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(54) ASSET MANAGEMENT SYSTEM

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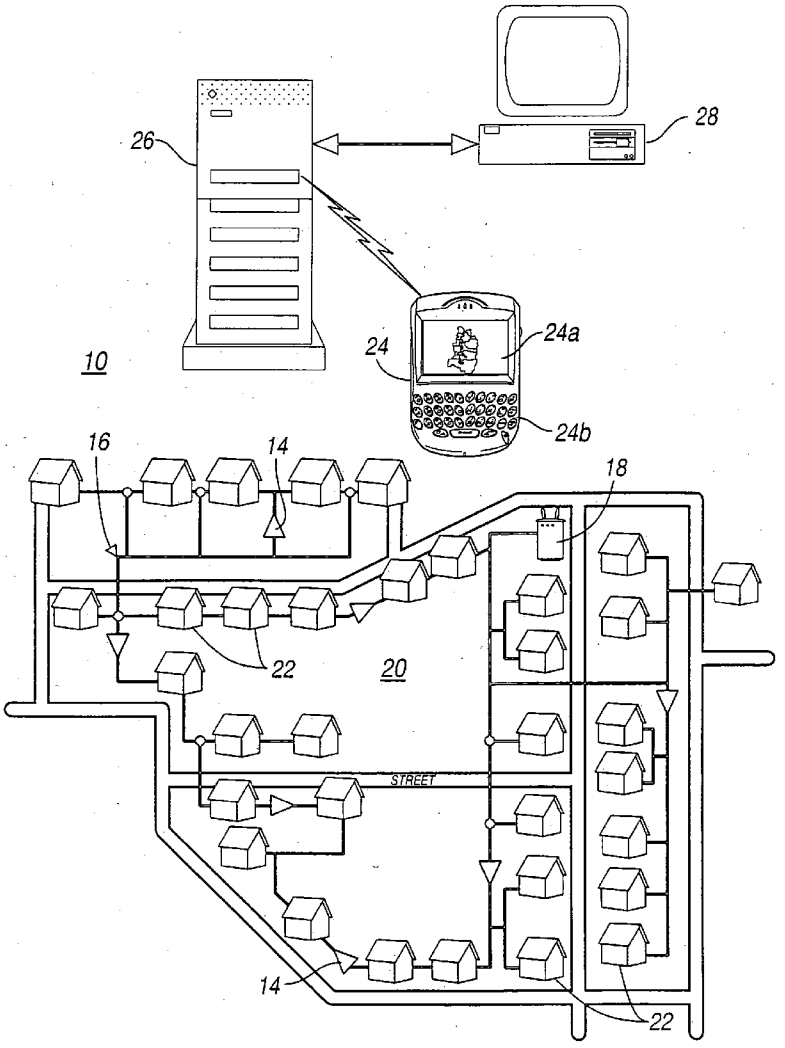
(57) **ABSTRACT**

A system for managing assets includes at least one asset located within a geographic area and a server configured to store data associated with the assets. The server may be adapted to store data associated with the asset location and be updated with current asset data by at least one administrator. The server is further adapted to generate and integrate asset symbols within an electronic spatial illustration of the geographic area wherein the location of the asset symbol on the spatial illustration corresponds to the location of the asset within the geographic area. The system further includes a portable device that communicates with the server and is adapted to display the data generated by and stored on the server. The portable device is also adapted to receive inputs from a user, display data in response to the user inputs, and display the spatial illustration having the integrated asset symbols and asset locations.



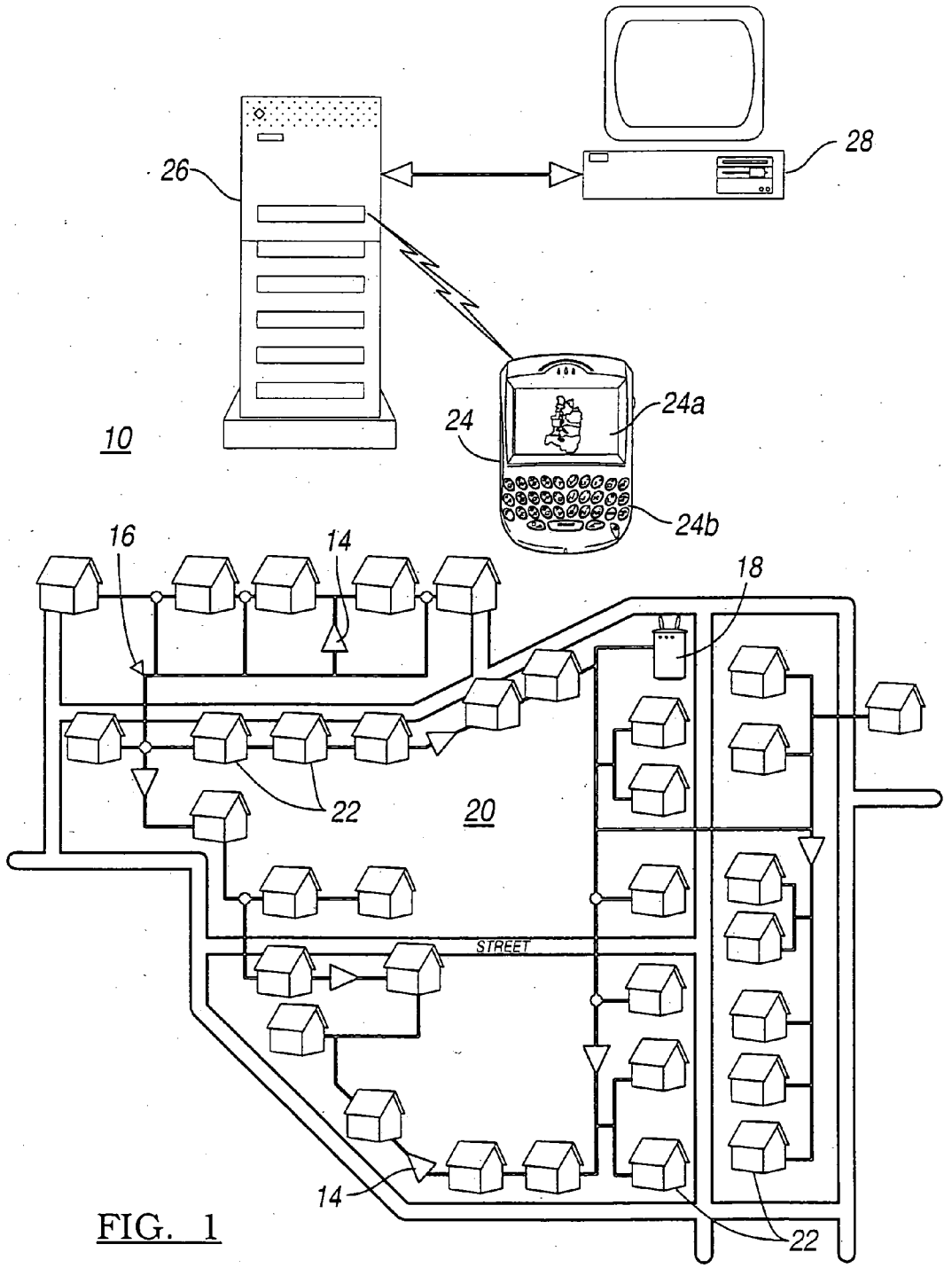


FIG. 1

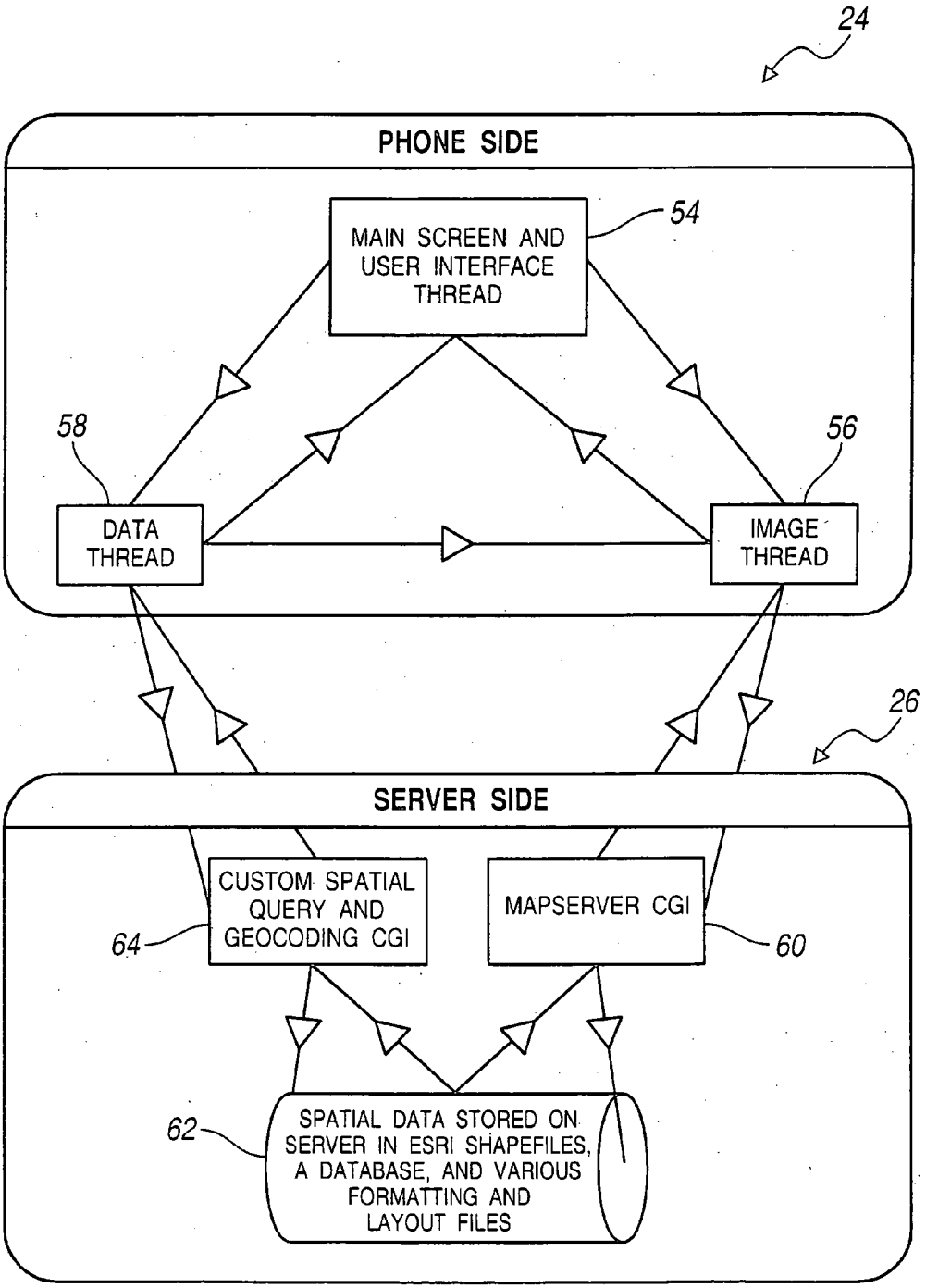

24
PHONE SIDE
MAIN SCREEN AND USER INTERFACE THREAD
54
58
56
DATA THREAD
IMAGE THREAD
26
SERVER SIDE
CUSTOM SPATIAL QUERY AND GEOCODING CGI
64
MAPSERVER CGI
60
62
SPATIAL DATA STORED ON SERVER IN ESRI SHAPEFILES, A DATABASE, AND VARIOUS FORMATTING AND LAYOUT FILES

