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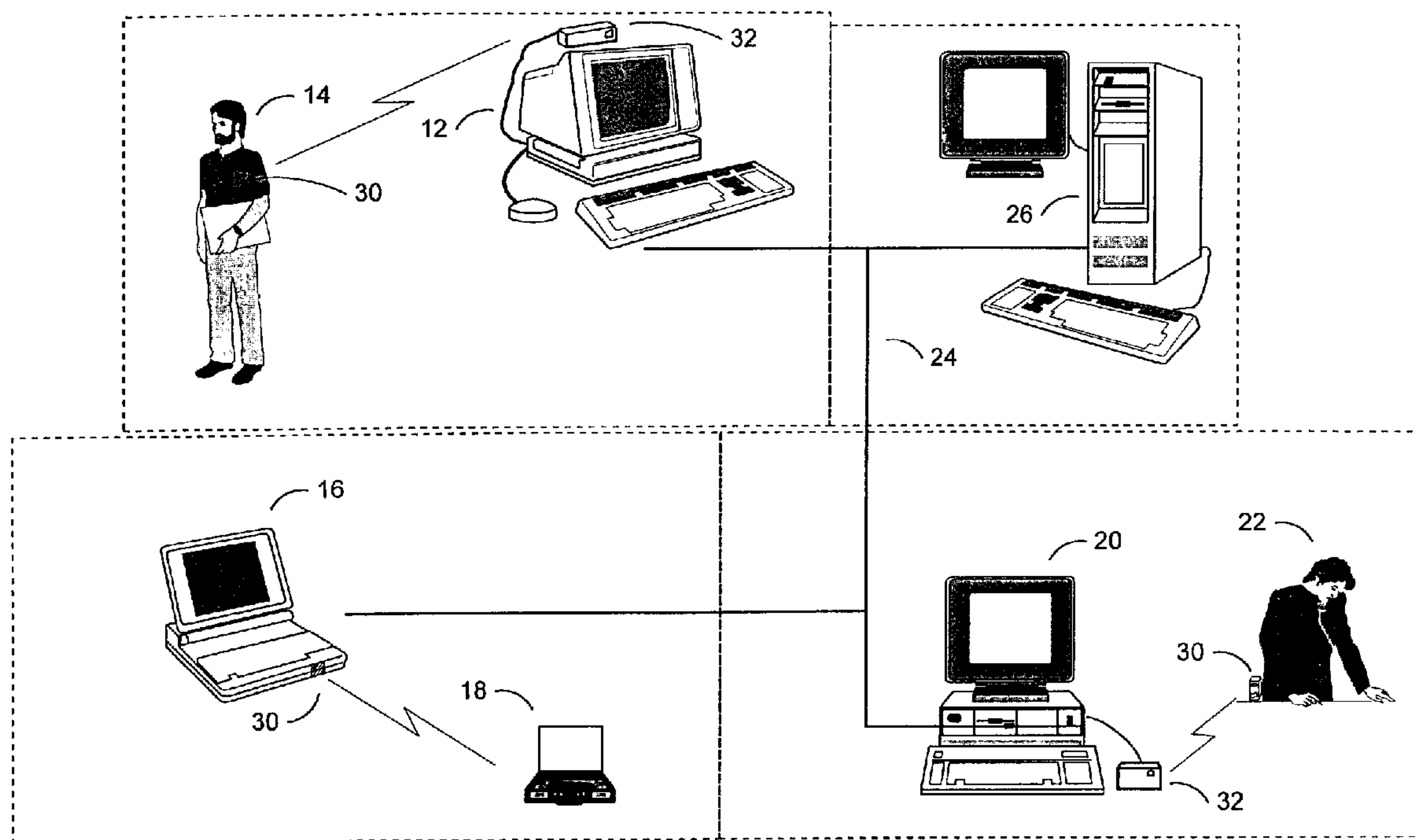
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(54) **SYSTEME INFORMATIQUE EN RESEAU SERVANT A LOCALISER DES OBJETS**

(54) **NETWORKED COMPUTER-BASED SYSTEM FOR IDENTIFYING OBJECT LOCATION**



(57) An object location system is provided for locating personnel or objects within a facility by the use of an existing computer system network. Transceiver circuitry is installed on a printed circuit card in conjunction with the network interface circuitry inside each computer or by itself in a unit attached externally to the computer. The transceiver communicates with remote portable units that are coupled to respective objects or personnel to be located. The remote units include transmission means for transmitting identification information associated with their respective objects or personnel. This information is disseminated throughout the network so that all computers within the network have access to the location of all identified portable units.



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ABSTRACT OF THE DISCLOSURE

An object location system is provided for locating personnel or objects within a facility by the use of an existing computer system network. Transceiver circuitry is installed on a printed circuit card in conjunction with the network interface circuitry inside each computer or by itself in a unit attached externally to the computer. The transceiver communicates with remote portable units that are coupled to respective objects or personnel to be located. The remote units include transmission means for transmitting identification information associated with their respective objects or personnel. This information is disseminated throughout the network so that all computers within the network have access to the location of all identified portable units.

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**A NETWORKED COMPUTER-BASED  
SYSTEM FOR IDENTIFYING OBJECT LOCATION**

5    **1. Technical Field of the Invention**

          This invention relates to an object location system and more particularly to a local area networked (LAN) computer based system with multiple computers networked together where at least one computer includes a sensory device for sensing or receiving coded transmissions from a portable unit attached to an object  
10 or person. The system determines the locations of objects or persons by processing the received transmissions.

