relating to objects having an association with a particular location.

Prior Art

Systems have been devised to display images of objects which may be in the field-of-view of a vision system. Images may be formed in response to a determination of position and attitude of the vision system which locates the field-of-view with respect to objects being addressed. Details may be fully appreciated in consideration of U.S. Patents # 5,625,765; 5,682,332; and 5,742,521.

While these systems are highly useful and sophisticated, they may require complex imaging apparatus and technique forming composite images which are aligned to actual objects.

While the systems and inventions of the prior art are designed to achieve particular goals and objectives, some of those being no less than remarkable, these inventions have limitations which prevent their use in new ways now possible. These prior art inventions are not used and cannot be used to realize the advantages and objectives of the present invention.

SUMMARY OF THE INVENTION

Comes now, Thomas Ellenby with an invention of an information system including devices and methods of presenting information relating to an object being addressed.

The present invention includes devices and methods for presenting information relating to objects having an association with a particular geometry and location. Specifically, devices are arranged with a pointing reference and user interface. A device which is pointed toward an object known to a computer database, responds by determining which objects are being addressed and presenting information which relates to the objects at the interface.

After a device of the invention is pointed towards an object, the device makes a determination of the position and attitude of the device. A reference vector associated with the determined position and attitude is defined and used in a search of a database. The database comprised of data elements having identifiers or descriptors associated with position and other spatial definition may form a geometric intersection with the reference vector. The search produces output which includes information about objects which are being addressed by the device. The information is presented to a user via a user interface.

Objectives of the Invention

It is a primary objective of the invention to provide systems for presenting information.

It is further an objective to provide systems for addressing an object and presenting information relating to the object.

It is further an objective to provide systems for addressing an object, identifying the object and presenting information relating to the object.

It is further an objective to provide systems for addressing an object, recalling information relating to the object by way of a spatial reference and presenting information relating to the object being addressed.

A better understanding can be had with reference to the detailed description of preferred embodiments and with reference to the appended drawings. These embodiments represent particular ways to realize the invention and are not inclusive of all ways possible. Therefore, there may exist embodiments that do not deviate from the spirit and scope of this disclosure as set forth by the claims, but do not appear here as specific examples. It will be appreciated that a great plurality of alternative versions are possible.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims and drawings where:

Figure 1 is a block diagram illustrating major elements of a device of the invention;
Figure 2 is a block diagram showing the configuration of a database of the invention;
Figure 3 is a geometric construct of interest;
Figure 4 shows a similar geometric construct which illustrates an important geometry;
Figures 5 – 9 similarly show geometries of importance;
Figures 10 - 13 illustrate practical uses of devices of the invention;

PREFERRED EMBODIMENTS OF THE INVENTION

In accordance with each of the preferred embodiments of the invention, there is provided an apparatus for and method of presenting information relating to an object being addressed. It will be appreciated that each of the embodiments described include both an apparatus and method and that the apparatus and method of one preferred embodiment may be different than the apparatus and method of another embodiment.

Throughout this disclosure, reference is made to some terms which may or may not be defined in popular dictionaries exactly as they are defined here. To provide a more precise disclosure, the following terms are presented with a view to clarity so that the true breadth and scope may be more readily appreciated. Although every attempt is made to be precise and thorough, it is a necessary condition that not all meanings associated with each term can be completely set forth. Accordingly, each term is intended to also include its common meaning which may be derived from general usage within the pertinent arts or by dictionary meaning. For purposes of this disclosure:

A **geometric descriptor** is a mathematical definition of a geometric body. A geometric descriptor of the invention is used in association with an object which may be addressed by systems of the invention.

An **information element** is a database record which relates to a particular object of interest. An information element comprises many forms of multi-media data including but not limited to: text, audio recordings, video streams, pictures, photographs, icons, Java applets, etc. In addition, each information element has associated therewith a geometric descriptor.

Address is a term used herein as a verb, most commonly with the gerund *-ing*, to indicate a relationship between a device of the invention and an object; the object being the subject of the address. A device of the invention which is pointing at an object is said to be 'addressing' the object.

An **address vector** has its origin at a device of the invention and points in the direction of a reference direction associated with the device by way of an attitude determining means.

A **range gate** is a line segment which is colinear with an address vector having a first endpoint at some minimum distance from a point reference and a second endpoint at some maximum distance from the same point reference.

objects refer to any element which may be of interest to a user. An object may be a real tangible object or may be a figurative element in space. The term 'object' should be read in a liberal sense. Although buildings and mountains suggest concrete forms of objects, objects for purposes of this disclosure include abstract forms as well. For example, the region of airspace over an airport which may be restricted is considered an 'object'. Indeed any region of space may considered an object whether is actually contains a tangible object therein or not.

In simplest versions of the invention, apparatus include the following elements as described herefollowing.

Geometric References

Devices of the invention include a point reference and a directional reference. These may be mere structural constructs. The actual point and directional references may or may not correspond to any tangible object or element of the device. alternatively, they may be collocated with actual physical elements of the device. In either case, an important relationship is made between them and a position and attitude determining means which are also included in devices of the invention.

Position Determining Means

A position determining means is arranged to measure the position of the point reference. Since in many embodiments of the invention the position determining means is a global positioning system GPS receiver, the point reference lies at the center of the sphere which is defined by the resolution limits of the positioning system. For practical purposes, a handheld receiver which includes a GPS antenna may be said to have the point reference within the handheld unit. The position determining means therefore measures the position of the handheld unit. Many forms of alternate positioning systems may be used to accomplish the identical task. The particular positioning system employed may be chosen for a specific task at hand, for example a global positioning system would not be appropriate for a small space such as a warehouse so a radio triangulation technique may be preferred. The essence of the invention is not changed by the particular choice of positioning system. Therefore versions of the invention should not be limited to one particular type of positioning system. The limitation described by 'position determining means' is met when the position of the point reference is measured and made available to a computer processor. Therefore, by use of the term "position determining means" it is meant that any conceivable means for determining the position of a point reference and making that position known to a computer is anticipated. Experts will recognize that there are many thousands of possible ways of determining position and it will not serve a further understanding of the invention to attempt to catalogue them here. The reader will appreciate that the broadest possible definition of "positioning determining means" is intended here.

Attitude Determining Means

Systems of the invention also include an attitude determining means. An attitude determining means is arranged to determine the pointing direction or orientation of a directional reference. In simple versions, an electronic compass will serve as an attitude determining means. More sophisticated versions will include an attitude determining means which is operable for measuring inclination as well as direction in a horizontal plane. Although an electronic flux gate compass or laser gyroscope system may be used in certain versions of the invention, it does not improve the description to limit the attitude determining means to any particular device. Similar to the position determining means described above, the limitation described as 'attitude determining means' is fully met by any device or systems which may be used to determine the attitude of a directional reference and make that information known to a computer processor.

