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(54) **MULTIFUNCTION DATA PORT PROVIDING AN INTERFACE BETWEEN A DIGITAL NETWORK AND ELECTRONICS IN RESIDENTIAL OR COMMERCIAL STRUCTURES**

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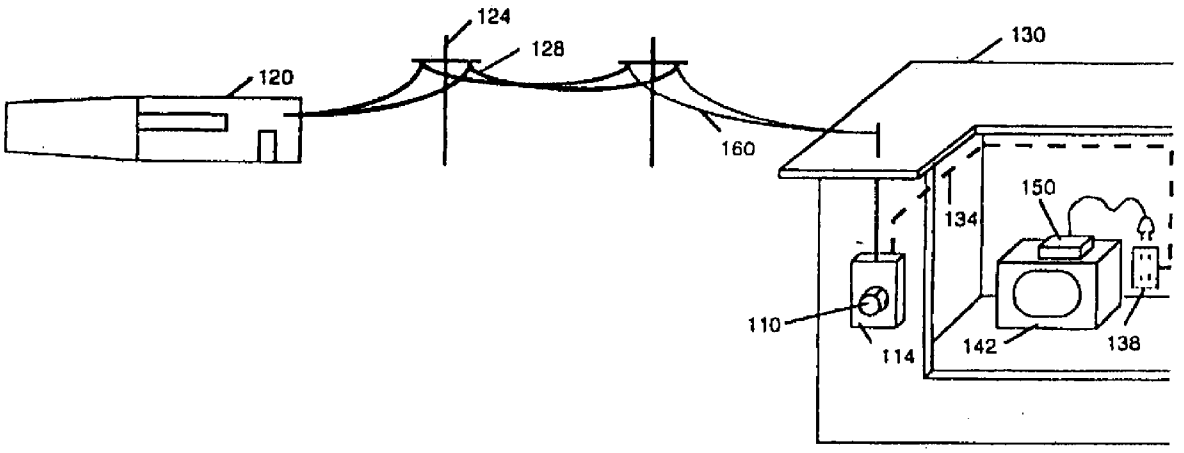
(57) **ABSTRACT**

A multifunction data port is located in or attached to the utility meter or the meter box. The installation or removal of the data port requires opening the meter seal. The data port interface can provide broad band access to a digital network and the Internet. It can provide the utility customer with a secure computer terminal for commerce and telecommunications. It can provide the electric utility load management and time of use metering of electrical power.