**2. Background of the Invention**

          Location systems for locating objects or personnel within a facility are  
15 known. One type of personnel location system used in hospitals involved personnel within the facility reporting their locations by manually setting switches at designated areas. The switches are monitored at a central station and the locations of the personnel are determined by the locations of the activated switches.

          Other systems include techniques which locate personnel or objects by  
20 seeking out where the object or personnel is closest to designated monitors. Such systems generally include a central controller connected to a plurality of transceivers distributed at designated locations throughout a facility. U.S. Patent No. 5,455,851 describes one such system.

          U.S. Patent No. 4,955,000 to Nastro and U.S. Patent No. 5,119,104 to  
25 Heller propose location reporting systems which include portable electronic units worn or attached to objects. The portable units periodically transmit individually

unique ID signals. A plurality of transceivers are distributed at designated locations and the transceiver(s) within range of the portable unit transmissions receives the transmitted ID signals. The transceiver(s) in turn communicates the ID information to the central controller. From the location of the transceiver and the ID of the portable unit, the central controller is able to determine the location of the object.

A disadvantage to this type of location system is the expense in mounting all the transceivers and wiring them throughout a facility back to the central controller. A second disadvantage to this type of system is the inability of a user to be able to locate a person or object without having to return to the central controller.

Personal computers (PC) have been known and widely used for quite some time. They are typically of a size that will fit on a desktop with a display monitor resting on top of the computer. This size averages six to eight inches in height and one and a half to two feet in both width and depth. Larger PCs are commonly called tower models and stand approximately two feet upright next to a desk. Along with the display, a keyboard, mouse or trackball, and speakers are also placed on the desk.

A PC typically contains a central processing unit (CPU) that executes programs in the computer; a memory storage area, such as magnetic disk and hard drive to store these programs and data that the programs manipulate; and various interfaces to communicate with equipment or entities external to the PC. Some of these interfaces have already been mentioned, i.e. the display, keyboard, mouse, trackball and speakers. These external devices operate with associated hardware or software internal to the PC. For example, the speakers may be driven by a "soundcard", a card having circuitry for converting data to audio information. The card may be factory installed or subsequently installed to the PC hardware as an add-on accessory. The software programs that run these devices are part of what is normally called the operating system. The operating system runs constantly as a

background task to whatever other program may be concurrently running in the foreground. Examples of these foreground tasks include word processing programs, data spreadsheet, analysis programs, real time simulation programs, and screensaver programs when the computer is on standby.

5 Other interfaces in a personal computer include a network card connected to a serial port to link up and communicate with other computers directly or a different type of serial port which will allow the PC to tie into the telephone lines to communicate with other devices.

10 In the present business offices, it is typical to find a PC in each office, and the PCs are connected or networked to each other in a local area network for facilitating communication between any two or more PCs. Thus, in a LAN based office building, the offices are all electronically connected.

15 A sophisticated location system affords the users, typically in business or a hospital environment, to timely locate individuals or objects which are generally mobile within the facility with accuracy and thus reduces lost time or contact.

However, the costs and labor involved in installing the location system, including numerous transceivers in spatially dispersed locations throughout the facility, may be substantial.

20 It can be seen that a need exists for a location system having transceivers that can be installed throughout a facility without the expense of wiring the entire facility.

### SUMMARY OF THE INVENTION

25 The present invention is an object location system for locating and communicating with personnel or objects in conjunction with a networked computer system within a facility. Each networked computer in designated areas of the facility includes a transceiver, which may be operatively connected and having a portion

disposed externally to the computer, such as in a portable housing placed proximal to the computer. The transceiver circuitry may also be mounted on an interface card which plugs into the computer, such as a network card or a soundcard. Each person or object has or wears a portable unit which transmits coded signals to the transceiver. One of the computers on the LAN acts as a network server to direct and control information between the other remote computers on the network. The server includes a locator program which receives the coded signals transmitted from the portable units through the transceivers, processes the coded signals, and determines the locations of the portable units. The server also maintains a database of the identification of all the portable units within the facility. Advantageously, the installation of transceivers at networked computers facilitates the usage of the existing interconnects of the Local Area Network (LAN) as the interconnected components of the locator system.

According to an object of an aspect of the present invention there is provided an object location system comprising:

at least one portable unit coupled to a respective object to be located including wireless transmission means for transmitting information including a unique identification signal; and

a plurality of remote computers disposed at spaced apart areas, each of said remote computers includes transceiver means for receiving said information from said at least one portable unit and means for processing said information, said transceiver means comprising an interface card installed in each of said plurality of remote computers and including a sensor and receiver circuitry, said plurality of remote computers being interconnected in a local area network (LAN), each of said remote computers having a respective display, keyboard, memory and interface and control circuitry for operating as a desktop computer, and any one of said remote computers having means for determining the location of said portable unit from said information received from said portable unit.

According to an object of another aspect of the present invention there is provided an object location system comprising:

a plurality of portable units, each being attached to an object to be located and each having a transmitter for wireless communication;

a plurality of personal computers disposed throughout a facility, said computers being interconnected to one another via a local area network (LAN), each  
5 of said computers having a respective sensor and a respective transceiver electrically connected thereto and disposed proximally therewith for receiving information transmitted from said plurality of portable units, said respective sensor and said respective transceiver being controlled and powered by a respective one of said computers;

10 wherein any one of said interconnected personal computers acts as a controller for the network and determines the locations of said objects.