User Interface

A user interface of the invention serves to convey information to a user of the device. A simple speaker driven by computer audio systems is operational for producing audio information and description to a user. Similarly, a display screen driven by video systems of the computer functions to present video or graphic information to a user. Although a display screen and speakers are preferred devices for interfacing with a user, other systems include non-display type visual systems such as simple light emitting diodes, or non-speaker audio systems such as buzzers, tactile outputs such as vibrating systems, et cetera. In all cases, a user interface includes a transducer which is electronically driven by the computer which produces some physical disturbance which can be detected by a user's senses.

Computer Processor

In addition, systems of the invention include a computer programmed to execute specific routines. In particular, a computer is arranged to receive inputs from the position and attitude determining means. From these inputs, the computer defines a vector having an endpoint at the device reference point and pointing direction identical to the directional reference. From this vector definition, the computer performs a database search and determines if any of the geometric objects described in the information element geometric descriptors intersects the vector. Data from those information elements which are determined to intersect is recalled and played back to the user interface as appropriate and in agreement with other criteria which may be selected.

Database

In systems of the invention a database is arranged to accommodate data relating to objects of interest. Data relating to objects is prepared and stored in a predetermined and well organized fashion. The data may be stored in many formats and configurations and may be of the nature sometimes referred to as 'multi-media'. A database of the invention is comprised of a plurality of information elements. Each information element relates to a particular object which may be of interest. Each information element contains a descriptor which is describes a geometry and location relating to the object for which the stored information pertains.

A geometric descriptor is a definition set for a specific geometry including position. For example, in a Cartesian coordinate system, a sphere may have its center at a point (X, Y, Z) = (2, 5, 9) while having a radius of 7 units. Thus the sphere and all of the points within the sphere's boundary are completely described. A geometric descriptor may describe a geometry which includes a single point, alternatively a polygon which defines a planar region, a solid such as a sphere, or even a three dimensional object of arbitrary shape. Thus the rules which perfectly describe those geometries which are well known in the sciences are used in geometric descriptors of the invention. In all cases, a geometric descriptor includes at least one point and more frequently includes a set of many points.

Methods of the invention are best described as being comprised of the follows steps.

In a first step, an object is addressed. To address an object, the device is merely pointed toward the object. The device having a pointing reference necessarily is continuously pointing in some direction at all times. Although it is not a necessity that the device be pointing to an object known to the database, the device is always pointing at something and thus it is said that it is addressing something at all times.

In a step to be performed after the first step, the position of the device reference point is determined. A GPS employed locally at the device operates to measure the global position of the reference point. Although convenient measurement units might be latitude, longitude and altitude, others similarly provide workable solutions. Data from the position determining step is passed to the computer processor.

In a further step to be performed after the first step, the attitude of the device directional reference is determined. A compass may be used to determine which direction the device is being pointed. Data from the attitude determining step is similarly passed to the computer processor.

Data received at the computer processor from the position and attitude determining means is used to define an address vector. A search of database information elements is commenced. A search operation reads database geometric descriptors and performs a coincidence test to see if an address vector intersects any of the points in a geometry described. Items meeting that criteria are recalled for further processing and presentation at a user interface.

A more complete understanding can be realized in consideration of the drawing figures with reference numerals as follows. Figure 1 illustrates a block diagram of major components of devices of the invention. A point reference 1 is a geometric construct to which measurements of position are directed. The point may correspond to an actual device such as a GPS antenna or may alternatively be merely a point in space having a convenient location within a physical device. A directional reference 2 similarly forms a geometric construct at a device of the invention but is otherwise arbitrary with respect to any physical element or part of a device of the invention. A position determining means 3 is in communication with the point reference and is arranged to measure its position. The position determining means is further in communication with a computer. The position measurement is made without regard to any particular coordinate system in various versions of the invention but some versions using GPS devices preferably use a latitude, longitude and altitude scheme which allows one to define position anywhere on or above the Earth's surface. Determination of position within a coordinate system is the essence of the function performed by the device without regard for the coordinate system chosen.

An attitude determining means 4 similarly is in communication with a directional reference 2 and with a computer. The attitude determining means measures the pointing direction and reports that information to the computer processor.

A computer processor 5 is coupled to and receives measurement data from position and attitude determining means. The computer is further connected to a user interface 6 and presents information to a user by way of the interface. The computer includes a database 7 which may contain preprogrammed information.

Now, with reference to Figure 2 the database may be more precisely defined. A database 21 of the invention has a special construction. The database may include a great plurality of basic units each referred herethroughout as an information element 22. An information element may contain stored information in various formats 23. Each information element contains a descriptor 24 which defines a geometric body of interest. Additional information elements 25 each having their own descriptors and stored information further make up the database. The database is comprised of any number of information elements the last element being the N^{th} element 26.

The above described elements when assembled as directed form a device of the invention which is preferably integrated into a small handheld machine. A sturdy case formed of durable plastic operates to contain the assembly and allows a user easy access to functions associated therewith.

In consideration of the above described arrangement and the following procedural description with reference to additional drawings, one will now better appreciate operation of some preferred devices of the invention. Drawing Figure 3 illustrates a simple geometric construction showing a point reference 31, a directional reference 32, a rectangular cylinder 33 and a circular cylinder 34. A portion of space 35 indicated by a dotted line is shared by the rectangular cylinder and a vector 36 having an endpoint coincident with the point reference and colinear with the direction reference. Having full geometric definition of the vector, and the cylindrical objects, a computer routine is executed to determine which objects are intersected by the vector and which are not. In the case of Figure 3, the square cylinder is intersected by the vector but the circular cylinder is not. A device having a reference point 31 and directional reference 32 is said to be addressing the square cylinder. A computer having programmed information as to the location and shape of the cylinders can tell when a vector is intersecting the space of interest and when it is not. The computer only needs the preprogrammed information and a measurement of the device point and direction references. The computer does not require input from any real object which may be associated with the space of interest and does not need to detect or probe it in any way.

For example if the square cylinder 33 is associated with a hotel known by the computer, the hotel is implicitly addressed whenever the device addresses the square cylindrical space. If a construction crew removes the hotel and the computer is not updated, the computer still assumes the presence of the building because it is a necessity that the space remain despite the actual presence, or lack of presence, of the building therein. Accordingly, devices of the invention merely determine what space is being addressed and imply that particular objects are being addressed by way of the association of objects to spatial definitions or geometric descriptors. The mere fact that information contained in the database is accurate suggests and implies the presence of the hotel. It is the geometric descriptor which is preprogrammed into the computer which dictates if an intersection exists or not. The actual presence of an object does not affect whether the device is addressing it or not.