FIG. 2

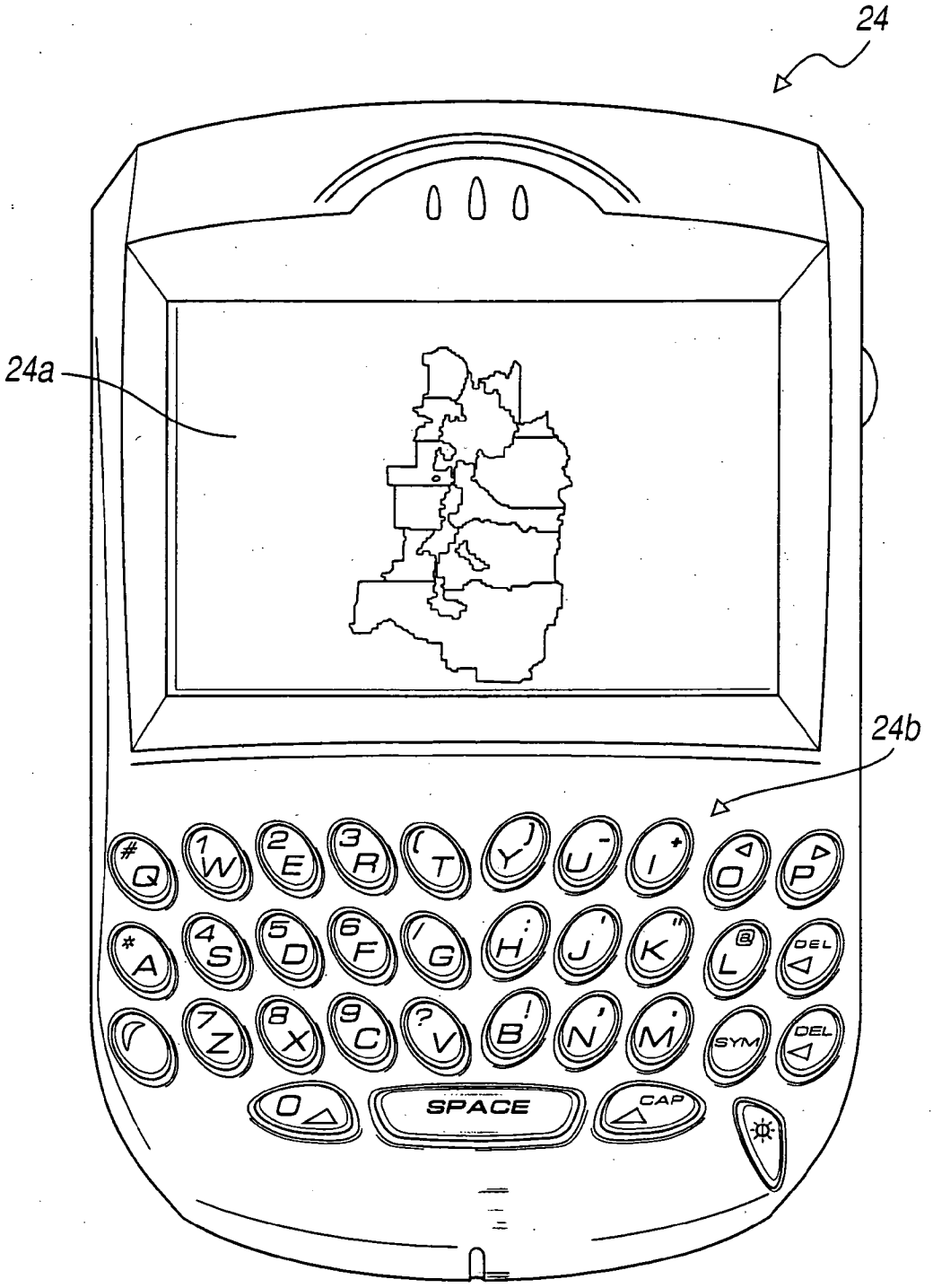


FIG. 3

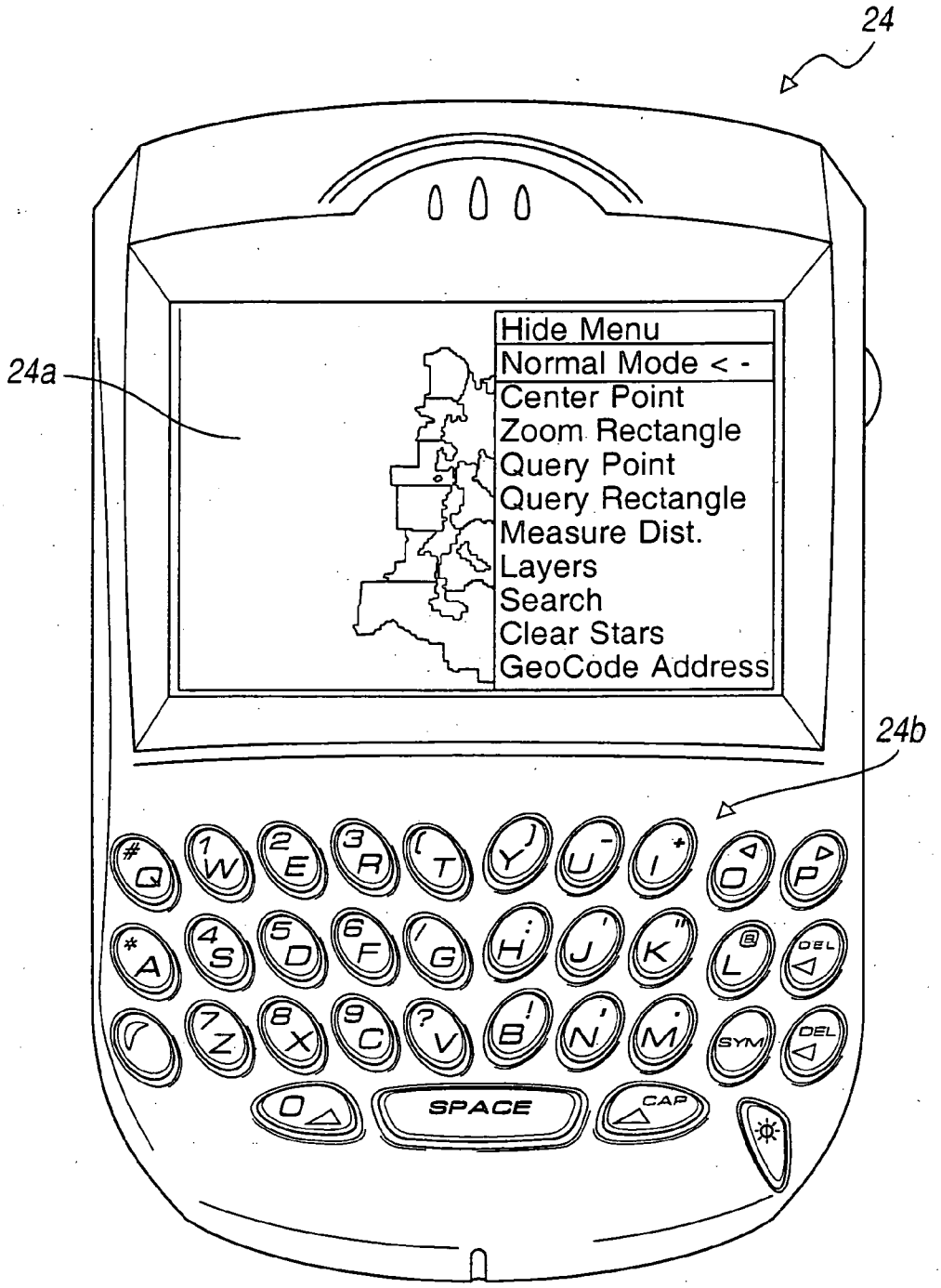

24
24a
Hide Menu
Normal Mode < -
Center Point
Zoom Rectangle
Query Point
Query Rectangle
Measure Dist.
Layers
Search
Clear Stars
GeoCode Address
24b
SPACE
CAP
SYM
DEL

FIG. 4

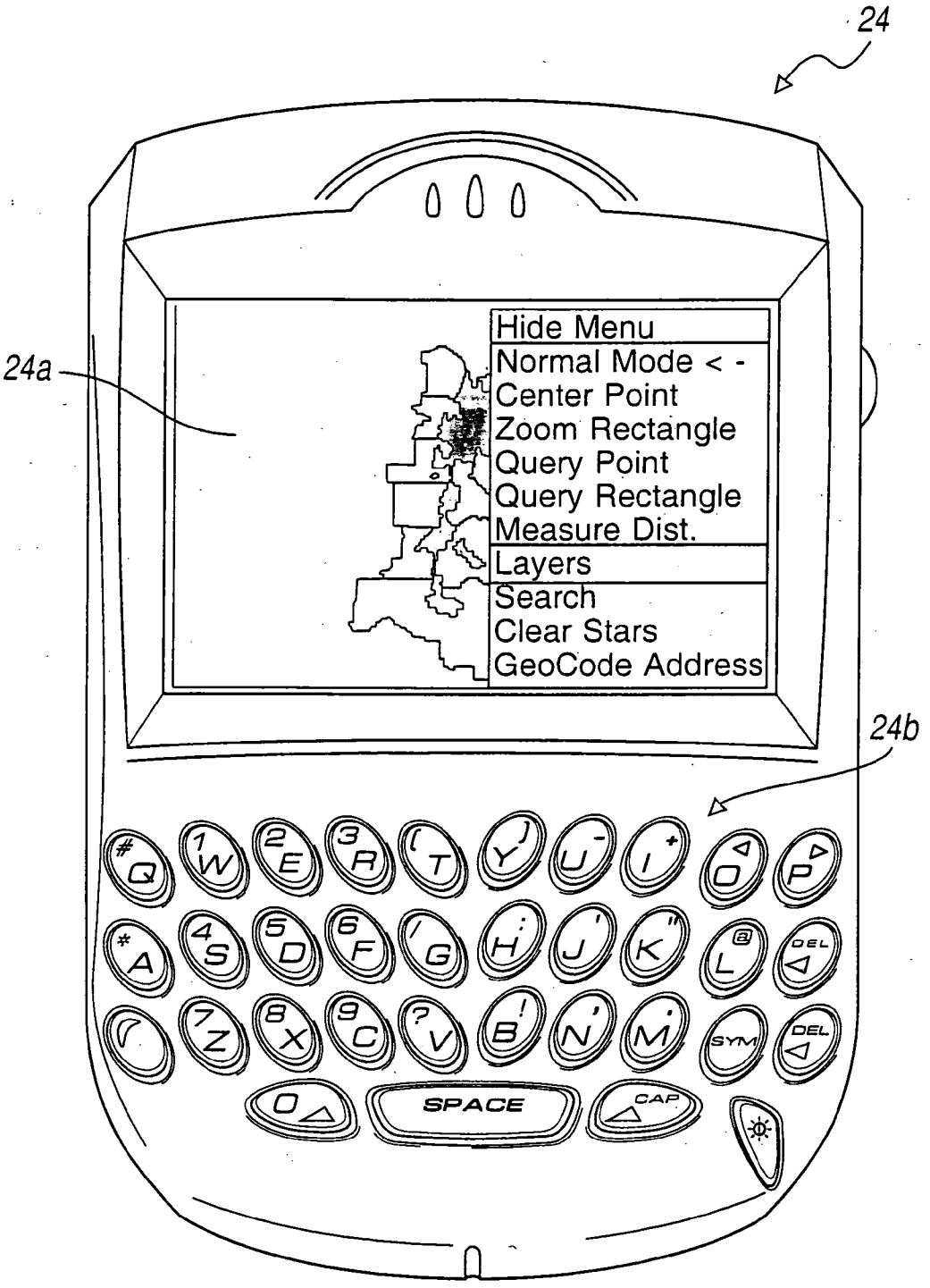

24
24a
24b
Hide Menu
Normal Mode < -
Center Point
Zoom Rectangle
Query Point
Query Rectangle
Measure Dist.
Layers
Search
Clear Stars
GeoCode Address
SPACE
CAP
SYM
DEL