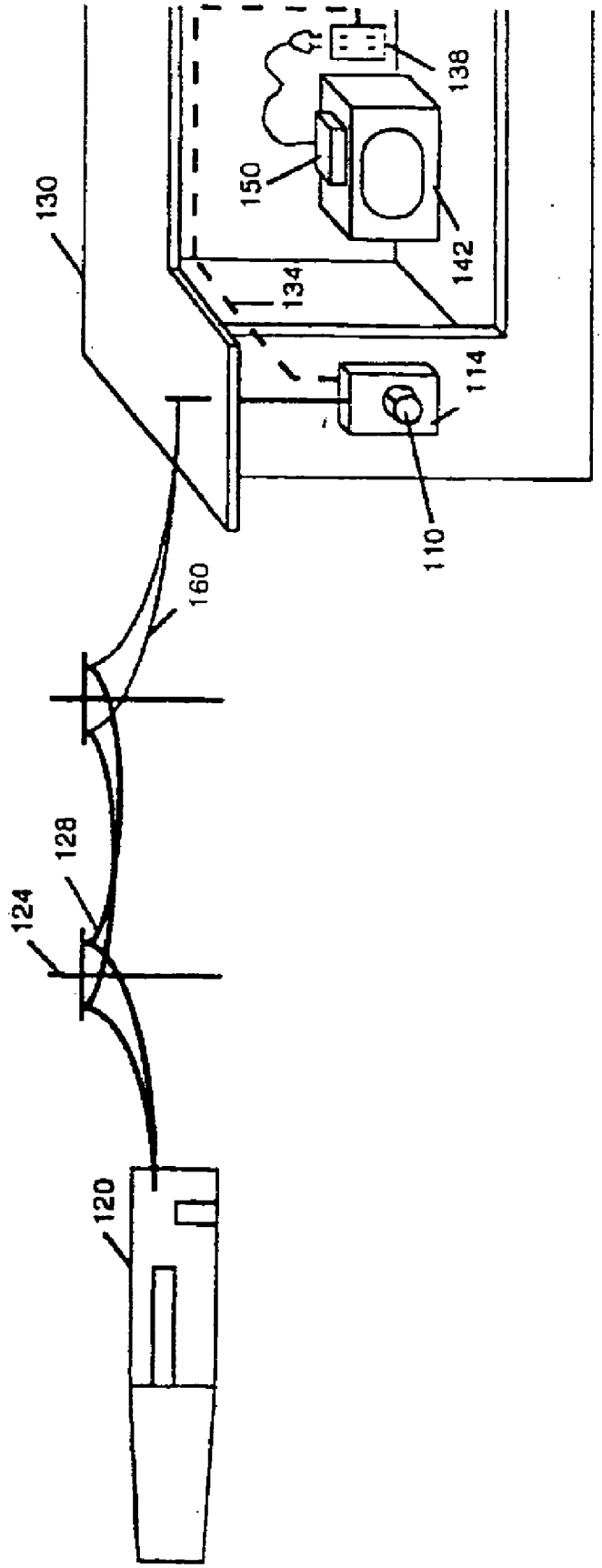


Figure 1

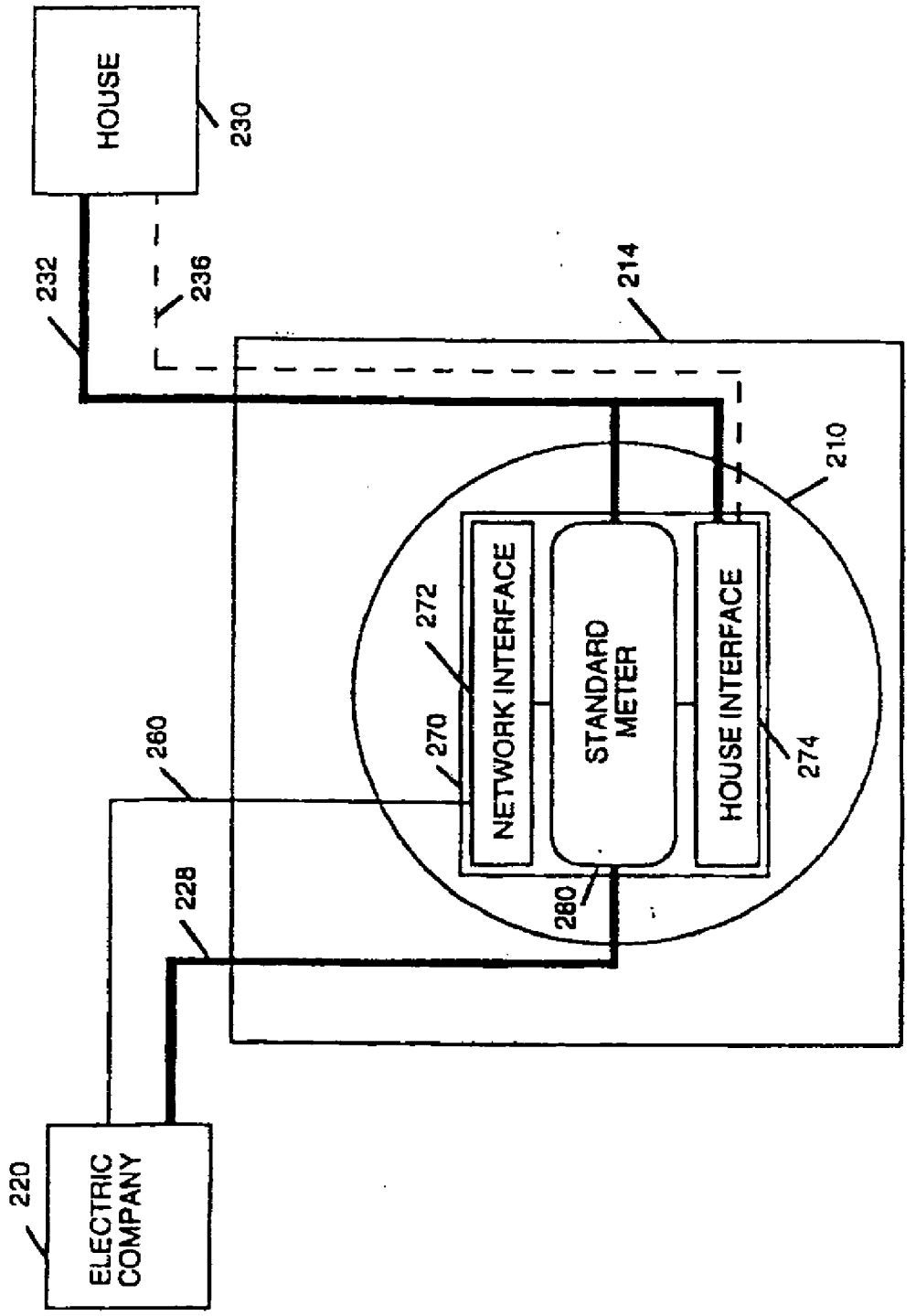

HOUSE
230
232
236
214
210
NETWORK INTERFACE
272
270
STANDARD METER
HOUSE INTERFACE
274
280
260
228
ELECTRIC COMPANY
220

Figure 2

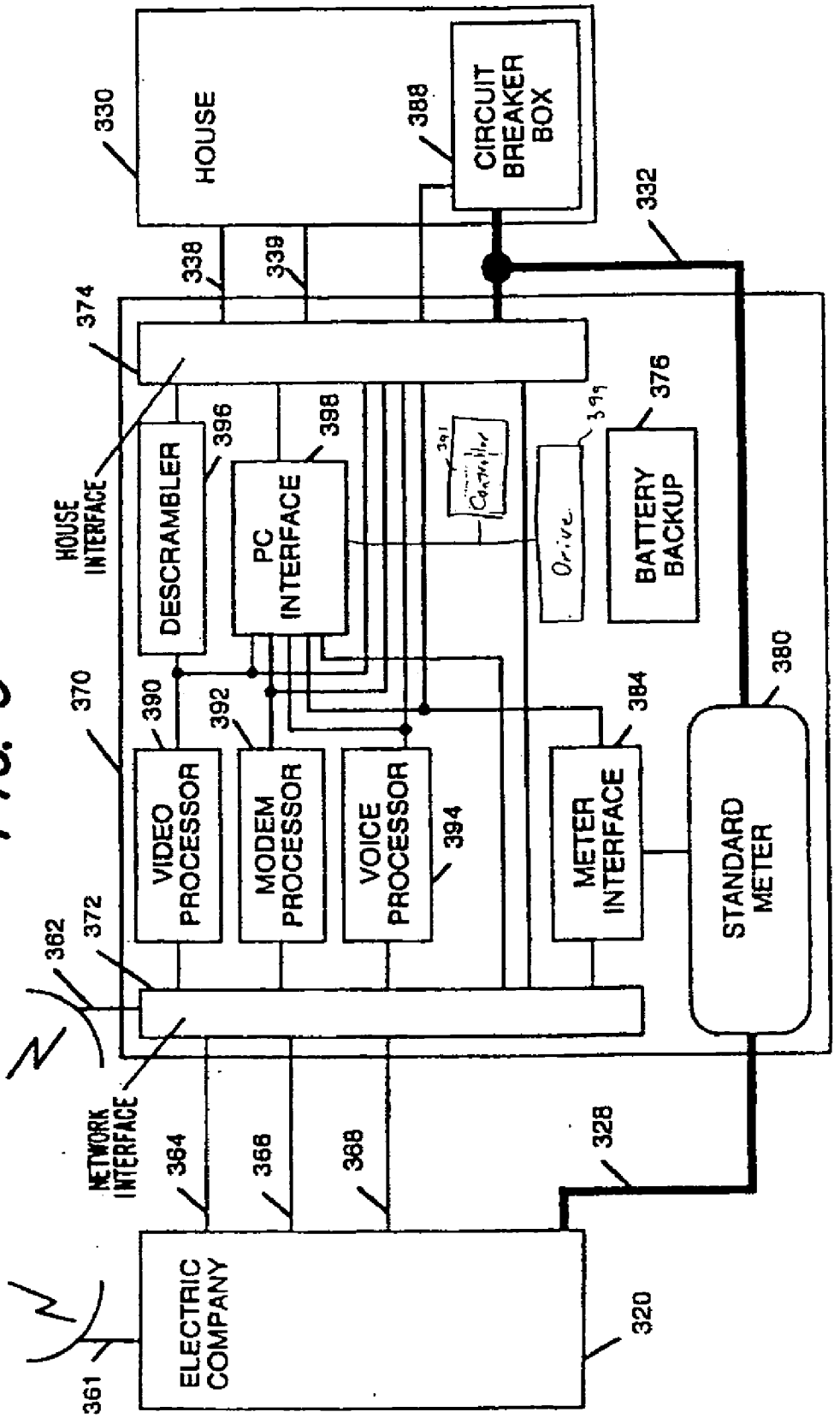

HOUSE
330
CIRCUIT BREAKER BOX
388
332
338
339
374
HOUSE INTERFACE
DESCRAMBLER
396
PC INTERFACE
398
391
399
376
BATTERY BACKUP
370
390
392
384
380
VIDEO PROCESSOR
MODEM PROCESSOR
VOICE PROCESSOR
394
METER INTERFACE
STANDARD METER
362
372
NETWORK INTERFACE
364
366
368
328
ELECTRIC COMPANY
361
320