It is useful to rely on this technique for most items of interest. For example, the Empire State Building presently occupies a space which is well defined. It is a very reliable fact that the Empire State Building will similarly occupy that same space tomorrow. A device of the invention which is pointed at the Empire State Building, the position of the device and attitude being measured and defining an address vector, can reasonably deduce that the building is there. In this way, devices of the invention 'know' what they are addressing simply by measuring their own position and attitude and comparing that information with information in a database.

For purposes of this disclosure, an intersection of only one point is sufficient to have the vector be coincident or to have an intersection with the geometric object. Figure 4 illustrates a scheme whereby the vector defined by the reference point 41 and the reference direction 42 is coincident with the square cylinder 43 at a single point 44. The circular cylinder 45 is not intersected by the vector and is not said to be coincident therewith.

It is not a requirement that an object be three dimensional; quite contrarily, a two dimensional or single dimensional object forms perfect basis for an intersection with a vector. Figure 5 illustrates a point reference 51 and a direction reference 52 forming a vector which intersects and is coincident with a plane 53 at a single point 54. One might envisage every advertising billboard as a plane having position information associated with it. When programmed properly, these geometric definitions allow a device of the invention to know of any billboard anywhere. When pointed at a billboard the device can identify the advertiser and be made to respond by playing back information such as a product jingle, text information, video clips, et cetera. The connection between the billboard (object) and the geometric descriptor is made via the database where real objects are associated with geometric descriptors in preprogrammed data storage schemes.

The shape does not necessarily have to be regular or "well-behaved". A geometric description is available for a complexly shaped element as well as those more readily described in simple terms. Figure 6 shows a reference point 61 and reference direction 62 which define a vector having an intersection with a spatial element 63 at line segment 64.

A geometric descriptor used in devices of the invention to associate object data with position and shape may change in time. Although the trains in Japan are moving objects, they move in a highly reliable way in accordance with a rigid schedule. Therefore, a geometric descriptor might include information about changes of position with respect to time. When a device of the invention is pointed at a moving train, inquiry to the database may yield an intersection with a 'moving' spatial element.

Figure 7 shows one additional condition of interest. Although the term 'vector' implies a line segment with infinite extent in one direction, and indeed it is a true vector which is of primary interest for most examples presented, in some cases only a certain portion of the vector is of interest. Some operations described hereafter will refer to a "range gate". A range gate has two delimiters which define a portion of the vector which is of particular importance. Figure 7 shows a reference point 71, a reference direction 72, a first delimiter 73 a second delimiter 74, a cube body 75, a line segment 76, a circular cylinder 77, and a vector 78. Although the vector 78 intersects and passes through both the cube body and the circular cylinder, only the portion of the vector in the range gate, i.e. that portion between delimiters 73 and 74, forms an intersection with the cube body. Thus, in some instances, a range gate is created to designate which portions of the vector are of greatest interest.

Figure 8 shows another important range gate. A range gate may include all the points along the reference vector from the reference point to a selected maximum distance. For example a user may specify all targets "within fifty meters of the device". Objects which are greater than fifty meters away from the user are not included in any recall effort. Figure 8 illustrates this concept. A reference point 81 and reference vector 82 form basis for a system having a range gate starting at the reference point and ending 83 at some predetermined distance from the reference point. A cubic object 84 has a portion 85 of the vector passing through it. Similarly, circular cylindrical object 86 also has a portion of the vector intersecting that object. Of course, the vector 87 continues on without limit. The difference between the cubic object and the circular cylindrical object is that the cubic object lies within the range gate region of the reference vector and the circular cylindrical object does not. A computer search engine arranged to be responsive to criteria describing such a rate gate is useful in restricting objects which are presented as presently being addressed by the device.

It is entirely possible that two objects fall within the limits of a particular range gate. Figure 9 illustrates a reference point 91 and a direction vector 92 which passes through 93 a first object, continues through space 94 and passes through a second object 95. In this case, both objects a cubic object 96 and a circular cylindrical object 97 form an intersection with the vector and lie with a range which lies on the vector somewhere past the point indicated as 98. A search engine therefore identifies both objects as being addressed by the system. A display can handle this occurrence by listing all objects be addressed simultaneously. A list may include a scheme whereby closer objects are listed first while more distant objects appear nearer the end of the list. A user may select from the list an object of particular interest and request from the computer more information relating to that object.

Now with reference to drawing Figures 10 - 13, one will more readily understand a very practical use of the invention. The photograph is of the central place in the village of Chamonix, France with Mont Blanc in the background. A gentleman walking on the sidewalk and having therein one hand a device of the invention is positioned behind cars slightly to the left of center of the photograph. By pointing the unit towards the statue shown in the left hand portion of the photograph, the gentleman addresses the statue object. The device determines the position and attitude of the handheld unit and reports those values to the computer. The computer searches its database to learn that the statue occupies a portion of the same space as the vector defined in the object address step. The computer responds by displaying information to the user about the statue. A brief history of the events being represented and memorialized may be presented as text. In addition, sound clips and video recordings which are associated with the statue similarly provide content accessed by the computer and presented to a user who has pointed the device at the statue out of interest in it.

On desire to identify lodging for the night, the gentleman might point the device at hotels in the area. Figure 11 shows a first building being addressed by the handheld unit. In response, the device quires its database which contains information relating to the hotel building. Prices and description of the accommodation can be displayed nearly instantly. Figure 12 shows the device being pointed toward another hotel, the Hotel Astoria. Data relating to the Hotel Astoria can similarly be presented to a user in real-time. If the user wishes to address the mountain peak behind the Hotel Astoria shown in Figure 13, a range gate is formed to exclude objects within a few hundred meters and the hotel is ignored. A display then responds by showing information relating to Les Bossons the world's largest glacier. Because a database can easily be created whereby information relating to particular objects can be associated with a descriptor which describes the object's location and shape, an object can be addressed from any location and information relating to the object can be presented to a interested user.

One will now fully appreciate how a system which measures position and attitude may present information relating to objects having an association with a particular geometry and location. Although the present invention has been described in considerable detail with clear and concise language and with reference to certain preferred versions thereof including the best mode anticipated by the inventor, other versions are possible. Therefore, the spirit and scope of the invention should not be limited by the description of the preferred versions contained therein, but rather by the claims appended hereto.