According to an object of yet another aspect of the present invention there is provided an method of locating objects comprising the steps of:

15 transmitting from a portable unit attached to an object a unique identification signal;

receiving said unique identification signal by a receiver in one of a plurality of personal computers networked in a LAN, said receiver comprising an interface card having a sensor for receiving signals transmitted from said portable unit and disposed within said computer;

20 relaying said unique identification signal to another of said personal computers controlling said LAN;

processing said unique identification signal at said another computer to determine the location of said portable unit;

maintaining the location information in said another computer; and

25 requesting from any one of said plurality of personal computers said location information and displaying said location information at said requesting computer.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Preferred embodiments of the invention are described hereinbelow with  
30 reference to the drawings wherein:

Fig. 1 pictorially illustrates the system configuration for the computer networked locator system of the present invention;

Fig. 2 pictorially illustrates the present invention locating multiple objects;

Fig. 3 is a block diagram of the components of the system according to the present invention;

Fig. 4 illustrates a typical computer display of any of the networked computers of the present invention;

Fig. 5 illustrates an alternative typical computer display of any of the networked computers of the present invention;

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Fig. 6 is a block diagram showing the interaction between a remote computer and a portable unit of the present invention; and

Fig. 7 is a block diagram showing the components of a transceiver.

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### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

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The general features of the apparatus according to the present invention is explained with reference to Fig. 1. A plurality of computers 12, 16 and 20 are typically located at various areas throughout a facility such as an office complex. Each computer is connected through a local area network (LAN) 24 to a central computer 26. This computer is commonly called a server. The server minimally serves a dual function. First, it acts as a bus traffic controller between all the nodes; i.e. computers on the network. Second, the server will contain a fairly large amount of memory. This memory is considered common to all the computers, and can be accessed by all the nodes and thus acts as a means for passing information between the computers.

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Each computer in the network includes a transceiver connected to it via one of the computer's I/O ports. Fig. 7 shows a block diagram of the components of a transceiver. The transceiver includes a sensor 72, which, according to the present embodiment comprises infrared photodiodes, for sensing the coded signals transmitted from the portable units 30 and receiver circuitry 76 for processing the received coded signals and interface with the CPU of the PC. The sensor portion, along with associated wave shaping and amplification circuitry 74, are preferably disposed in a portable housing 32 for placement proximal to the computer, such as on top of the computer. The receiver circuitry 76 is preferably installed in the PC hardware, in the form of an individual card or an IC chip which plugs into an interface card, such as a soundcard or network card. Alternatively, the entire transceiver may be housed in

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housing 32 and the output is connected to the PC via a standard interface jack such as a mouse connection to the PC.

Each person in the facility 14 or 22 and the objects to be monitored 18 have a portable unit, such as a badge or tag. The transmissions from the portable units are preferably coded infrared signals carrying information including an identification number. The coding is preferably a frequency modulation of the data to be transmitted. The transceiver detects the transmitted signals from all the portable units within its range of detection. This range is nominally the room in which the particular computer is located at around 20 feet. This detection is amplified and waveshaped by waveshaping and amplifier 74 and the receiver circuitry decodes or demodulates the signals into data and transfers the data to the CPU of the PC. The data is then distributed over the network to the server 26 and thus to all the other computers.

Fig. 2 shows the transceiver 32 connected to one of the I/O ports of a desktop computer 20. The portable units are shown as a badge 30 worn or carried by a person 22 or a tag attached to an object in a briefcase 18. The portable unit periodically transmits its identification information on its own accord to be picked up by any remote computer's transceiver.

The desktop computer is installed with a locator program that runs as a background task as part of the computer system's operational program. Typical installation of the locator program of this type is through a floppy disk drive located on the front of the computer or downloaded from the server. The program normally runs in the background of any other task or program concurrently running. This allows the computer to interface with the transceiver on a constant real time basis while the user is operating the computer for other purposes, e.g., spreadsheets, word processor, etc. Preferably, the locator program monitors a signal or a flag from the

transceiver signalling the reception of a transmission. Alternatively, the locator program may periodically, for example, every 2 seconds, poll the transceiver as to whether or not there exists transmitted signals detected from a portable unit.

5 Upon receiving updated information from the transceiver, the remote computer relays the updated information to the server 26 via the network 24. The server 26 (Fig. 3) then determines the location of the portable unit by identifying the ID of the portable unit and the particular remote computer which relayed the ID information. The server then updates the database in its memory 56, maintaining the location of all identified portable units that have been identified within the network. The system  
10 according to the invention is ideally suited in a facility having networked computers which are spatially dispersed in each office and throughout the facility. The remote computer 20 or 62 has the transceiver 32 connected to its I/O 44 or 68, or preferably, as part of the I/O interface module 52 of computer system 50. The server 26 communicates with the network by the server CPU 58 executing its interface software  
15 to transmit and receive information through the I/O interface 60.

A user of the system according to the present invention may access the locator system from any networked computer. Here the user requests information concerning the location of any of the portable units by entering a preassigned "locator" command, such as PF10, and the "tag number", ID number, or the person's name. The locator  
20 program of the networked computer sends a request to the server to search its database for that particular tag number or name previously assigned to a number. The server will either return to the networked computer a "not found" response, or a response as to where the portable unit or associated person was last identified. A typical computer display is shown in Fig. 4 where the request can be in the form of  
25 the tag ID number of a portable unit or the actual name of the person or object that is associated with a particular portable unit. The remote network computer will

associate the actual name with its tag ID number and send only the tag number to the server. This gives the user the ability to locate a fellow worker from any networked computer in the facility without having to go to any particular computer to request information nor does he need to know the fellow worker's ID tag number.