FIG. 5

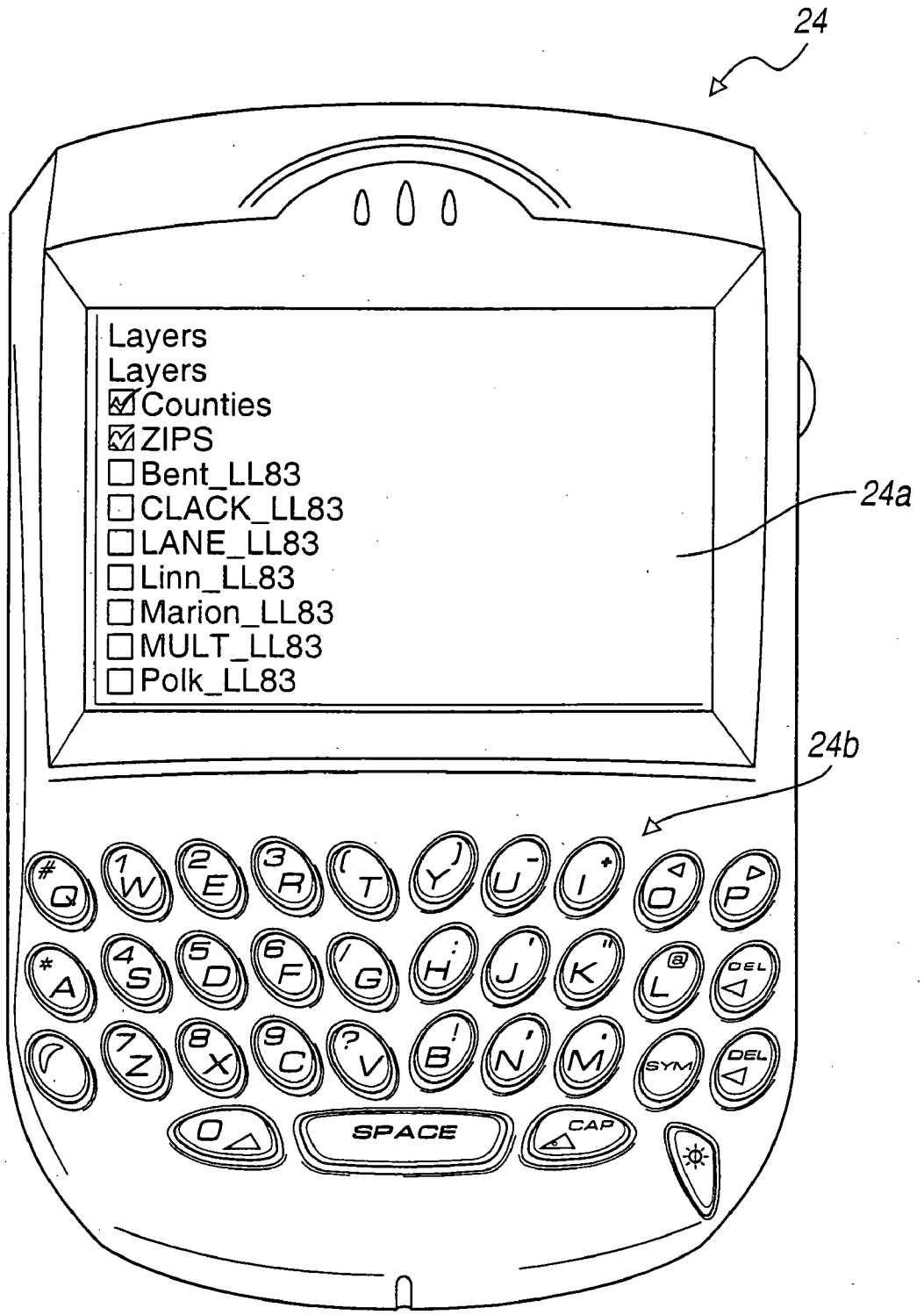

24
Layers
Layers
Counties
ZIPS
Bent_LL83
CLACK_LL83
LANE_LL83
Linn_LL83
Marion_LL83
MULT_LL83
Polk_LL83
24a
24b
SPACE
CAP
SYM
DEL

FIG. 6

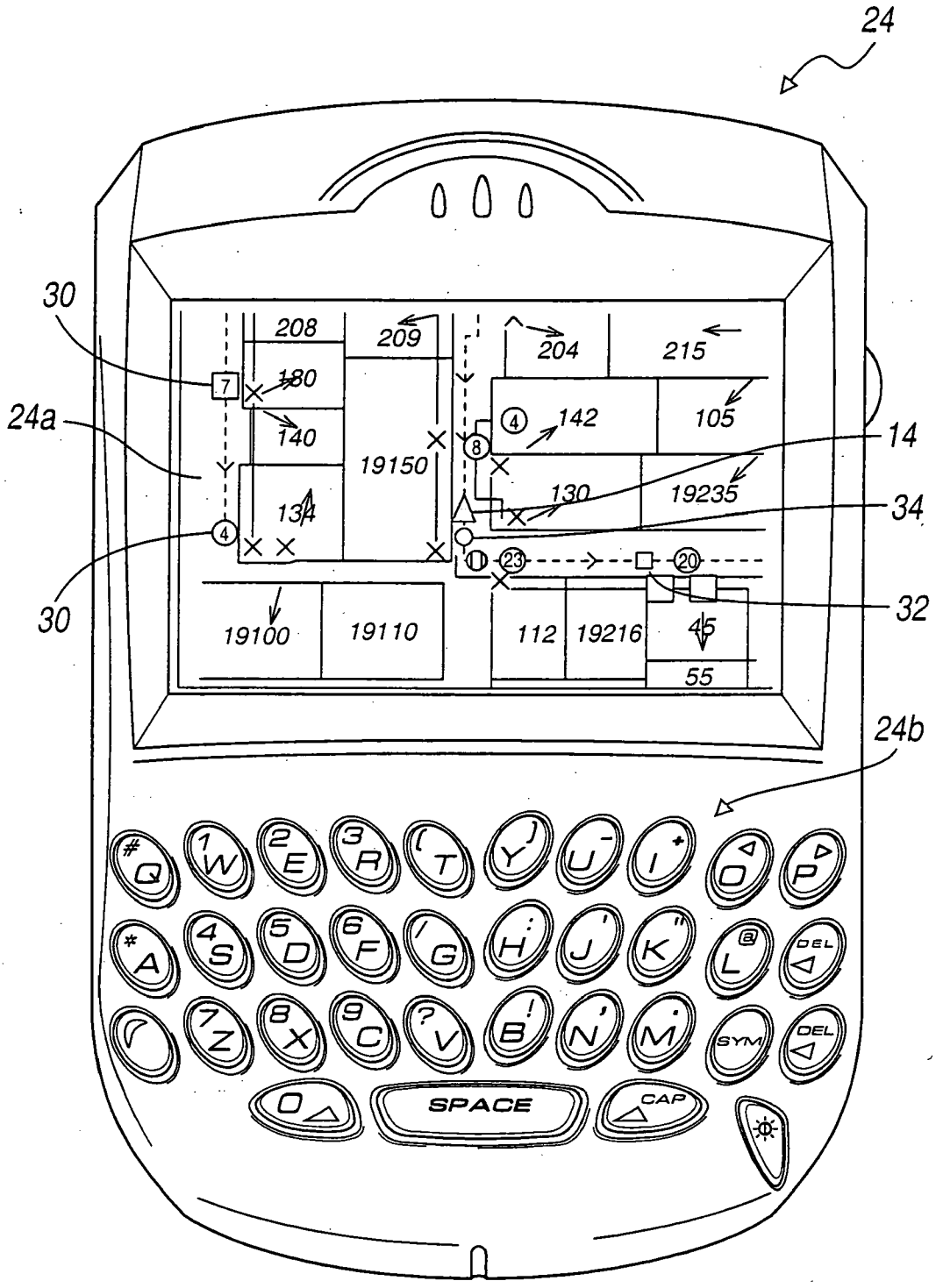

24
30
24a
30
208
209
204
215
180
140
19150
142
105
14
130
19235
34
134
23
20
32
19100
19110
112
19216
45
55
24b
SPACE
CAP
SYM
DEL