CLAIMS

1) An apparatus for the presentation of information relating to an object being addressed, the apparatus comprising:

a directional reference;

a point reference;

a position determining means;

an attitude determining means;

a computer processor;

a database of information elements; and

a user interface,

said position determining means being arranged to determine the position of the point reference and convey position information to said computer processor;

said attitude determining means being arranged to determine the orientation of the directional reference and convey attitude information to said computer processor;

said database being comprised of a plurality of information elements, each information element having a geometric descriptor associated therewith; and

said user interface being in electronic communication with said computer processor.

2 A method of presenting information relating to an object being addressed, the method comprising the acts:

addressing an object;

determining position;

determining attitude;

searching a database; and

presenting information,

said addressing an object further defined as pointing a reference pointer towards an object

said determining position further defined as measuring the position of an apparatus having a point reference;

said determining attitude further defined as measuring the orientation of an apparatus having a directional reference;

said searching a database further defined as executing a computer routine to compare vector definition to geometric descriptors of information elements;

said presenting information further defined as reporting the results of the search where coincidence is found.

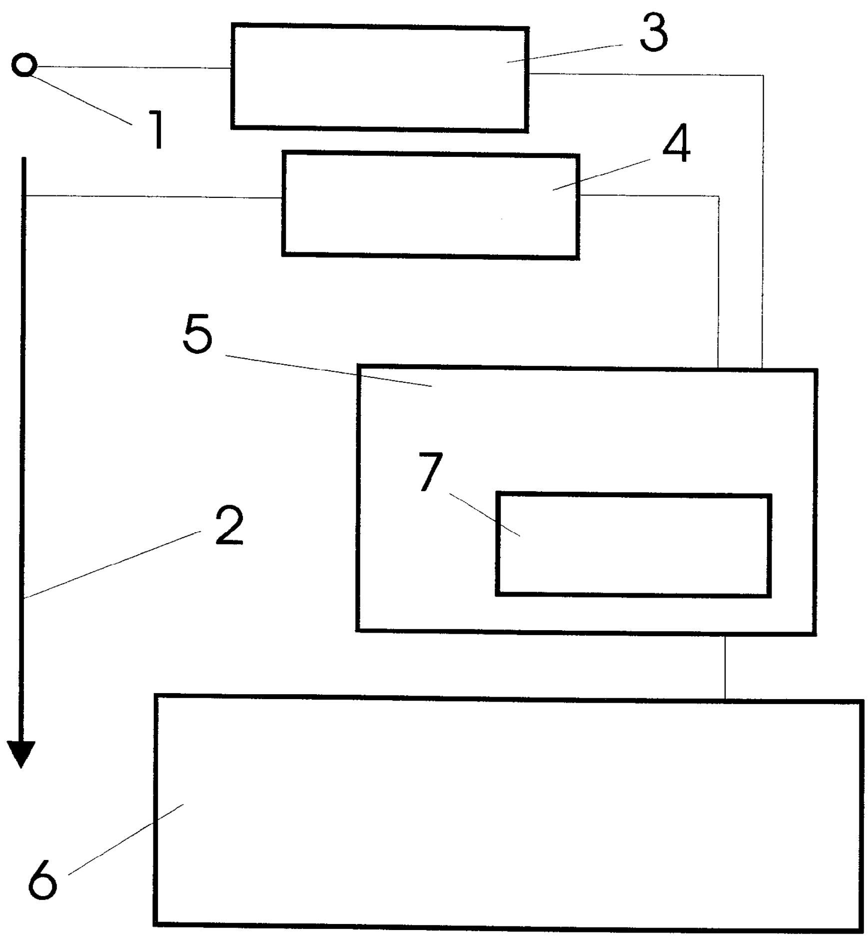

Fig. 1

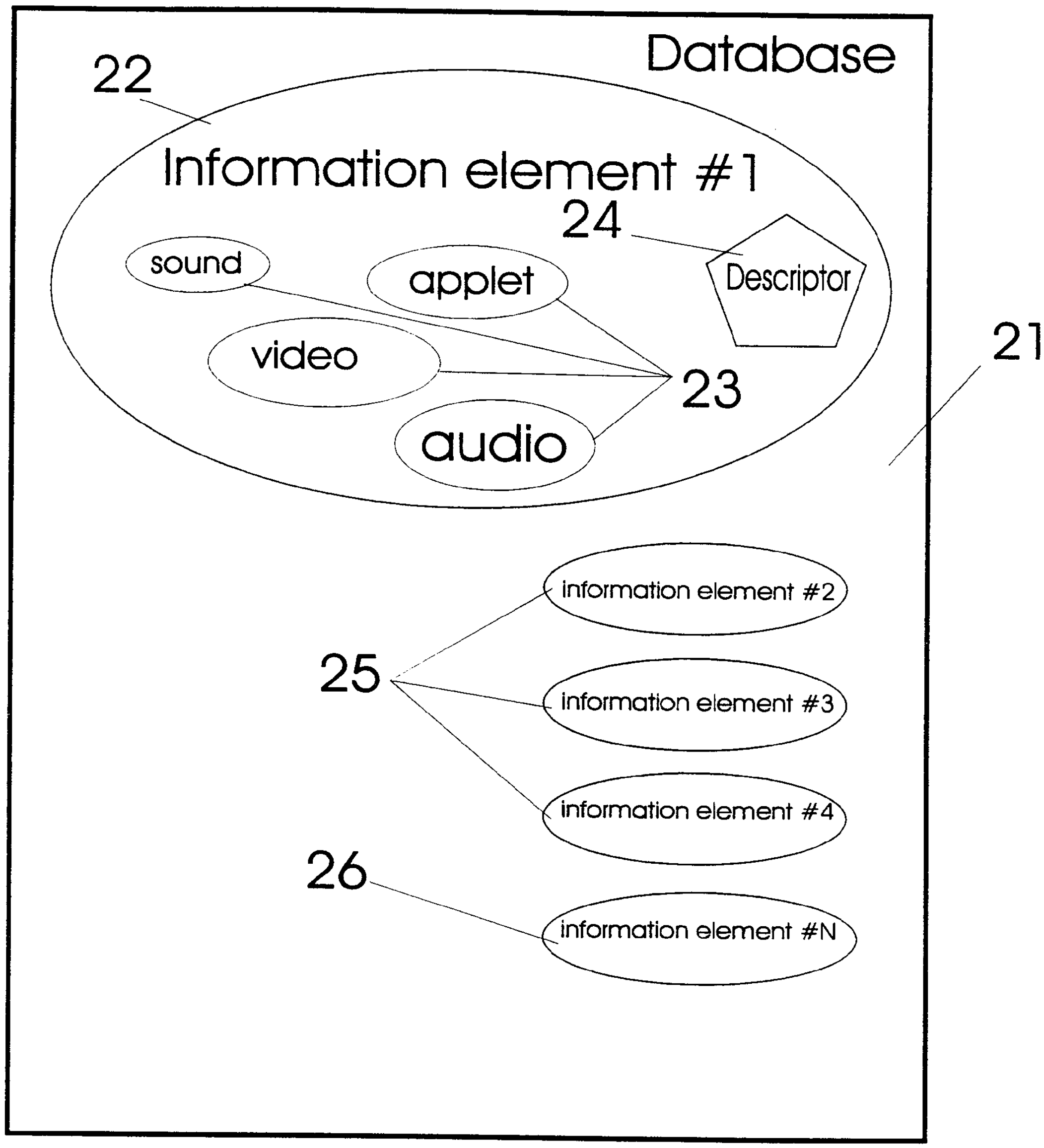
Database
22
Information element #1
24
Descriptor
sound
applet
video
audio
23
21
25
information element #2
information element #3
information element #4
26
information element #N