5           In an enhanced embodiment, a computer at the receptionist's station of the facility has a transceiver connected to it. This gives the system the ability to track all personnel going in and out of the facility. Since not all personnel at a facility have their own personal telephone line (for example, nurses at a hospital, or engineers sharing lines), this is an improvement and advantage to leaving voice mail recordings.  
10 This eliminates the requirement for persons to phone another person only to determine that the person is on vacation or gone for the day. The inquiring person need only to request a networked computer to locate a person, such as "Jim" in Fig. 4. This also eliminates the need for the arriving or departing person to always remember to update his or her message, or constantly tell the secretary where he or she will be.

15           As a further embodiment to the present invention, a remote computer may be tied into various electrical systems in the facility as shown in Fig. 3. For example, the environmental system 70, i.e. lights and temperature controls of a particular area, are automatically controlled by the identification of certain ID tags. This is further shown in the exemplary computer display of Fig. 5. In this particular example, the  
20 user is requesting automatic control of the lights in the local area around the computer that is being accessed. The computer has been instructed that anytime an ID tag with a "3" as the first digit is detected and identified within the local area, the lights in that area are to turn on. The lights will remain on for as long as that ID tag is detected. The lights will remain on for a specified delay time before turning off after the ID tag  
25 is no longer detected. This prevents the lights from flashing on and off every time an identified person in and out of the specified area.

Another automatic control is to the HVAC environmental control system. Continuing the above example of Fig. 5, the wearer of a badge or portable unit enters the designated local area, and is then detected and identified by the transceiver. Fifteen minutes later the computer sends a request to the HVAC to adjust the thermostat controls to raise the local area's temperature to 72 degrees. Once the computer fails to detect a portable unit with an identification tag of "3xx" for 20 minutes, it will send a request to the HVAC system to lower the temperature to 68 degrees. As with the lights, the 15 and 20 minute delays are to allow persons to enter and leave the designated local area without constant requests being sent to the HVAC system.

The ID tag number that is input into the system for detection and identification can be any subset of the total set of ID numbers. This allows the user to control the environmental system to any group of users. For example, the computer in a private office will only respond by adjusting the lights or temperature when the occupant of that office enters wearing his badge.

Another example is the use of the location information retrieved from a computer in a conference room. The computer, through the transceiver, detects and identifies all the occupants in the conference room. A user may retrieve the occupant information by entering another preassigned command. The computer may then further alert the user to any unauthorized occupant in the room, i.e. someone wearing a badge that has an identification number not within a specified range. The software in the computer is configured to monitor any level or levels of identification tags within its database. Different levels, i.e. different persons, are grouped together in different ways. These groups may be, for example, persons with a particular government security clearance to board of director members. The user pre-determines the persons, i.e. the tag numbers, in a particular group and assigns a

mnemonic to that group.

In an alternate embodiment to the present invention, Fig. 3 shows the transceiver circuitry added to the circuitry on the local area network interface printed circuit board card (I/O - Transceiver 52). The network interface card is installed into the computer system 50, and the locator system is thus installed in conjunction. As with the transceiver 32 external to the computer 20, the wireless communication between the transceiver and the portable unit is preferably via infrared signals, but can use RF or other communication means known to one skilled in the art. In order to enhance the line of sight between the portable unit and the transceiver, the LED detector 54 is placed on the edge of the I/O - Transceiver card adjacent to the serial connector. The LED is therefore physically outside of the computer unit.

The locator system may also be used with the individual computer units for performing custom automatic tasks. For example, the computer may automatically log-on to the LAN upon detecting a valid ID within a pre-specified time period, for example, a first detection within a four hour period.

Other logical functions incorporating the locator system may also be custom programmed into individual computers; a logical function is a decision tree which triggers an action upon detection of one or more criterias. For example, upon detection of three different IDs in a room, the thermostat is lowered by the computer to 65°F.

Fig. 6 shows a networked remote computer 20 and a portable unit 30. The computer's transceiver 32 communicates with the portable unit's transponder 86 by way of either an RF antenna or photo emitter 88. This depends on the type of wireless communication used. Preferably the communication is infrared and the infrared photo emitter is used. The portable unit also contains memory 80 for its own database and operational parameters, a CPU 82 to execute programs for operating the

unit; and an I/O interface 84 to communicate with the remote computers.

Although the subject invention has been described with respect to preferred embodiments, it will be readily apparent to those having ordinary skill in the art to which it appertains that changes and modifications may be made thereto without departing from the spirit or scope of the subject invention as defined by the appended claims.

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**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE  
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

1. An object location system comprising:  
5 at least one portable unit coupled to a respective object to be located including wireless transmission means for transmitting information including a unique identification signal; and  
a plurality of remote computers disposed at spaced apart areas, each of said remote computers includes transceiver means for receiving said information  
10 from said at least one portable unit and means for processing said information, said transceiver means comprising an interface card installed in each of said plurality of remote computers and including a sensor and receiver circuitry, said plurality of remote computers being interconnected in a local area network (LAN), each of said remote computers having a respective display, keyboard, memory and interface and  
15 control circuitry for operating as a desktop computer, and any one of said remote computers having means for determining the location of said portable unit from said information received from said portable unit.
2. The system according to claim 1 wherein said transceiver means  
20 includes a sensor and receiver circuitry, said sensor being housed in a portable housing for placement proximal to said respective remote computer.
3. The system according to claim 2 wherein said receiver circuitry is  
25 installed in an interface card which is installed in each of said plurality of remote computers.
4. The system according to claim 3 wherein said interface card is a  
soundcard.
- 30 5. The system according to claim 3 wherein said interface card is a network card.