FIG. 7

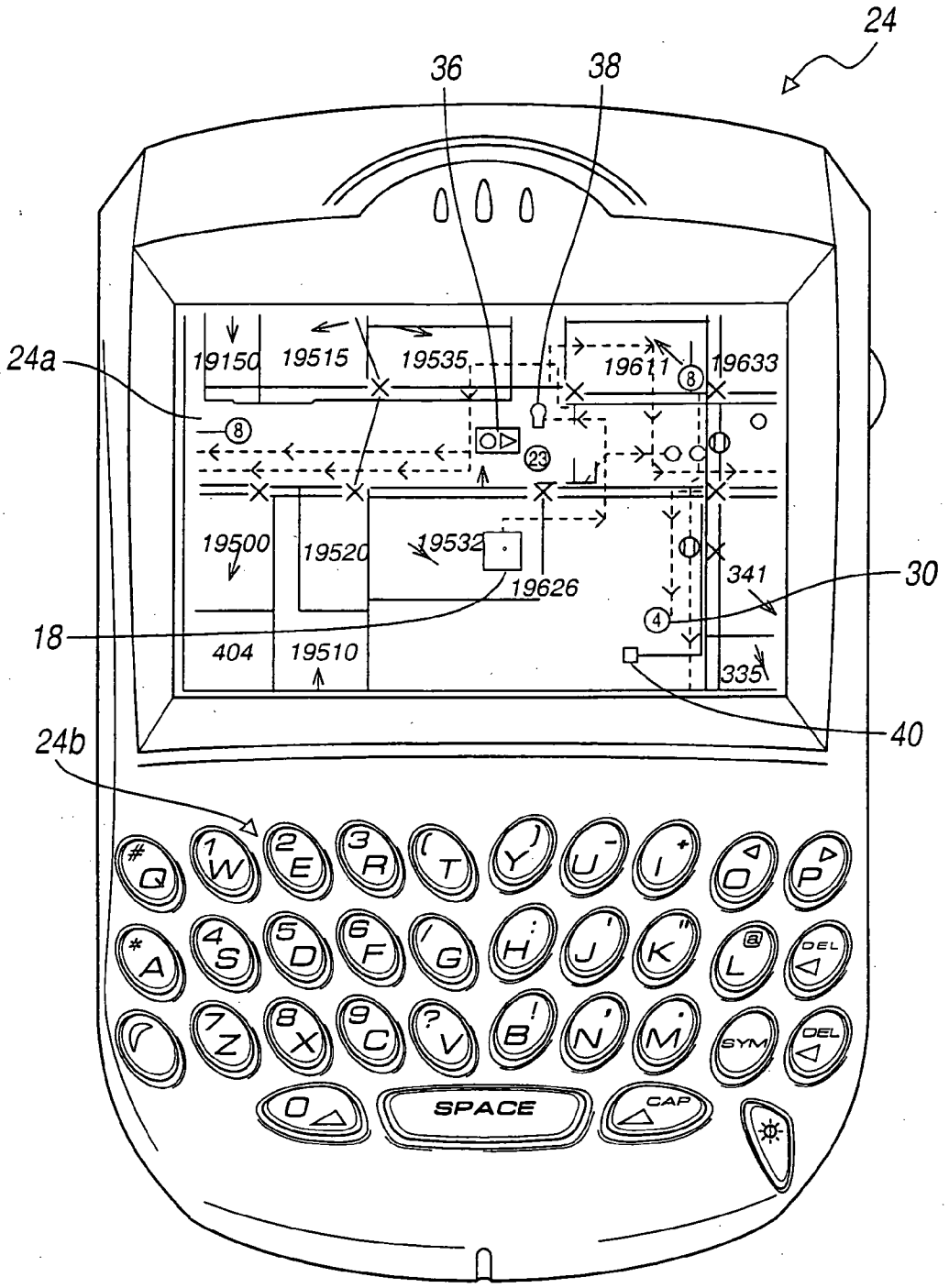

24
36
38
24a
19150
19515
19535
19611
19633
19500
19520
19532
19626
341
30
18
404
19510
335
40
24b
SPACE
CAP
DEL
SYM

FIG. 8

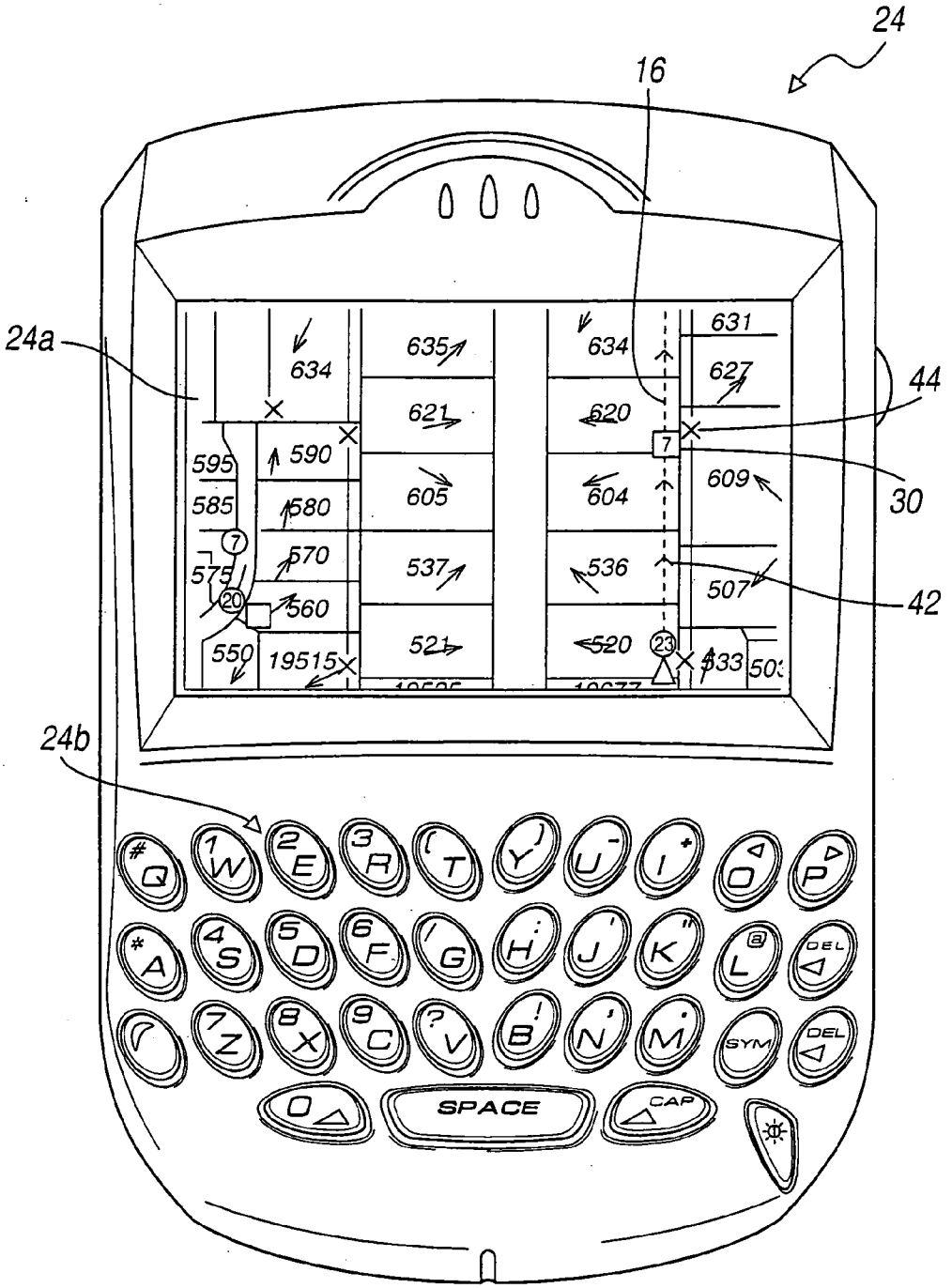

24
16
24a
44
30
42
24b
634
635
621
590
595
585
580
605
575
570
537
560
550
19515
521
634
631
627
620
609
604
536
507
520
533
SPACE
CAP
SYM
DEL

FIG. 9

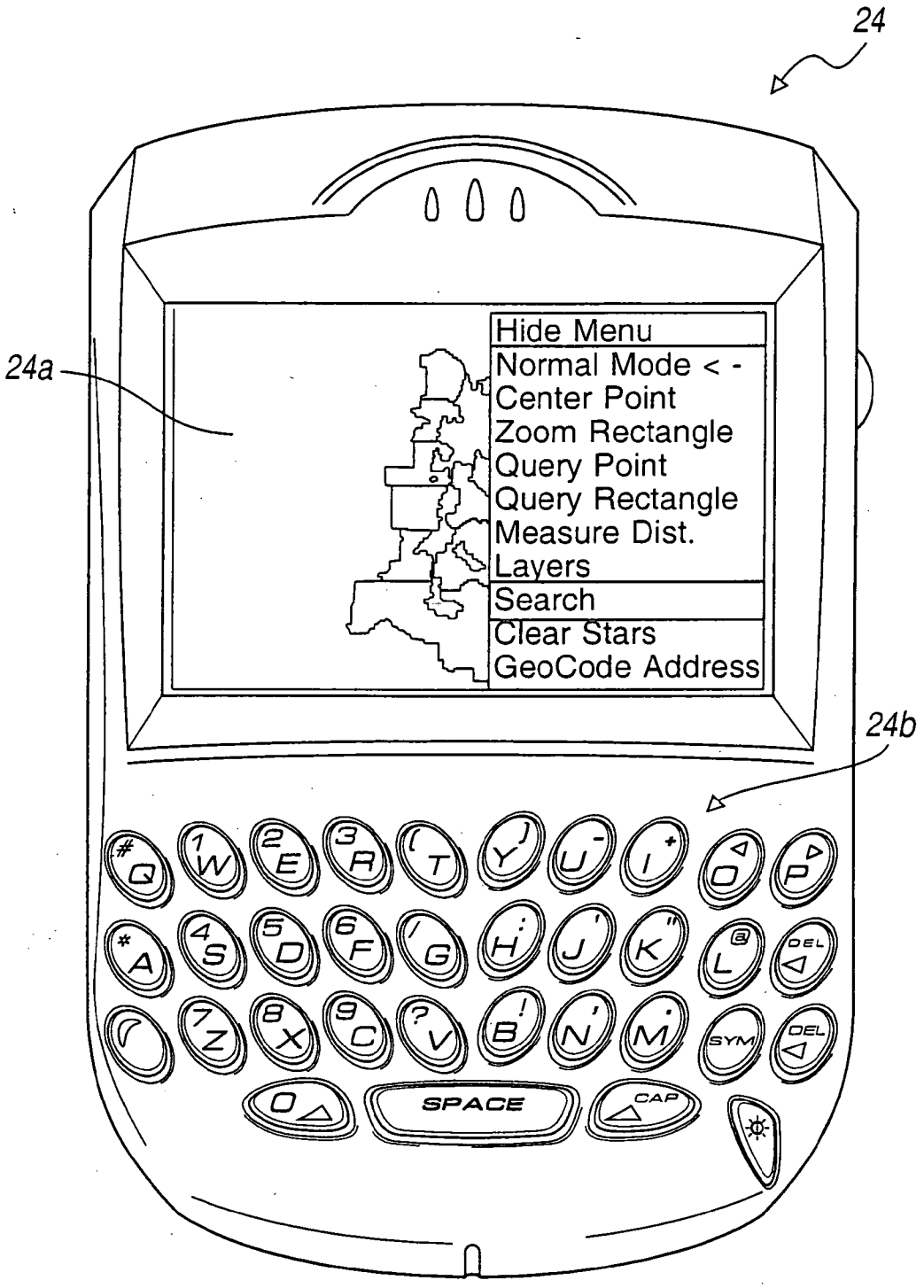

24
24a
24b
Hide Menu
Normal Mode < -
Center Point
Zoom Rectangle
Query Point
Query Rectangle
Measure Dist.
Layers
Search
Clear Stars
GeoCode Address
SPACE
CAP
SYM
DEL

FIG. 10

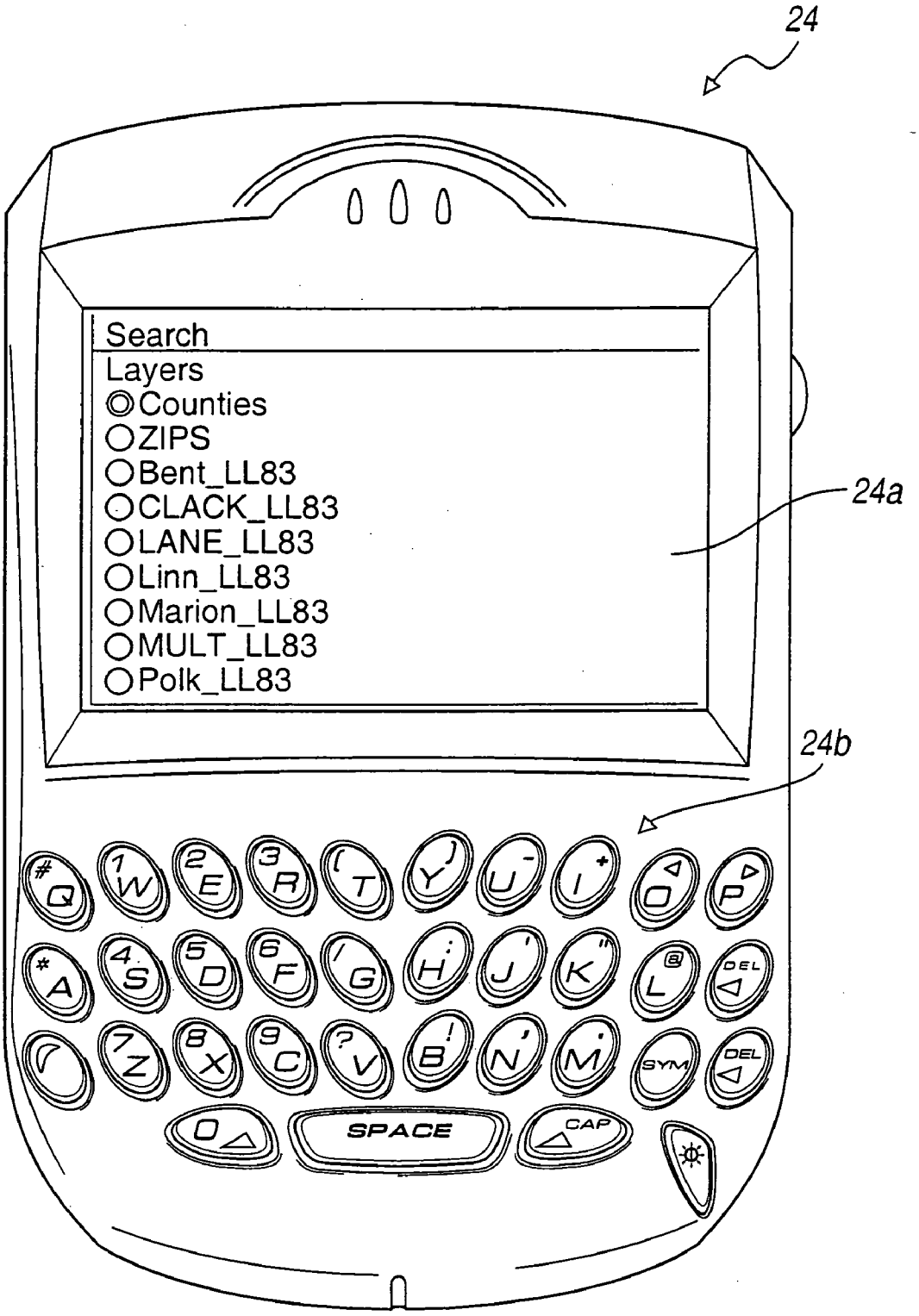

24
Search
Layers
Counties
ZIPS
Bent_LL83
CLACK_LL83
LANE_LL83
Linn_LL83
Marion_LL83
MULT_LL83
Polk_LL83
24a
24b
SPACE
CAP
DEL
SYM