Fig. 2

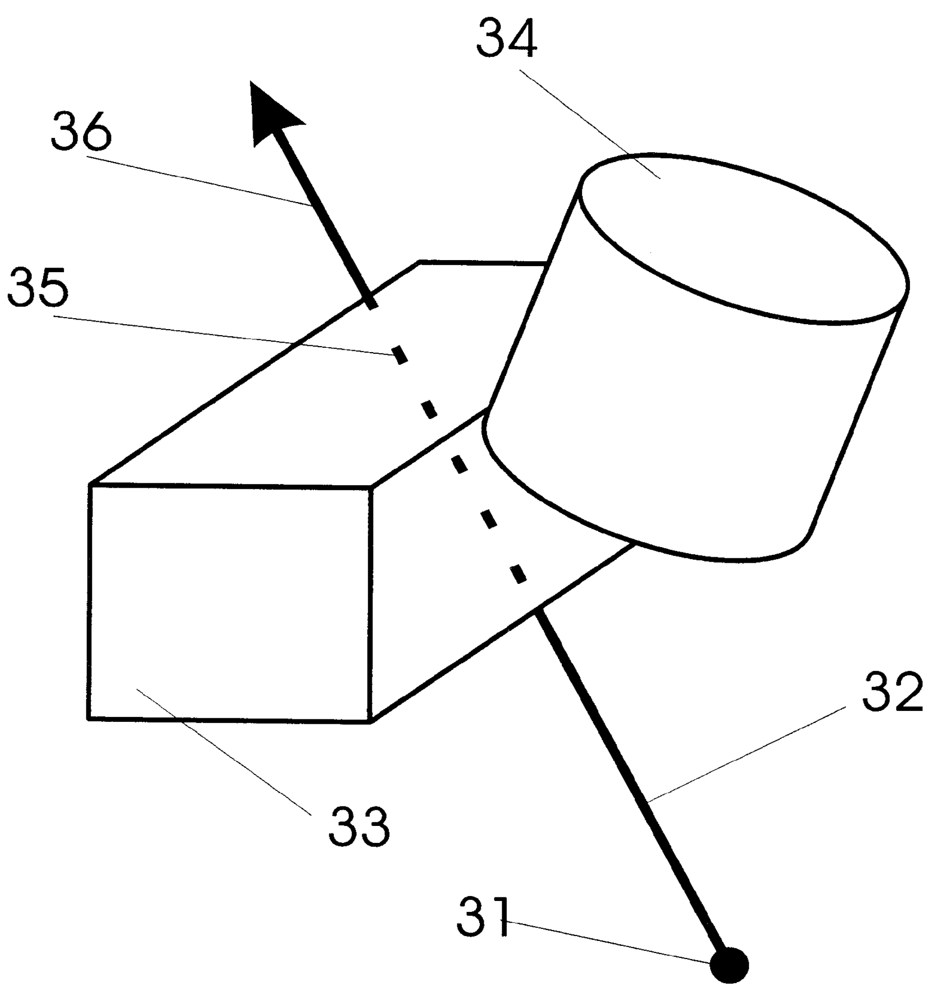

Fig. 3

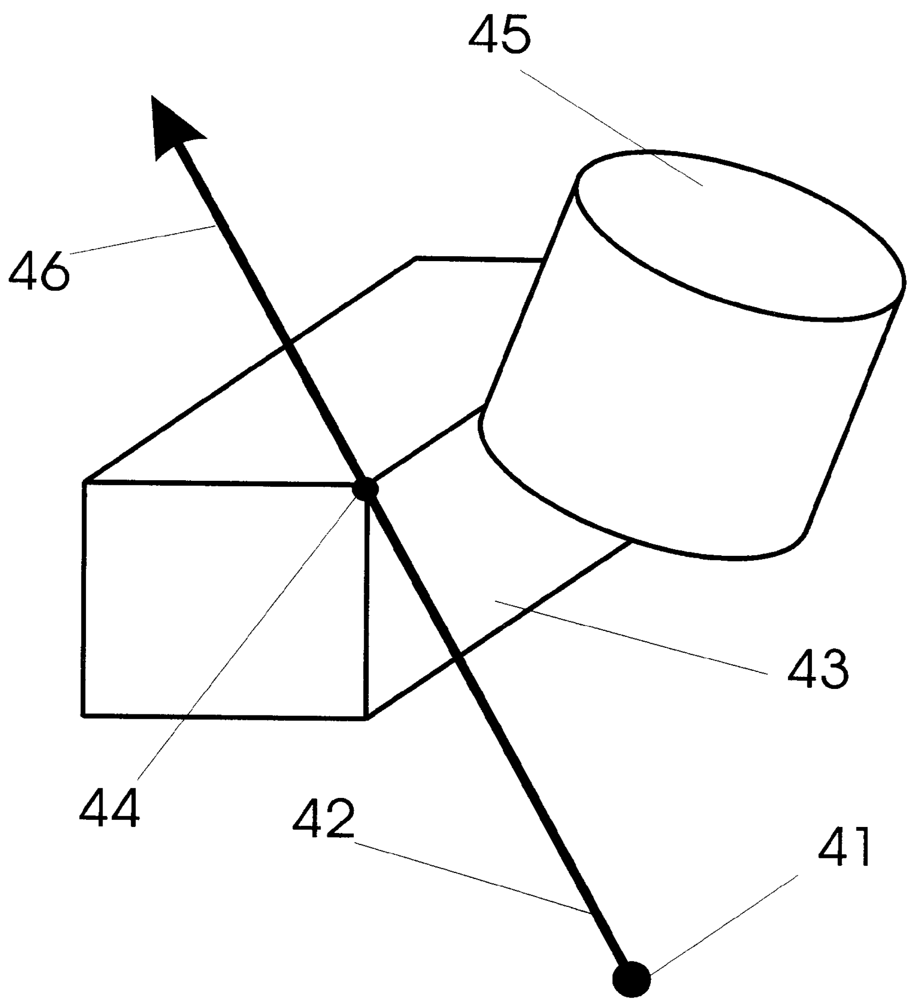