6. The system according to claim 1 wherein said information received by said transceiver means is forwarded via said LAN to another of said plurality of remote computers.

5 7. The system according to claim 1 wherein said one of said computers automatically logs-on to the LAN upon detection of a preassigned ID number.

8. The system according to claim 1 wherein said wireless transmission means of said portable unit includes infrared LEDs.

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9. The system according to claim 1 wherein said means for determining location includes a database for storing location information and further includes means for updating said location information.

15

10. The system according to claim 1 wherein said computer includes means for controlling external environmental systems upon detection of a specified condition by said transceiver means.

11. An object location system comprising:  
20 a plurality of portable units, each being attached to an object to be located and each having a transmitter for wireless communication;  
a plurality of personal computers disposed throughout a facility, said computers being interconnected to one another via a local area network (LAN), each of said computers having a respective sensor and a respective transceiver electrically  
25 connected thereto and disposed proximally therewith for receiving information transmitted from said plurality of portable units, said respective sensor and said respective transceiver being controlled and powered by a respective one of said computers;

30 wherein any one of said interconnected personal computers acts as a controller for the network and determines the locations of said objects.

12. The system according to claim 11 wherein said controller further

comprises a memory for storing and maintaining identification and location information corresponding to respective portable units and said stored information is accessible by any of said plurality of personal computers through said LAN.

5           13.    The system according to claim 11 wherein said sensor is housed in a portable housing for placement proximal to said respective personal computer and said receiver circuitry is installed in an interface card in said respective personal computer.

10           14.    The system according to claim 11 wherein said transmitter includes means for infrared transmission.

            15.    The system according to claim 11 wherein said wireless communication of said transmitter includes infrared LEDs.

15

            16.    A method of locating objects comprising the steps of:  
                  transmitting from a portable unit attached to an object a unique identification signal;

                  receiving said unique identification signal by a receiver in one of a  
20    plurality of personal computers networked in a LAN, said receiver comprising an interface card having a sensor for receiving signals transmitted from said portable unit and disposed within said computer;

                  relaying said unique identification signal to another of said personal computers controlling said LAN;

25             processing said unique identification signal at said another computer to determine the location of said portable unit;

                  maintaining the location information in said another computer; and

                  requesting from any one of said plurality of personal computers said location information and displaying said location information at said requesting  
30    computer.

            17.    The method according to claim 16 further including the steps of:

activating a plurality of computer controlled tasks at said one computer upon detection of said unique identification signal at said one computer.

5 18. The method according to claim 17 wherein the step of activating a plurality of computer controlled tasks included logging-in to said LAN.

19. The method according to claim 17 wherein the step of activating a plurality of computer controlled tasks includes controlling external environmental systems.

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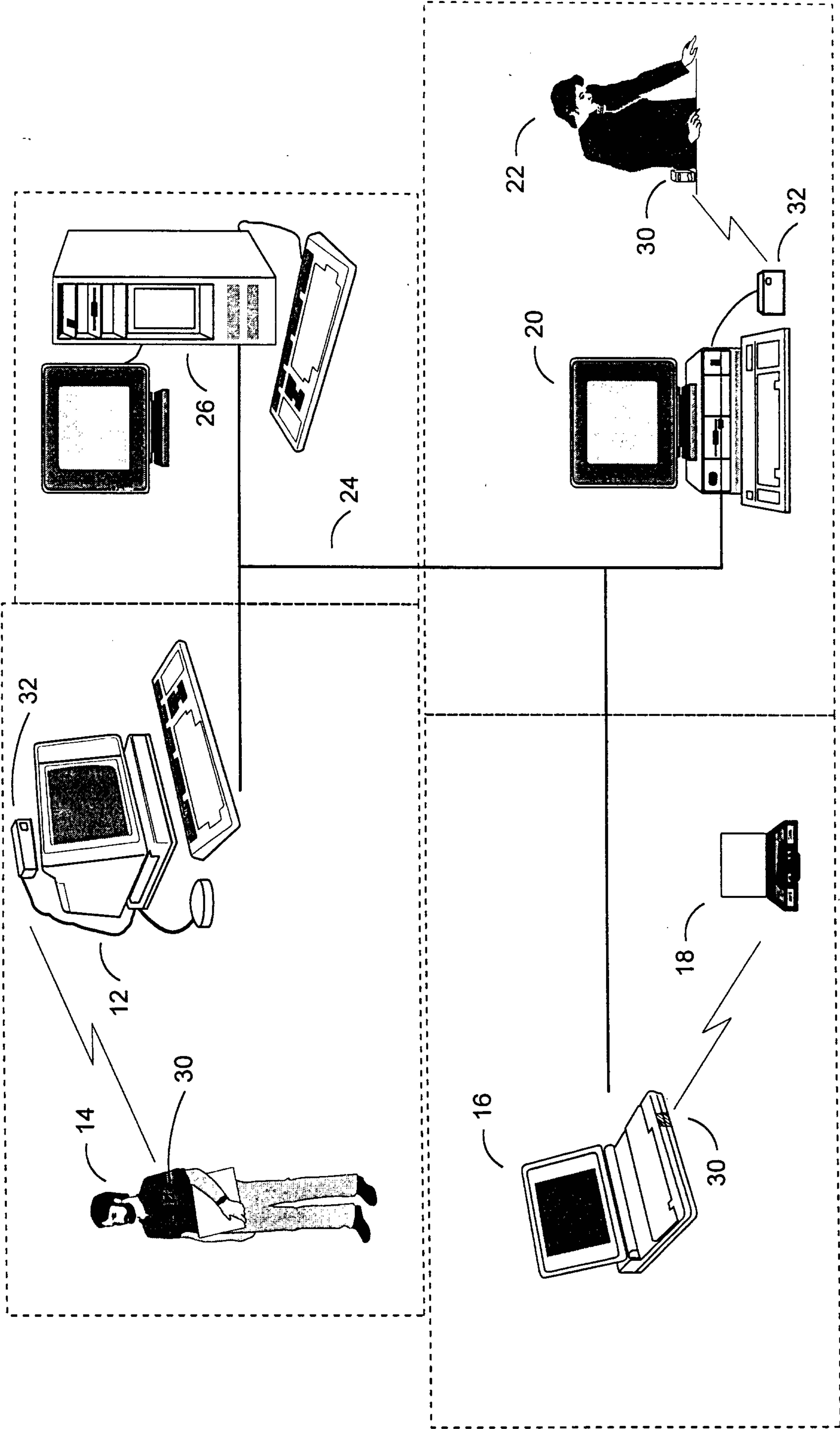