FIG. 11

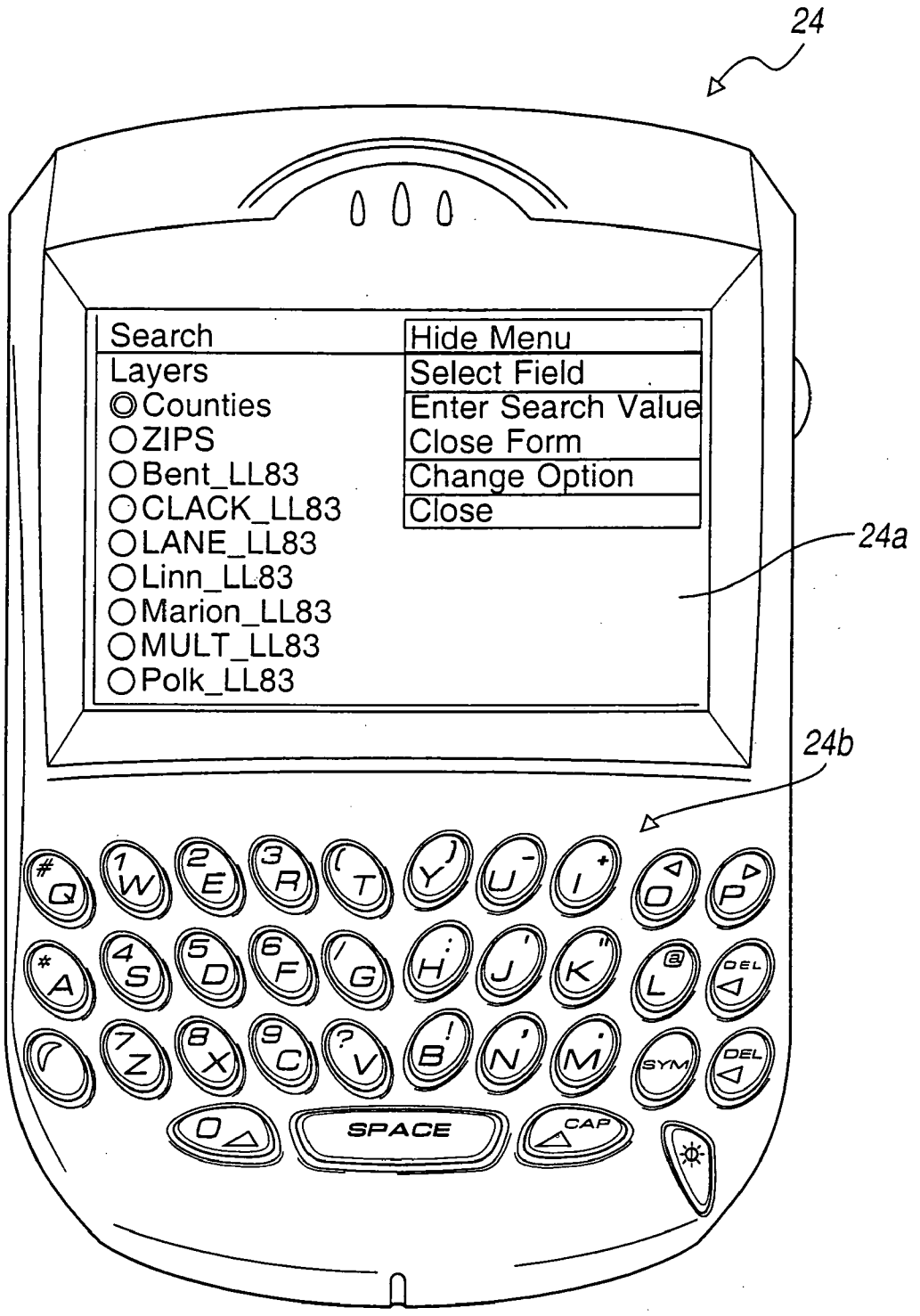

24
Search
Layers
Counties
ZIPS
Bent_LL83
CLACK_LL83
LANE_LL83
Linn_LL83
Marion_LL83
MULT_LL83
Polk_LL83
Hide Menu
Select Field
Enter Search Value
Close Form
Change Option
Close
24a
24b
SPACE
CAP
SYM
DEL

FIG. 12

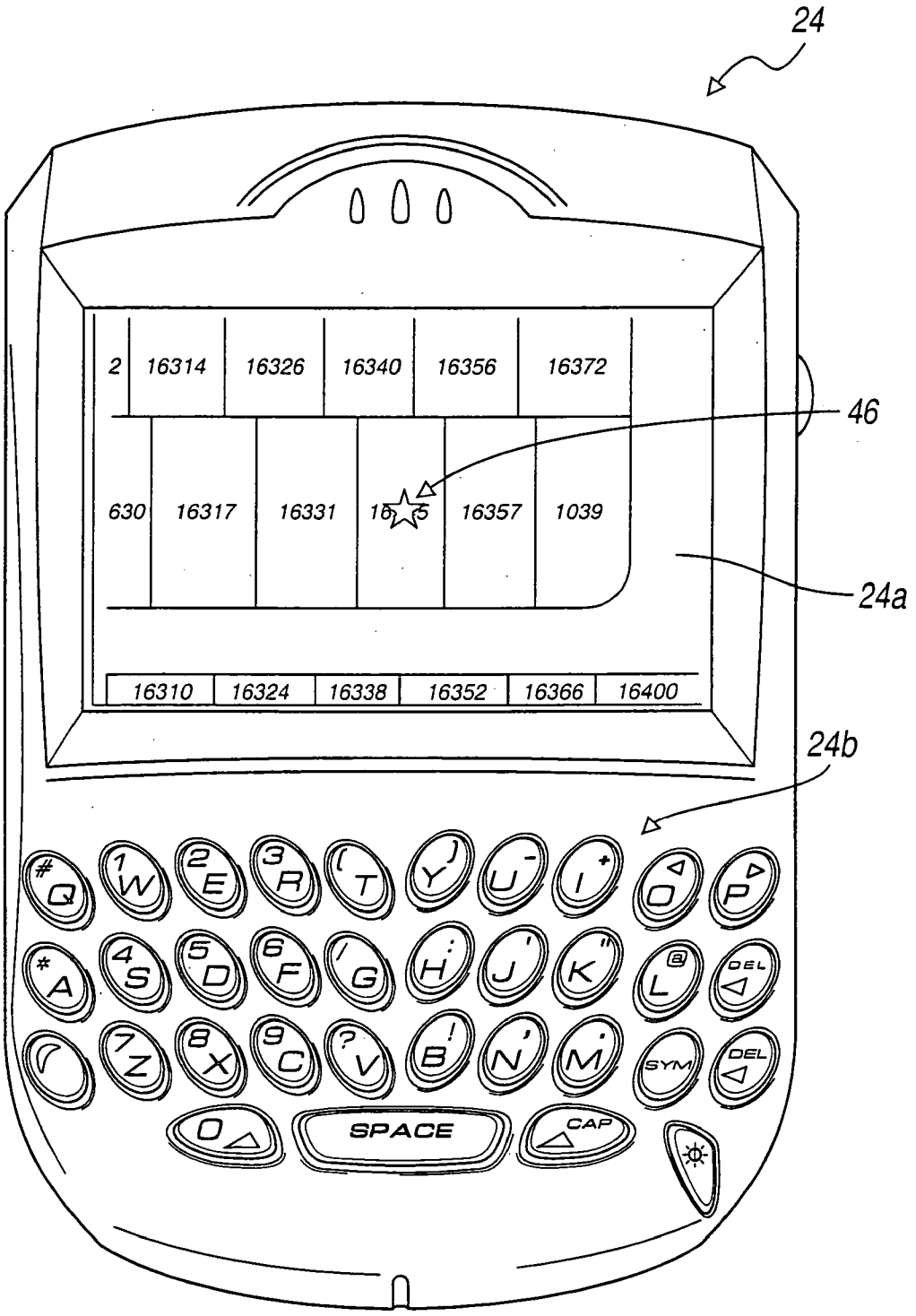

24
2
16314
16326
16340
16356
16372
46
630
16317
16331
16357
1039
24a
16310
16324
16338
16352
16366
16400
24b
SPACE
CAP
SYM
DEL