Fig. 4

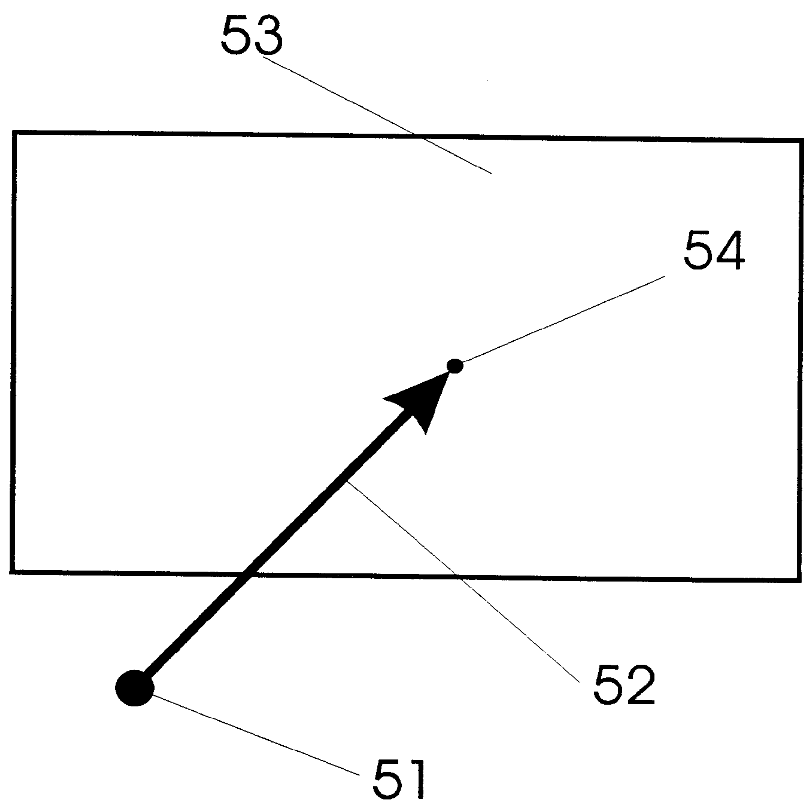

Fig. 5

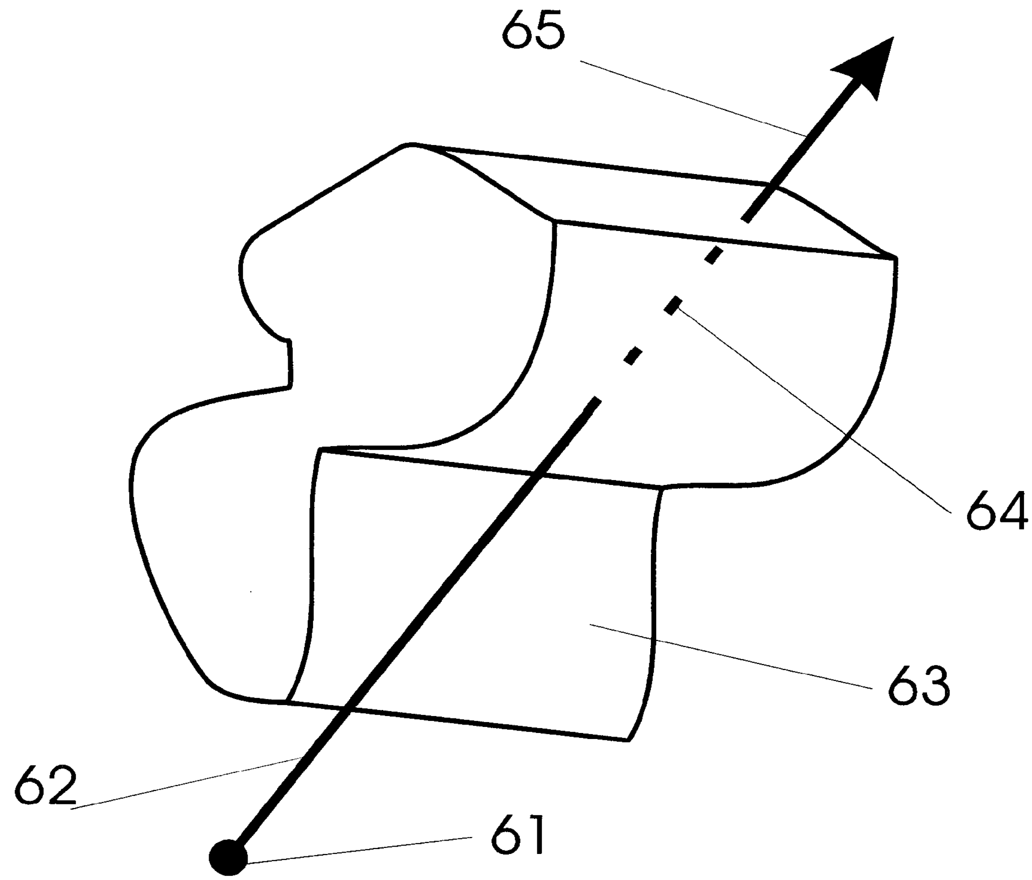