Fig. 1

*Sim. J. M. Sweeney*



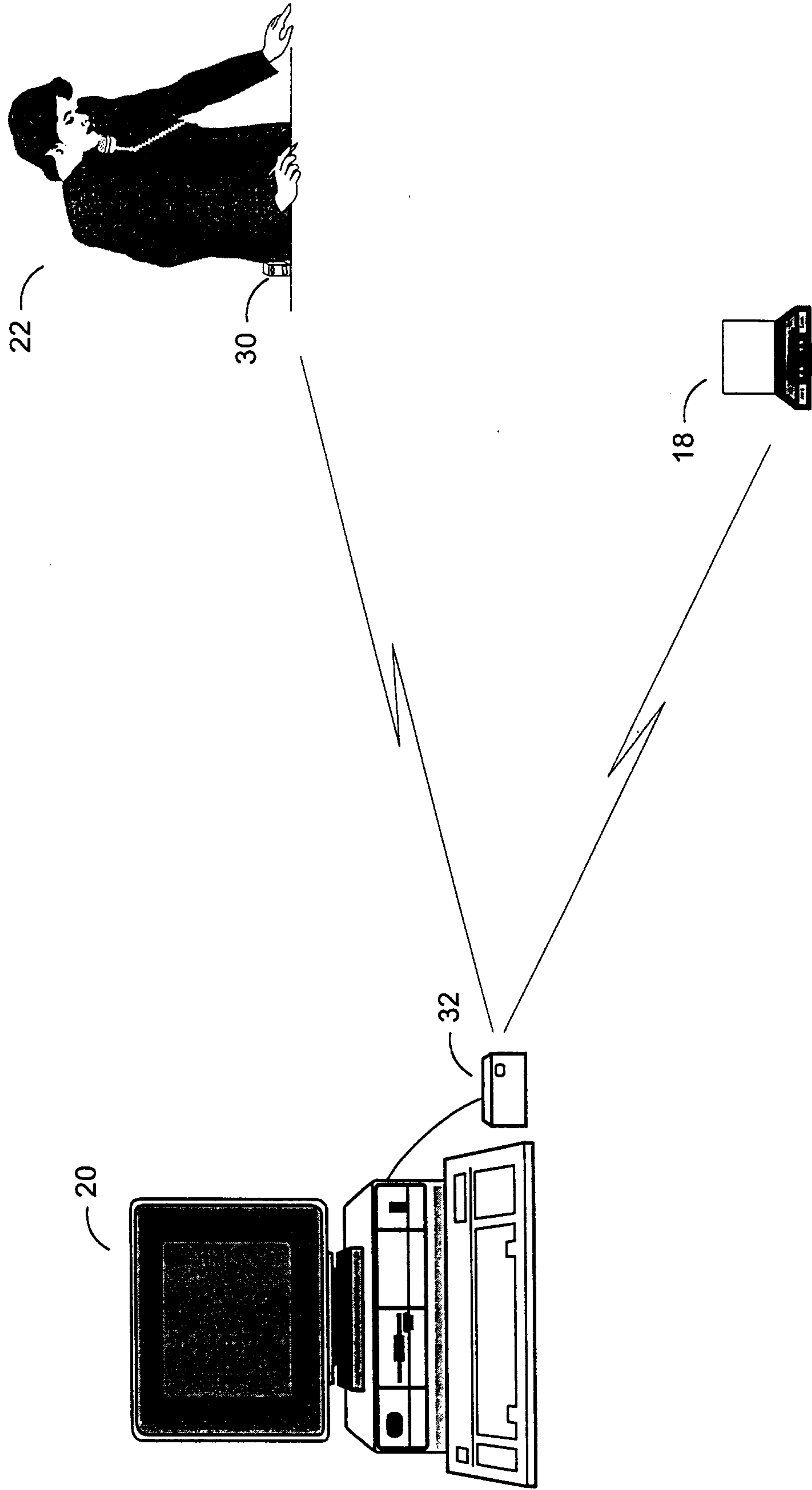