FIG. 13

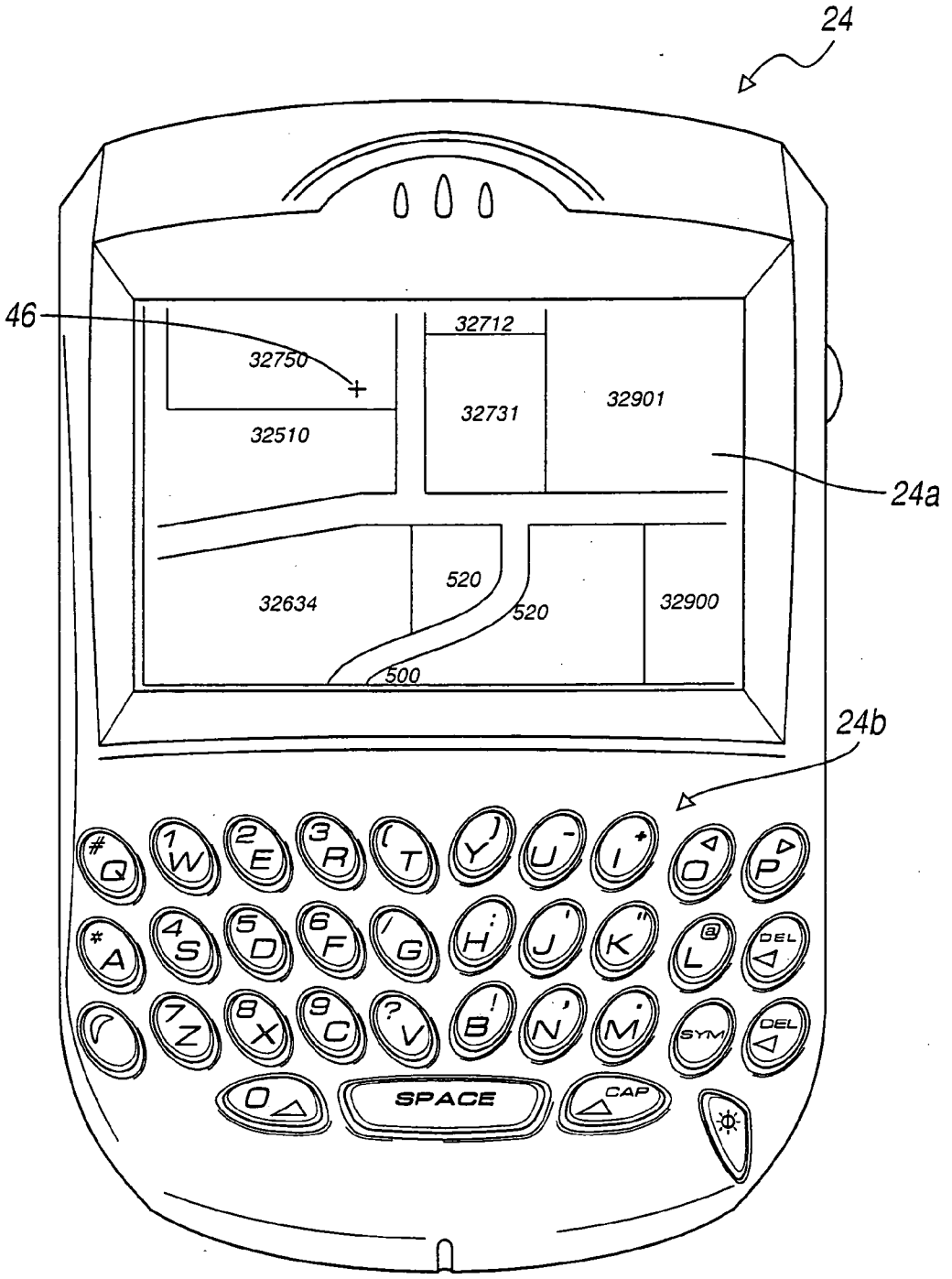

24
46
32712
32750
32731
32901
32510
24a
520
32634
520
32900
500
24b
SPACE
CAP
SYM
DEL

FIG. 14

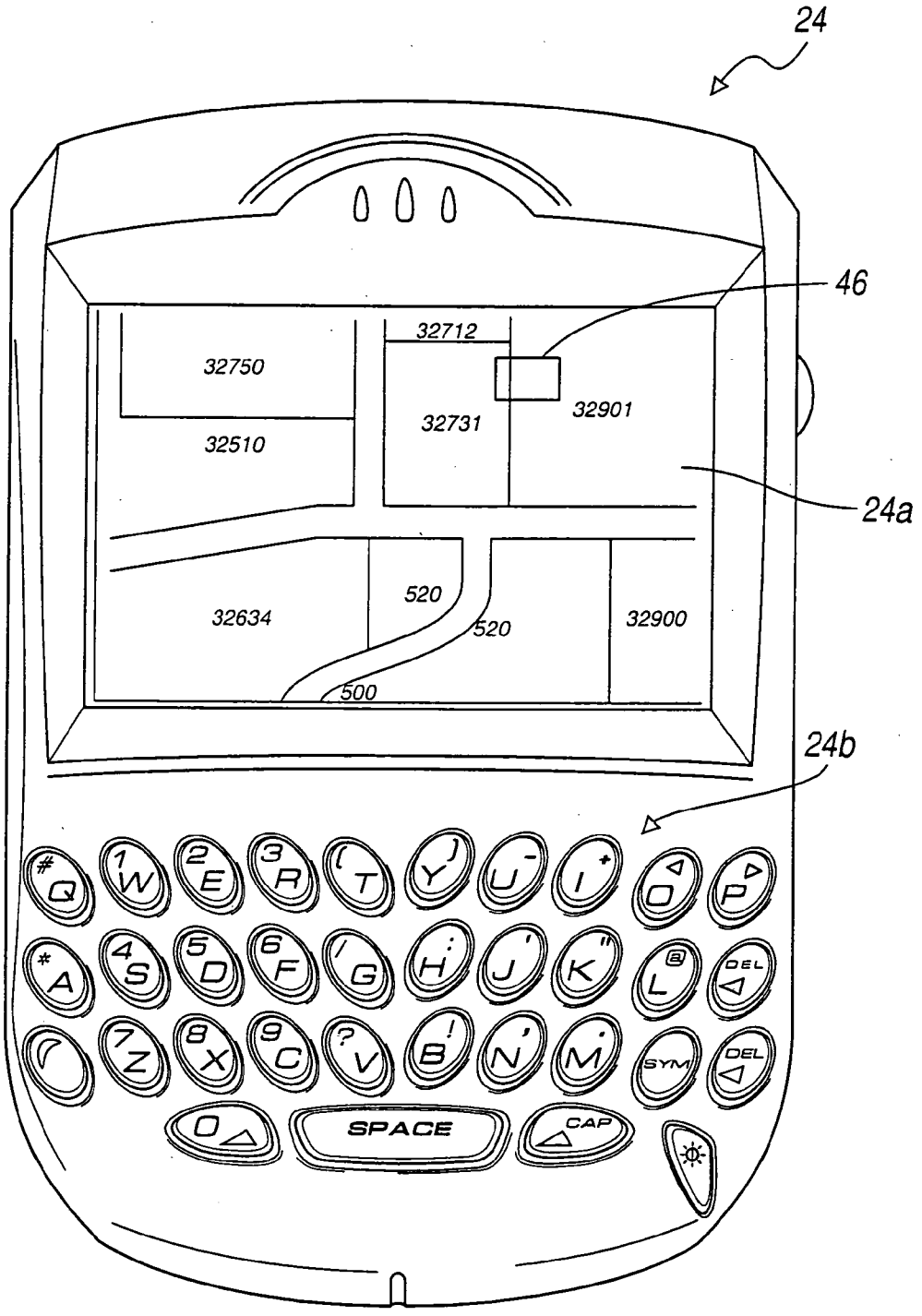

24
46
32712
32750
32731
32901
32510
24a
520
32634
520
32900
500
24b
SPACE
CAP
SYM
DEL

FIG. 15

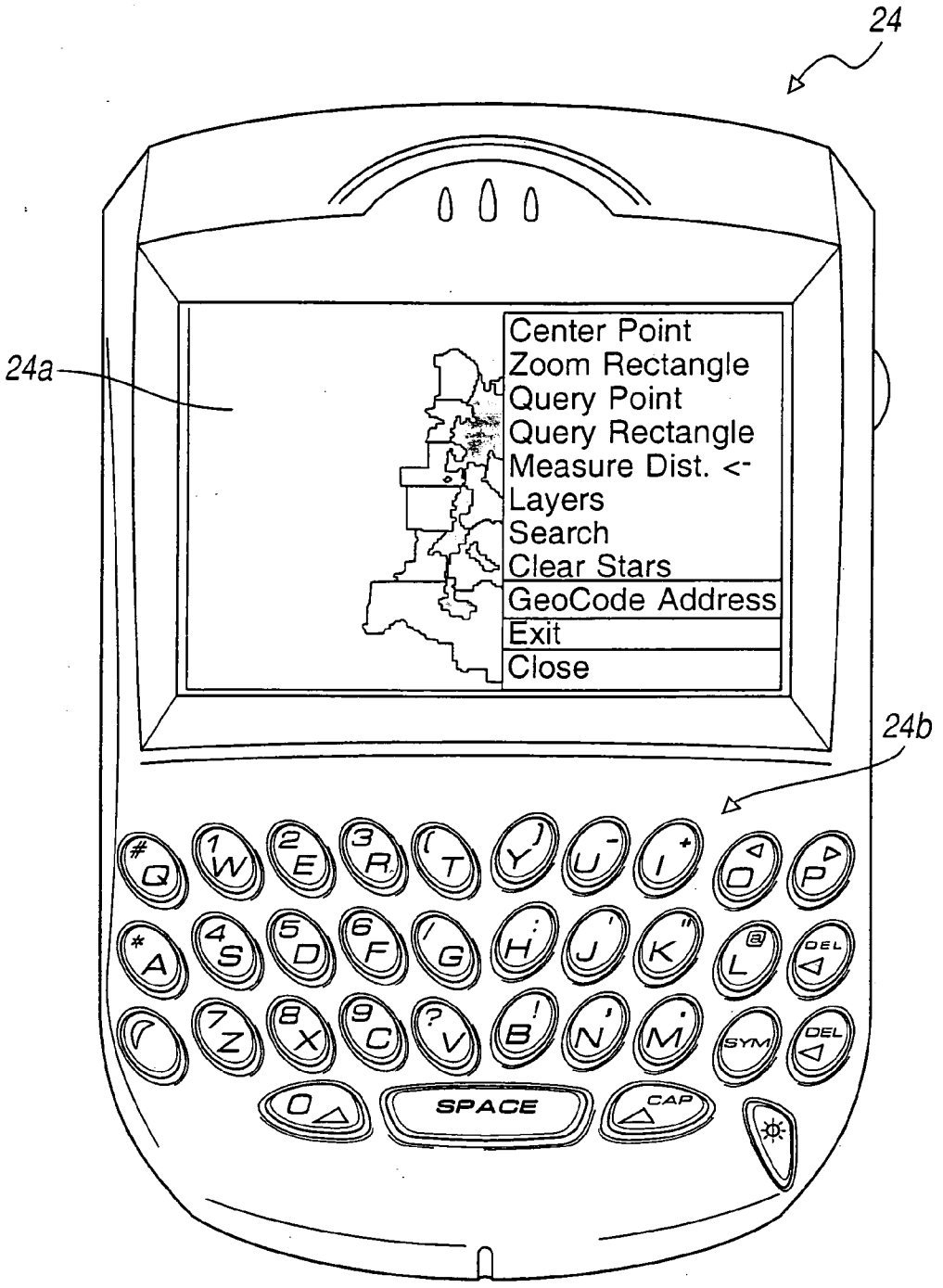

24
24a
Center Point
Zoom Rectangle
Query Point
Query Rectangle
Measure Dist. <-
Layers
Search
Clear Stars
GeoCode Address
Exit
Close
24b
SPACE
CAP
SYM
DEL