Fig. 6

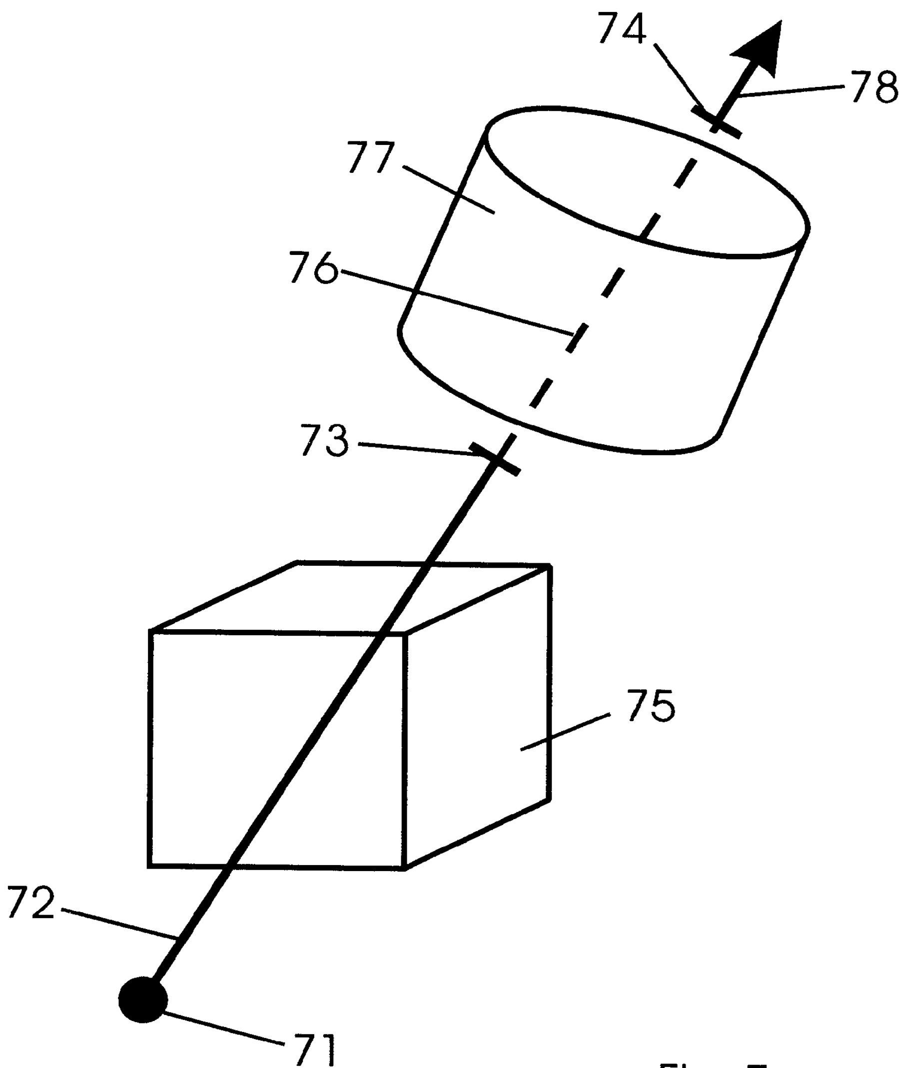

Fig. 7

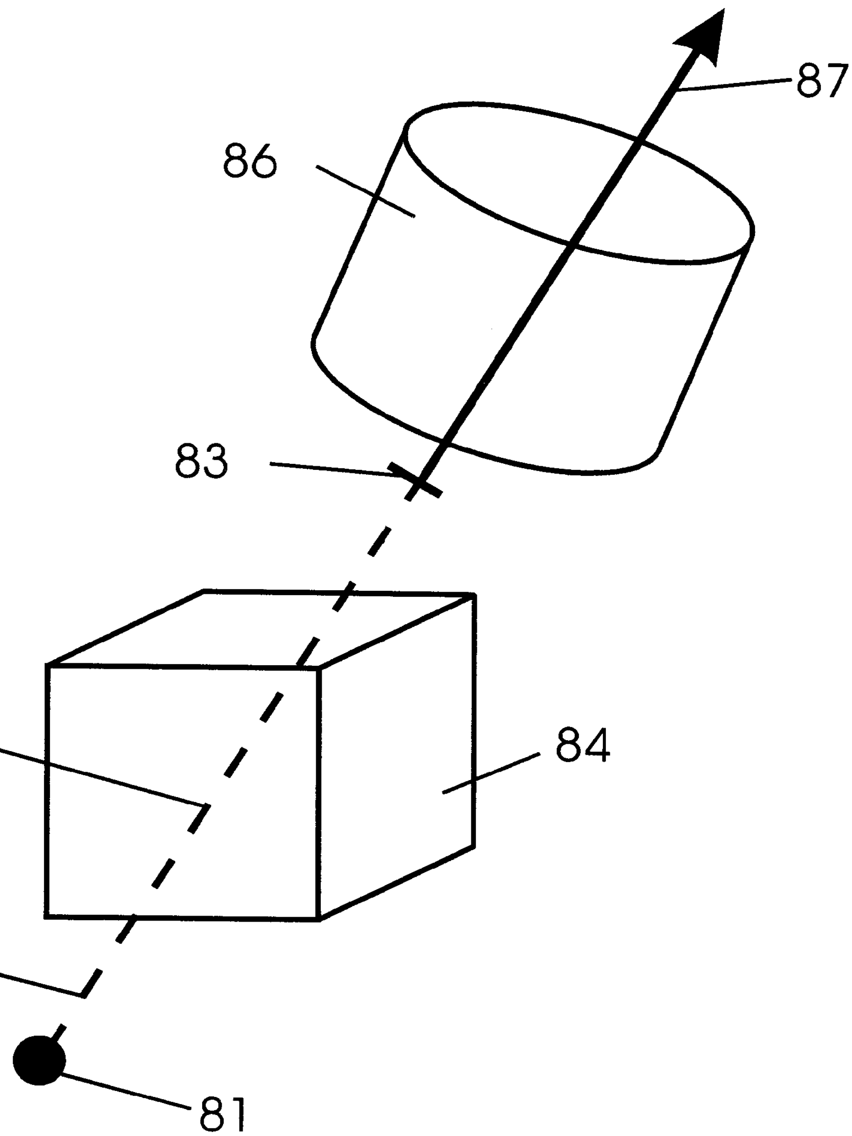

Fig. 8