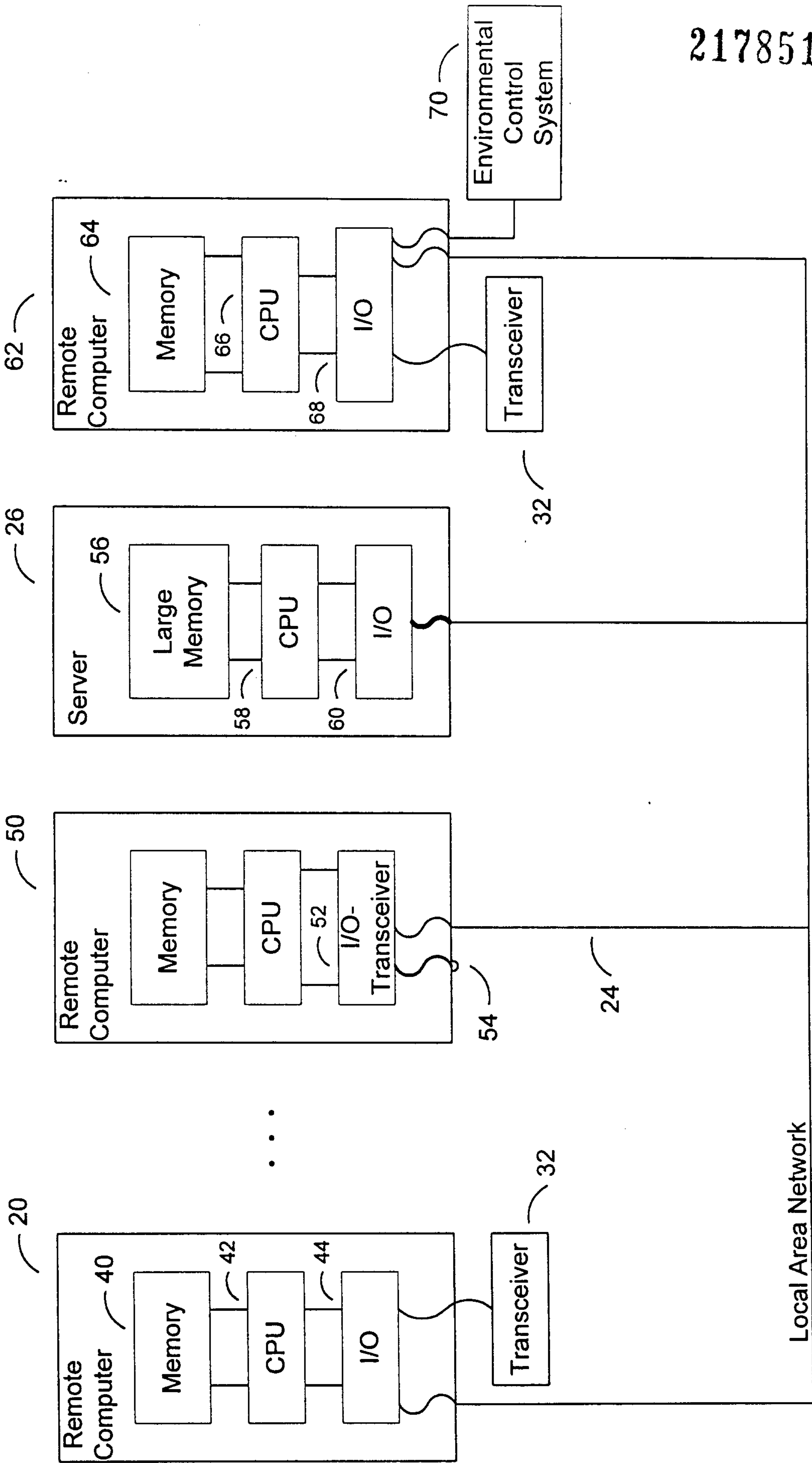