FIG. 16

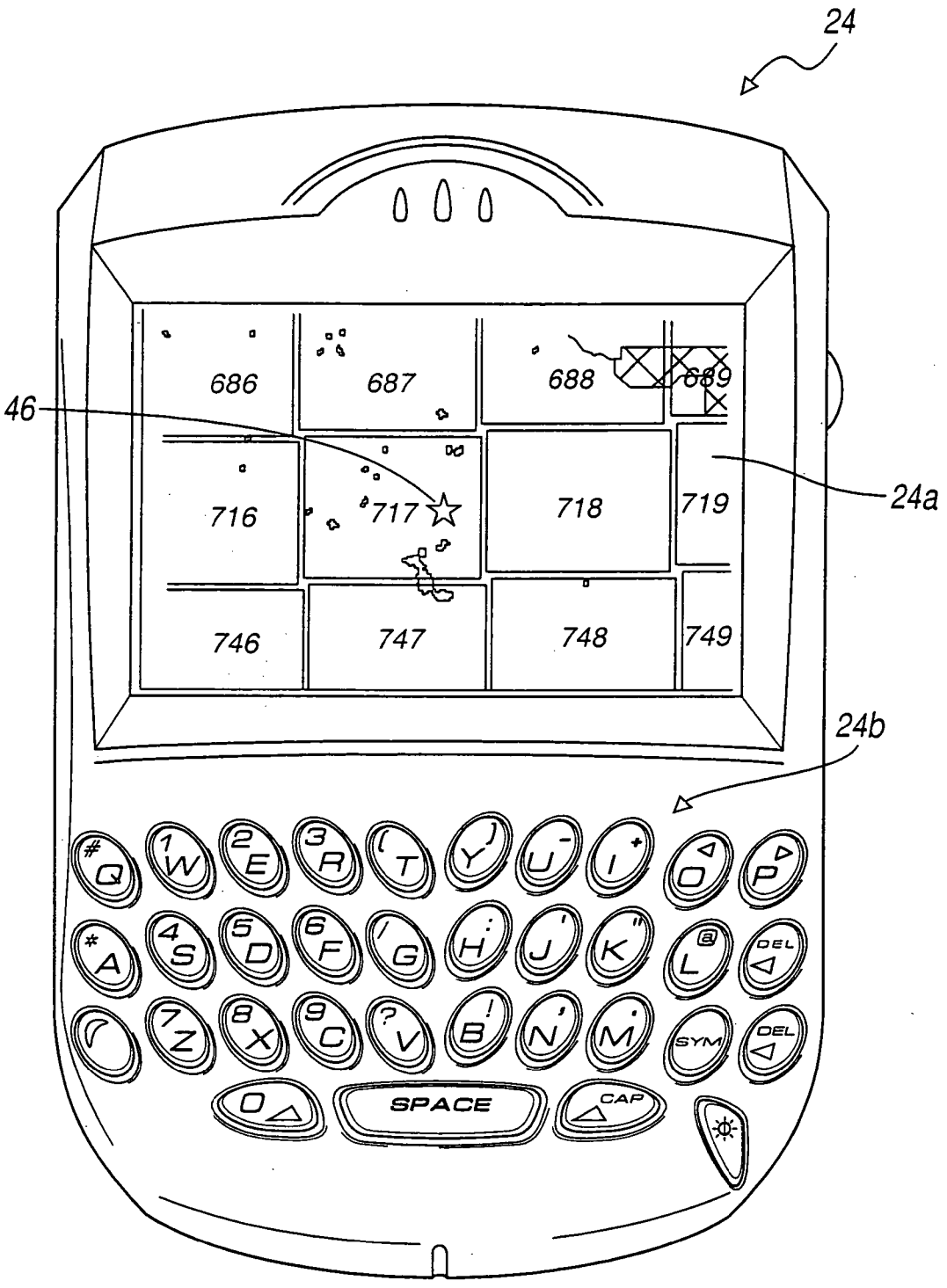
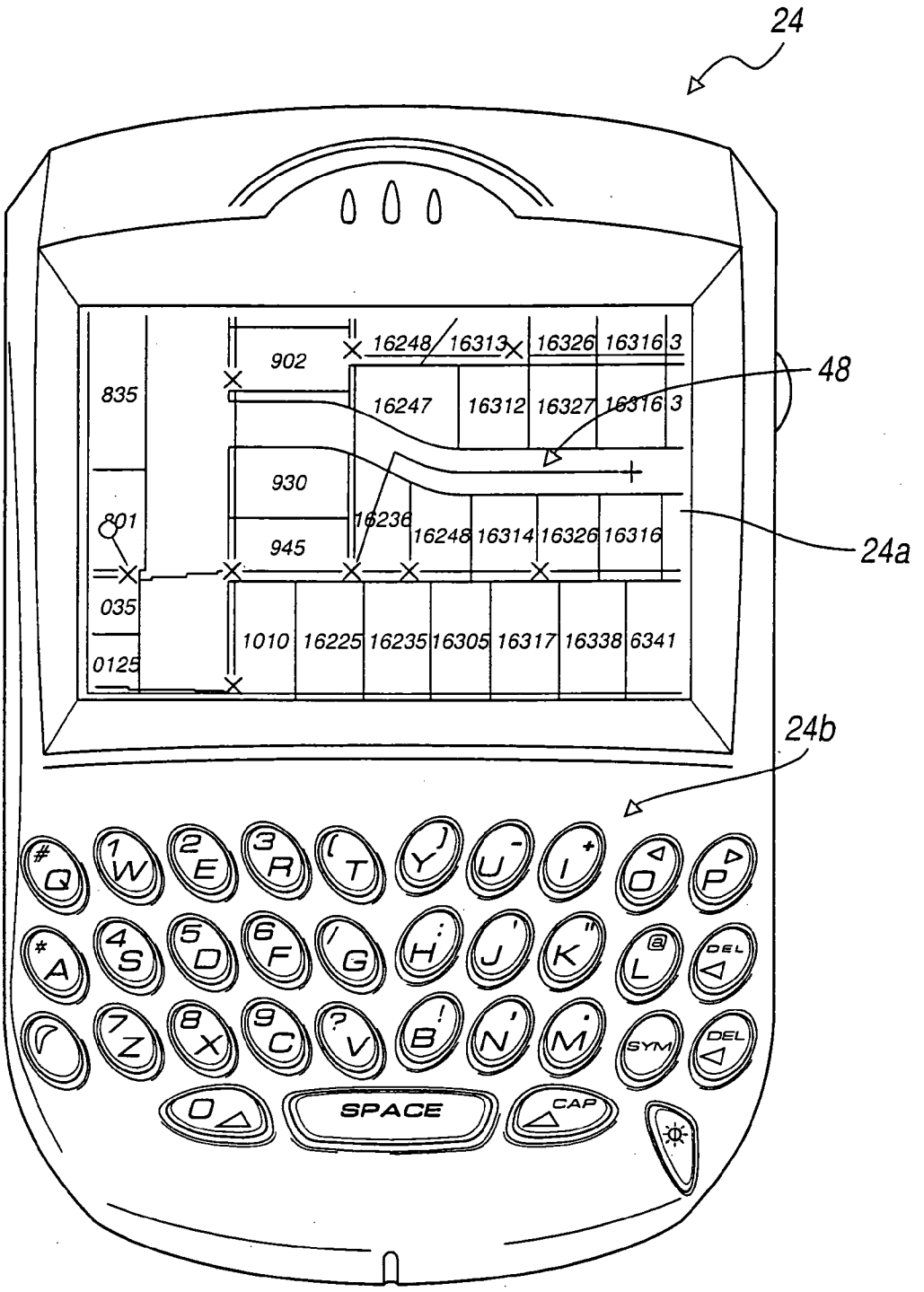

24
686
687
688
689
46
716
717
718
719
24a
746
747
748
749
24b
SPACE
CAP
SYM
DEL

FIG. 17


24
48
24a
24b
902
16248
16313
16326
16316
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835
16247
16312
16327
16316
3
930
801
16236
16248
16314
16326
16316
945
035
0125
1010
16225
16235
16305
16317
16338
6341
SPACE
CAP
DEL
SYM

FIG. 18

ASSET MANAGEMENT SYSTEM

TECHNICAL FIELD

[0001] The present invention relates to a system for managing assets through the use of a geographic information system.

BACKGROUND

[0002] The analysis and management of data from a geographic perspective has become of great importance. Geographic information systems (GIS) have experienced increased usage by businesses and governments alike because of the ability to manipulate, analyze and present information that relates to geographic areas. The conventional GIS includes a desktop computer and/or a server based software system. The desktop computer or server stores maps, data and other related information that may be assessed by a user through the use of GIS software. The software is capable of analyzing the stored data and providing this data to the user.

[0003] Even more recently, handheld/portable devices such as a personal digital assistant (PDA) have been incorporated with GIS to access data stored on a server. Through the use of these portable devices, the user may import maps and other map-related data to access data located on the server. Although the foregoing GIS/PDA systems have experienced increased usage, these systems possess several disadvantages. For example, the conventional systems that utilize have proven to be costly and inefficient. Additionally, the conventional GIS/PDA systems are primarily a navigation/routing tool that is designed to display maps for driving directions. Accordingly, these systems have proven to be inadequate at enabling efficient and cost-effective management of assets.

[0004] The present invention was conceived in view of these and other disadvantages of conventional GIS and asset management systems.

SUMMARY

[0005] The present invention provides a system for managing assets. Accordingly, an asset management system is provided that includes at least one asset located within a geographic area and a server configured to store data associated with the assets. The server may be adapted to store data associated with the asset location and be updated with current asset data by at least one administrator. The server is further adapted to generate and integrate asset symbols within an electronic spatial illustration of the geographic area wherein the location of the asset symbol on the spatial illustration corresponds to the location of the asset within the geographic area. The system further includes a portable device that communicates with the server and is adapted to display the data generated by and stored on the server. The portable device is also adapted to receive inputs from a user, display data in response to the user inputs, and display the spatial illustration having the integrated asset symbols and asset locations.

[0006] A method is disclosed for managing a system of assets wherein the system includes at least one asset located within a geographic area. The method comprises configuring a server to store data associated with the asset wherein the data includes an asset location. The method further includes updating the server with current asset data wherein the data is input by at least one administrator. The method also comprises generating asset symbols and an electronic spatial illustration of the geographic area, wherein the location of the asset symbol on the spatial illustration corresponds to the location of the asset within the geographic area.

[0007] The method also includes displaying data generated by and stored on the server through the use of a portable device, wherein the portable device is adapted to receive inputs from a user and transmit signals to the server that correspond to the user inputs. The portable device is further adapted to display data in response to the user inputs and display the spatial illustration having the integrated asset symbols and asset locations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] These and other features and advantages of the invention will be apparent from the following detailed description and the appended claims, taken in conjunction with the accompanying drawings, in which:

[0009] FIG. **1** is an illustration of an asset management system in accordance with an embodiment of the present invention;

[0010] FIG. **2** is a software diagram illustrating a data flow and data processing between the portable device and server shown in FIG. **1** in accordance with an embodiment of the present invention; and

[0011] FIGS. **3-18** illustrate the portable device of FIG. **1** having various screen displays in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0012] By way of example, a system and methodology for implementing the present invention is described below. The provided system and methodology may be adapted, modified or rearranged to best fit a particular implementation without departing from the scope of the present invention.

[0013] FIG. **1** illustrates an asset management system **10** that enables efficient and cost-effective management of assets located within a geographic area **20**. In one aspect of the invention, the managed assets include an amplifier **14**, a cable line **16**, and a power supply **18** that are strategically located within geographic area **20**. Asset management system **10** further includes a portable device **24**, a server **26**, and an administrator **28**.

[0014] Portable device **24** may be utilized by a service technician while making service calls to customers **22** within geographic area **20**. Portable device **24** may be a personal digital assistant (PDA), a cellular telephone, or a handheld computer. Accordingly, portable device **24** includes a display **24***a* and a keypad **24***b*. Accordingly, portable device **24** is configured to process, store, and retrieve data. Portable device **24** is also adapted to communicate with server **26**. Server **26** is configured to store data associated with assets **14**, **16** and **18**, and receive updated asset data from administrator **28** and portable device **24**. In one aspect, administrator **28** receives information pertaining to assets **14**, **16** and **18**. In response, administrator **28** transmits the received

information to server **26**. As such, administrator **28** may be a desktop computer or any device capable of receiving asset data and transferring the asset data to server **26**. Portable device **24** is capable of accessing the received data located on server **26**. The asset data located on server **26** may include spatial illustrations of geographic area **20** (e.g., a map), the location of assets **14**, **16** and **18** within geographic area **20**, and data related to the specific asset type and configuration. Server **26** is also capable of analyzing the information/data received from administrator **28**. In particular, server **26** is capable of generating asset symbols that correspond to assets **14**, **16** and **18** and integrating the asset symbols with the spatial illustration. Additionally, the asset symbols generated by server **26** may be configured to indicate the condition or state of the asset. For example, server **26** may be configured to generate a display showing the asset symbols wherein the color or shade of the asset symbol indicates whether the asset is in proper operating condition. Server **26**, in one aspect, is further configured to determine the distances between a user of portable device **24** and the location of assets **14**, **16** and **18**. As described above, the information stored and/or generated by server **26** is accessible by portable device **24**.

[**0015**] Referring to FIG. **2**, a software diagram is shown that illustrates the flow and processing of data between portable device **24** and server **26**. Upon startup of portable device **24**, a main screen/user interface thread **54** spawns a data request thread **58** to a file located on server **26** having a predetermined format. In one embodiment, the file contains map information for geographic area **20** (FIG. **1**) such as geographic and/or system layer names, and map extents. Also, the main thread is configured to parse the return from data thread **58** and spawn an image request thread **56** to a mapserver common gateway interface (CGI) **60** with the parameters needed for the mapserver to generate an image from spatial data stored on server **26** (block **62**). In one aspect of the invention, the spatial data stored on server **26** may utilize spatial file formats developed by the Environmental Systems Research Institute, Inc. (ESRI), 380 New York Street, Relands, Calif. 92373-8100. Mapserver CGI **60** responds to the request with an image file in a graphical format. In one embodiment, the graphical format is the portable network graphics (PNG).

[**0016**] As such, image thread **56** streams the image into a buffer and creates an image object. This image may the be sent back to the main screen thread **54**, wherein main screen thread **54** is configured to display the image on display **24***a* (FIG. **1**). When a user selects a move, pan or zoom function, the current coordinates are adjusted and the main thread **54** updates the request string in the image thread **56**. The image thread then sends the request to the mapserver CGI **60** which responds with a new image of the required data having an adjusted coordinate area in accordance with the selected move, pan or zoom function.