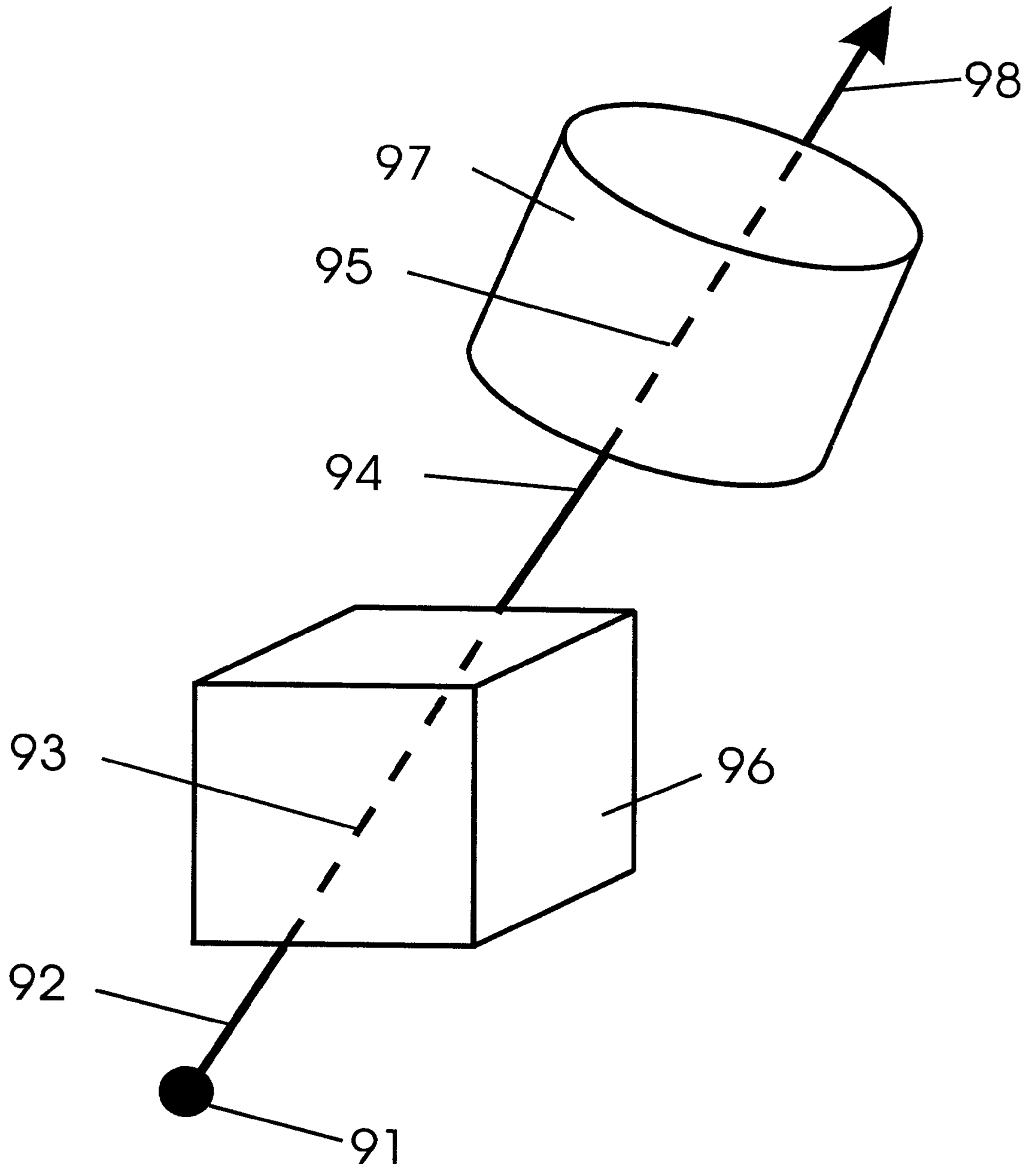

Fig. 9

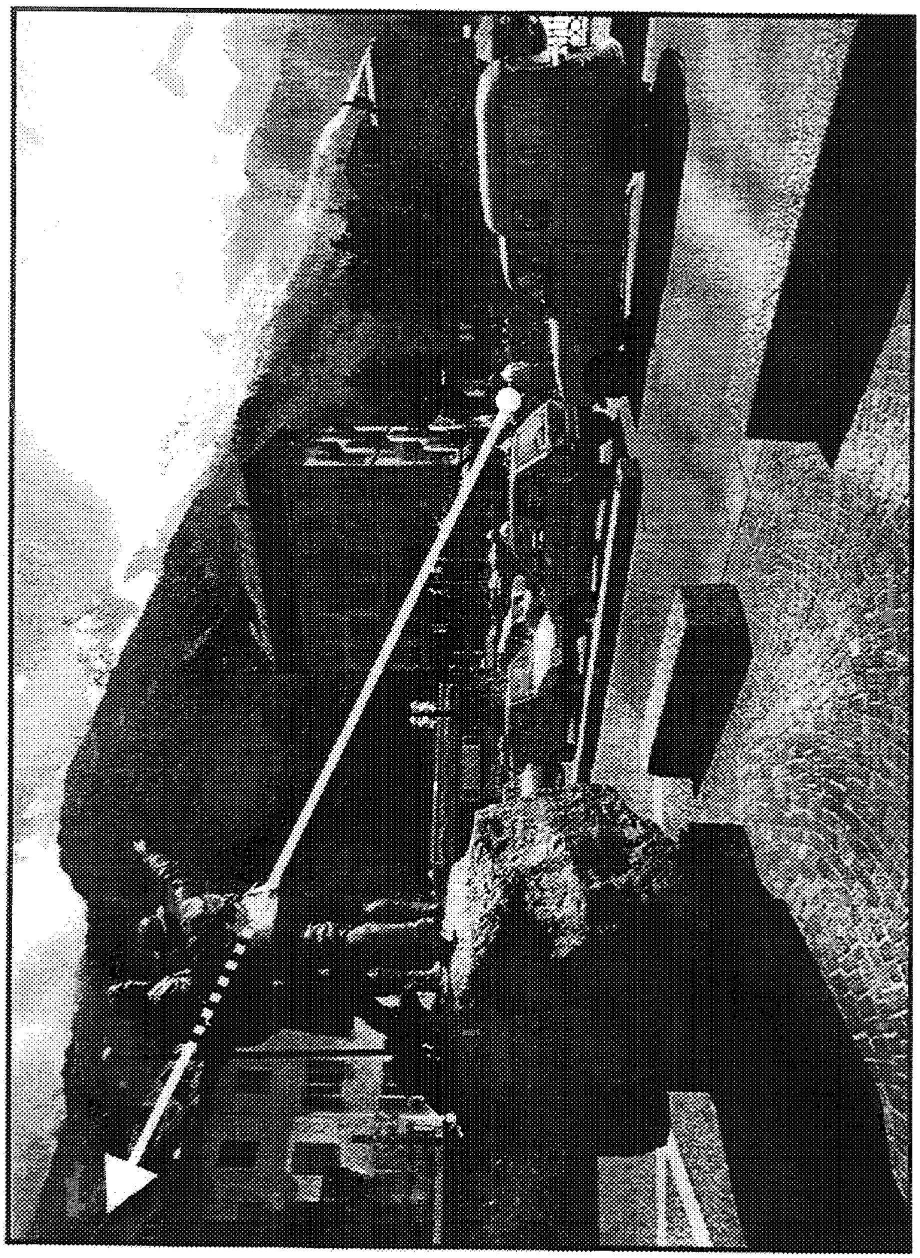

Fig. 10