Fig. 2

*Sam J. McBurney*



*Simon M. Lunn*

Fig. 3

Locate ? Tag #324  
Found at: "Dave's computer"

Locate ? Year-End Report  
Found at: "Not Found"

Locate ? Jill  
Found at: "Pete's Office, Rm 312"

Locate ? Jim  
Found at: "Out of Facility"



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*Sam H. Bennett*

Fig. 4

Locate ? Tag #324  
Found at: "Dave's computer"

Locate ? Year-End Report  
Found at: "Not Found"

Set lights ON for:  
Local  
Tag #: 3xx  
Delay: 15 minutes

Set thermostat:  
Local  
Tag #: 3xx  
Delay ON: 15 min.  
Delay OFF: 20 min.  
Temperature ON: 72 deg.  
Temperature OFF: 68 deg.

Locate? Jill  
Found at: "Pete's Office"



2178518 *Sam H. Bennett*

Fig. 5

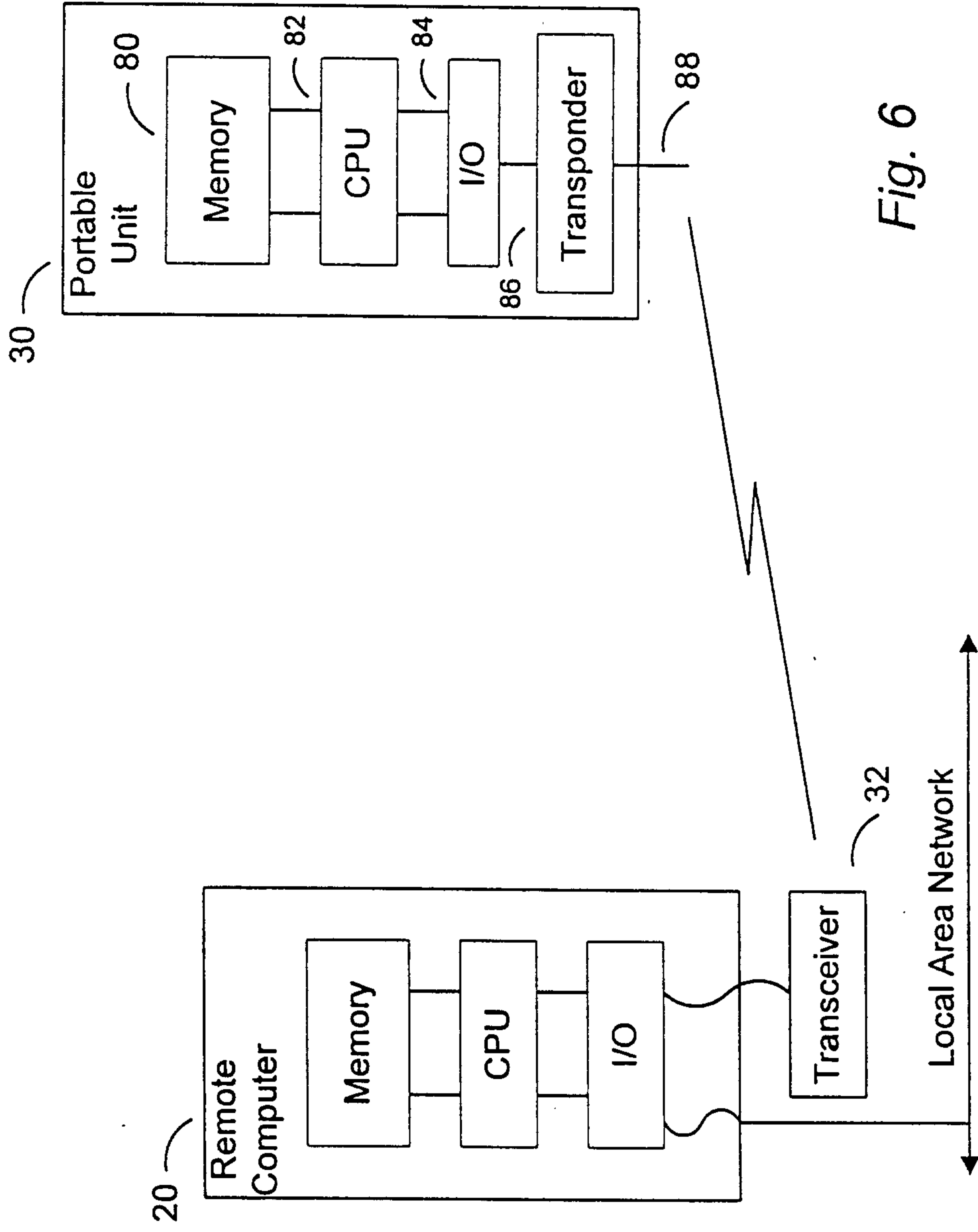


Fig. 6

*Seen by Mr. [Signature]*

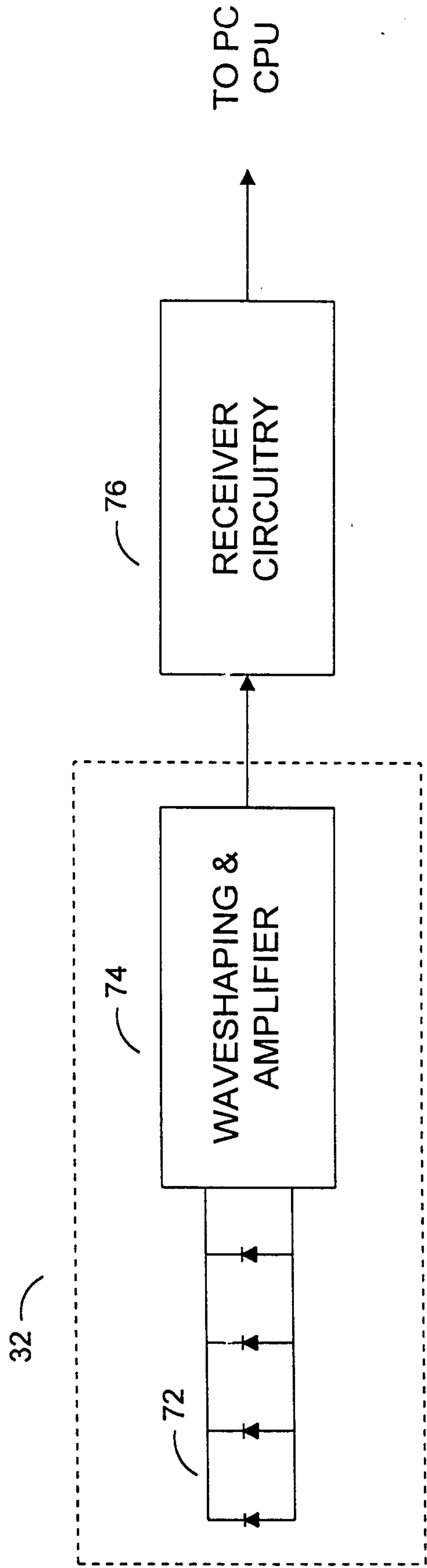


Fig. 7

*Seen by M. Burnham*