[**0017**] Data requests that occur when a user initiates a query or a geocode (to be described below) may be sent in a similar fashion. In one embodiment, an alternative CGI may be utilized that does not require the use of the Mapserver. The CGI in such an embodiment responds with the query, search or geocode results in a graphical format such as extensible mark-up language (XML). The data thread **58** may send that XML graphic to the main thread **54** which is then parsed to retrieve the results. The results are then displayed to the user for viewing.

[**0018**] Additionally, in the case of a search or a geocode, data thread **58** may send the data to the main thread **54**, which then takes that information and provides it to the image thread **56**. Image thread **56** receives the data and sends a request to the Mapserver CGI **60** which returns an image which is ultimately displayed on display **24***a* (FIG. **1**) for viewing by the user. The foregoing cycle may be repeated in various orders depending on the user's input.

[**0019**] Now, referring to FIG. **3** and as described in the foregoing, an electronic spatial illustration of geographic area **20** may be displayed on display **24***a*. Keypad **24***b* enables the user (i.e., a service technician) to input data requests, which are received by server **26**. As such, as shown in FIG. **4**, portable device **24** displays a menu that enables the user to request specific information for display and select various graphic display options. As information/data is input by administrator **28**, the updated information may be accessible virtually immediately through the use of portable device **24**, thereby providing the user the most recent asset information. This continuously updated display of asset data enables cost-effective management of the assets. For instance, if administrator **28** updates the operating status of amplifier **14** from a non-working status to a fully functional status, then the user (i.e., the service technician) does not unnecessarily expend time and/or resources attempting to find and troubleshoot amplifier **14**. The graphic illustrations and asset data displayed on portable device **24** further enables the user to quickly identify the specific location of an asset that is not working properly. As such, the service technician can provide prompt service to customers **22** (FIG. **1**) without expending time making trips to a customer service center (not shown) or reviewing maps of the geographic area where the troubled asset is thought to be located.

[**0020**] To expedite servicing and/or maintenance of assets **14**, **16** and **18**, server **26** is configured to store various data layers that are associated with the respective assets. These data layers are geographically positioned system layers that are capable of being mapped through the use of server **26** and portable device **24**. For example, the data layers may correspond to an aerial or underground illustration of the system of assets. Accordingly, referring to FIG. **5**, portable device **24** displays the user menu that includes a "Layers" option for displaying various system layers.

[**0021**] Now, referring to FIG. **6**, a list of layers is illustrated on display **24***a*. In the embodiment shown, the layers include selections for respective counties within geographic area **20** (FIG. **1**). In one aspect of the invention, each data layer has a layer identification associated with the layers. For example, as shown in FIG. **6**, the layer identifications associated with the respective geographic layers include "counties" and "zips". Additionally, each layer may include fields in which values may be entered and searched via portable device **24**.

[**0022**] As shown in FIG. **6**, the geographic layer having the layer identification counties and zips (e.g., zip code) has been selected. Upon selection of a particular layer(s), the server **26** will generate a spatial illustration (e.g., a map), thereby illustrating the particular layer(s) selected. In the embodiment shown in FIG. **6**, the selectable layer(s) include a listing of counties within a particular state.

[0023] Referring to FIGS. **7-9**, various embodiments of a selectable design layer are illustrated. Specifically, as shown in FIG. **7**, a spatial illustration of a geographic area is shown that includes assets that are embedded within the spatial illustration in a way that corresponds to the actual location of the asset within the geographic area. The functionality of server **26** and portable device **24** enables a service technician to quickly identify assets that require servicing and/or maintenance without repeated trips to the customer service center or time consuming review of hard-copy area and system maps.

[0024] In the embodiments shown in FIGS. **7-9**, the assets that are illustrated include amplifier **14**, a tap **30**, a splice **32** and a splitter **34**. As recognized by one of ordinary skill in the art, the above assets are commonly used in a cable service system. It is recognized however, that the managed assets may be any system component and/or device without departing from the scope of the present invention including but not limited to any physical asset of a utility or telecom network. Accordingly, as shown in FIGS. **8** and **9**, through the use of server **26** and portable device **24**, the managed assets may include power supply **18**, a node receiver **36**, a power inserter **38**, a lock box **40**, a cable **16**, a pole **44**, and a digital or analog radio frequency signal that is indicated by an asset symbol **42**. Each of the managed assets includes at least one asset symbol wherein the shade and/or color of the asset symbol on display **24***a* may indicate the condition or state of the asset.

[0025] As described in the foregoing, server **26** is searchable through the use of portable device **24**. Accordingly, portable device **24** includes a search option within the menu illustrated by FIG. **10**. The user may simply select the search option from the menu to initiate a search for data/information located on server **26**. The search option further enables any field of any layer to be searched by inputting a search criteria or selecting a particular value for searching. In one embodiment, the search criteria includes longitude and latitude coordinates that enable a specific location to be displayed on portable device **24**. As shown in FIGS. **11** and **12**, the user may select a layer and specific field within the selected layer to search for a particular location and/or asset. Once the criteria has been entered and the user executes the search query, the server **26** will generate the requested information that may include a graphic illustration of the geographic area having the managed asset.

[0026] Referring to FIG. **13**, portable device **24** displays a geographic area that includes one asset as indicated by a location symbol **46**. It is recognized that the symbol used to denote the location of a managed asset may be any symbol, such as a star, a point or a rectangle as illustrated in FIGS. **13** through **15**. In one embodiment, the user may select various display modes thereby customizing the display of a geographic area having assets located throughout.

[0027] Server **26** is further adapted to store location data that is associated with a geographic area. Through the use of portable device **24** and server **26**, the user may geocode an address. Geocoding enables a point or area on the Earth's surface to be determined based on specific criteria such as the location data. Accordingly, in the embodiment shown in FIG. **16**, the user may select to geocode an address from the menu displayed by portable device **24**. In another aspect, administrator **28** may geocode an address.

[0028] In the embodiment shown, the specific operation includes a street level geocode that enables searching of a street database for street addresses that are input by the user. Once server **26** identifies a street that corresponds to the search criteria, the server **26** filters the results by an address range that is compared to the original search criteria. If the address/street name falls within a valid range, the server **26** calculates where the address should be located if it exists and portable device **24** displays a map or grid that includes a location symbol where the address is located.

[0029] In one aspect, the user can also filter the search results by zip code thereby reducing the chance of finding results in two cities that have a similar street name and/or address ranges through the geocode operation. Nevertheless, where multiple search criteria results are found, these results are illustrated on the spatial illustration as either a star, a rectangle or a point (i.e., the location symbol).

[0030] Accordingly, referring to FIG. **17** following execution of an address geocode, an image of the particular geographic area is illustrated having a star that denotes the location of the managed asset within the geographic area. In this embodiment, the illustration includes a spatial grid wherein the spatial grid may correspond with a physical copy of the geographic area, such as a spatial grid commonly found within a "Thomas Guide," which is available from Rand McNally, 8255 N. Central Park, Skokie, Ill. 60076. Accordingly, the user may utilize the physical copy of his/her "Thomas Guide" and find the exact point illustrated by the electronic spatial grid and drive to the location denoted by the star.

[0031] As described above, portable device **24**, having data storage and data processing capability, is configured to determine (i.e., calculate) distances between portable device **24** and a managed asset. Such functionality enables precise scheduling for travel and service calls. Accordingly, the user may input the current location through the use of keypad **24***b*. The user can then select any assets displayed by portable device **24**. As such, portable device **24** will calculate the distance between the user's current location and the managed asset, and generate a display of the calculated distance for the user.

[0032] While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. An asset management system comprising:

at least one asset located within a geographic area;

a server configured to store data associated with the asset wherein the data includes an asset location, the server being updated with current asset data by at least one administrator and adapted to generate and integrate asset symbols with an electronic spatial illustration of the geographic area, wherein the location of the asset symbol on the spatial illustration corresponds to the location of the asset within the geographic area; and

a portable device communicative with the server and adapted to display the data generated by and stored on the server, the portable device adapted to receive inputs from a user, display data in response to the user inputs, and display the spatial illustration having the integrated asset symbols and asset locations.

2. A system according to claim 1, wherein the portable device is further configured to determine distances between the user and the asset location.

3. A system according to claim 1, wherein the server is further configured to be searchable for asset data through the use of the portable device.

4. A system according to claim 3, wherein the server is searched in response to the user inputting a search criteria into the portable device.

5. A system according to claim 4, wherein the search criteria includes longitude and latitude coordinates.

6. A system according to claim 1, wherein the asset symbols are configured to indicate the condition or state of the asset.

7. A system according to claim 1, wherein the server contains a plurality of data layers associated with the asset.

8. A system according to claim 7, wherein the plurality of data layers have a layer identification associated with the layers.

9. A system according to claim 8, wherein the layers include fields that contain searchable data.

10. A system according to claim 1, wherein the stored data associated with the asset includes asset type and configuration information.

11. A system according to claim 1, wherein the asset location is denoted by a location symbol that is a star, a point, or a rectangle.

12. A system according to claim 1, wherein the server is adapted to geocode locations based on values received from the portable device or the administrator.

13. A system according to claim 1, wherein the server is adapted to generate and integrate an electronic spatial grid with the asset symbol, wherein the spatial grid corresponds to a physical illustration of the spatial grid.

14. A system according to claim 1, wherein the at least one asset includes a tap, an amplifier, a splice, a splitter, a node receiver, a power inserter, a power supply, or a lock box.

15. A system according to claim 1, wherein the asset symbols correspond to the direction of an electronic signal, a cable, or a pole.

16. A system according to claim 1, wherein the portable device is a computer, a personal digital assistant (PDA) or a cellular telephone.

17. A system according to claim 1, wherein the portable device includes a main thread that is configured to:

spawn a data request thread that is received by the server in response to the user inputs;

parse the return from the data request thread;

spawn an image request thread to a mapserver common gateway interface (CGI) located on the server wherein the server generates an image file in a graphical format which is received by the main thread; and

display the data received by the main thread in response to the user inputs for viewing by the user.

18. A method of managing a system of assets wherein the system includes at least one asset located within a geographic area, the method comprising:

configuring a server to store data associated with the asset wherein the data includes an asset location;

updating the server with current asset data wherein the data is input by at least one administrator;

generating asset symbols and an electronic spatial illustration of the geographic area through the use of the server, wherein the location of the asset symbol on the spatial illustration corresponds to the location of the asset within the geographic area; and

displaying data generated by and stored on the server through the use of a portable device, the portable device being adapted to:

receive inputs from a user and transmit signals to the server that correspond to the user inputs,

display data in response to the user inputs, and

display the spatial illustration having the integrated asset symbols and asset locations.

19. A method according to claim 18, further comprising configuring the portable device to determine distances between the portable device and the asset location and generate an output corresponding to the distance that is displayed on the portable device.

20. A method according to claim 18, further comprising:

configuring the server to be searchable for asset data through the use of the portable device; and

searching the server in response to the user inputting a search criteria into the portable device.

21. A method according to claim 20, wherein inputting a search criteria includes inputting longitude and latitude coordinates.

22. A method according to claim 18, wherein generating the asset symbols and the electronic spatial illustration of the geographic area includes asset symbols that are configured to indicate the condition or state of the asset.

23. A method according to claim 18, further comprising:

configuring the server to store a plurality of data layers associated with the asset, wherein the plurality of data layers have a layer identification.

24. A method according to claim 23, wherein configuring the server to store a plurality of data layers further includes data layers that contain searchable values.

25. A method according to claim 18, wherein configuring the server to store data associated with the asset includes data associated with the asset type or configuration.

26. A method according to claim 18, wherein displaying data generated by and stored on the server through the use of a portable device that includes a main thread, the method comprising:

spawning a data request thread that is received by the server in response to the user inputs;

parsing the return from the data request thread;

spawning an image request thread to a mapserver common gateway interface (CGI) located on the server wherein the server generates an image file in a graphical format which is received by the main thread; and

displaying the data received by the main thread in response to the user inputs for viewing by the user.

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