FIG. 3

FIG. 4o

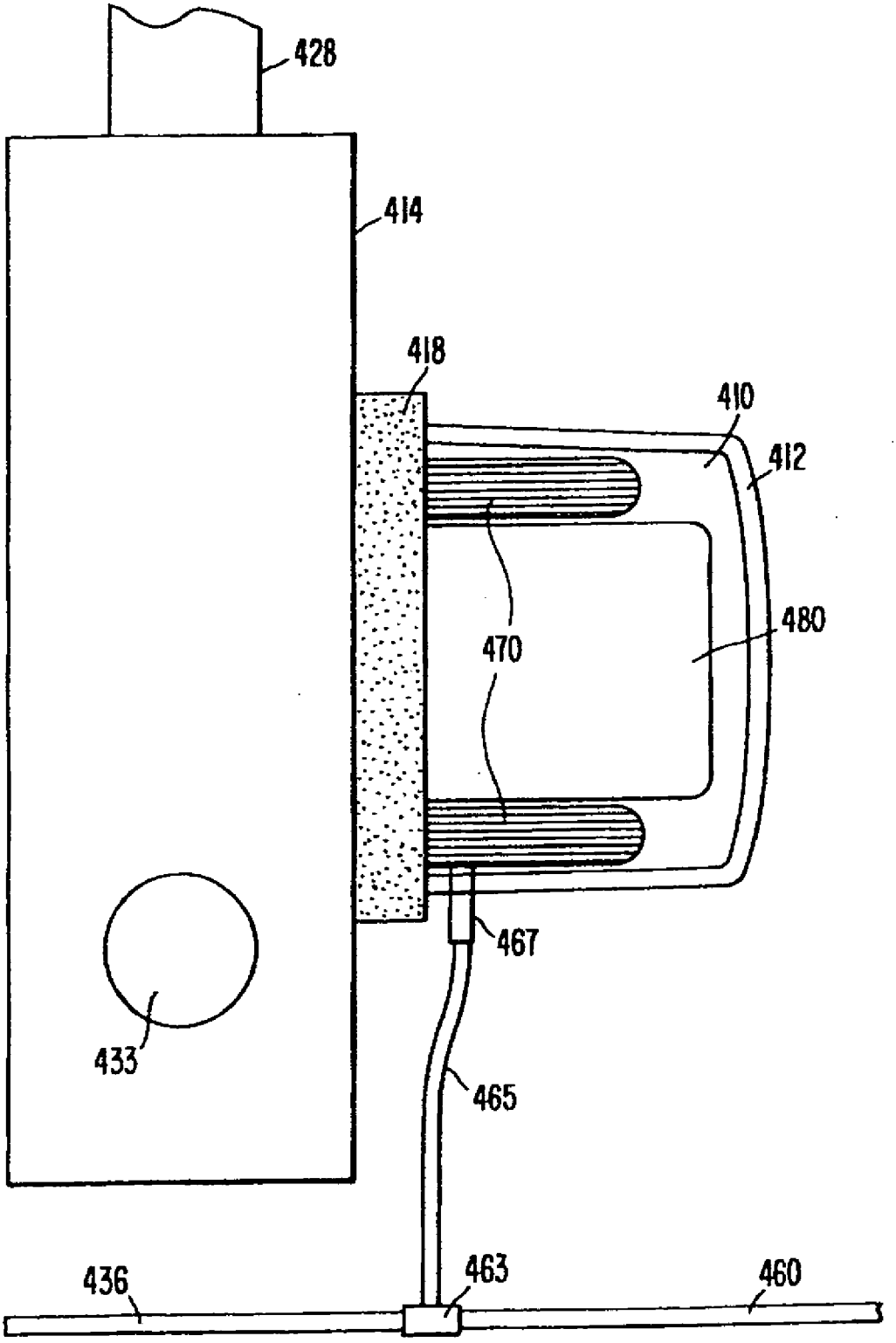


FIG. 4b

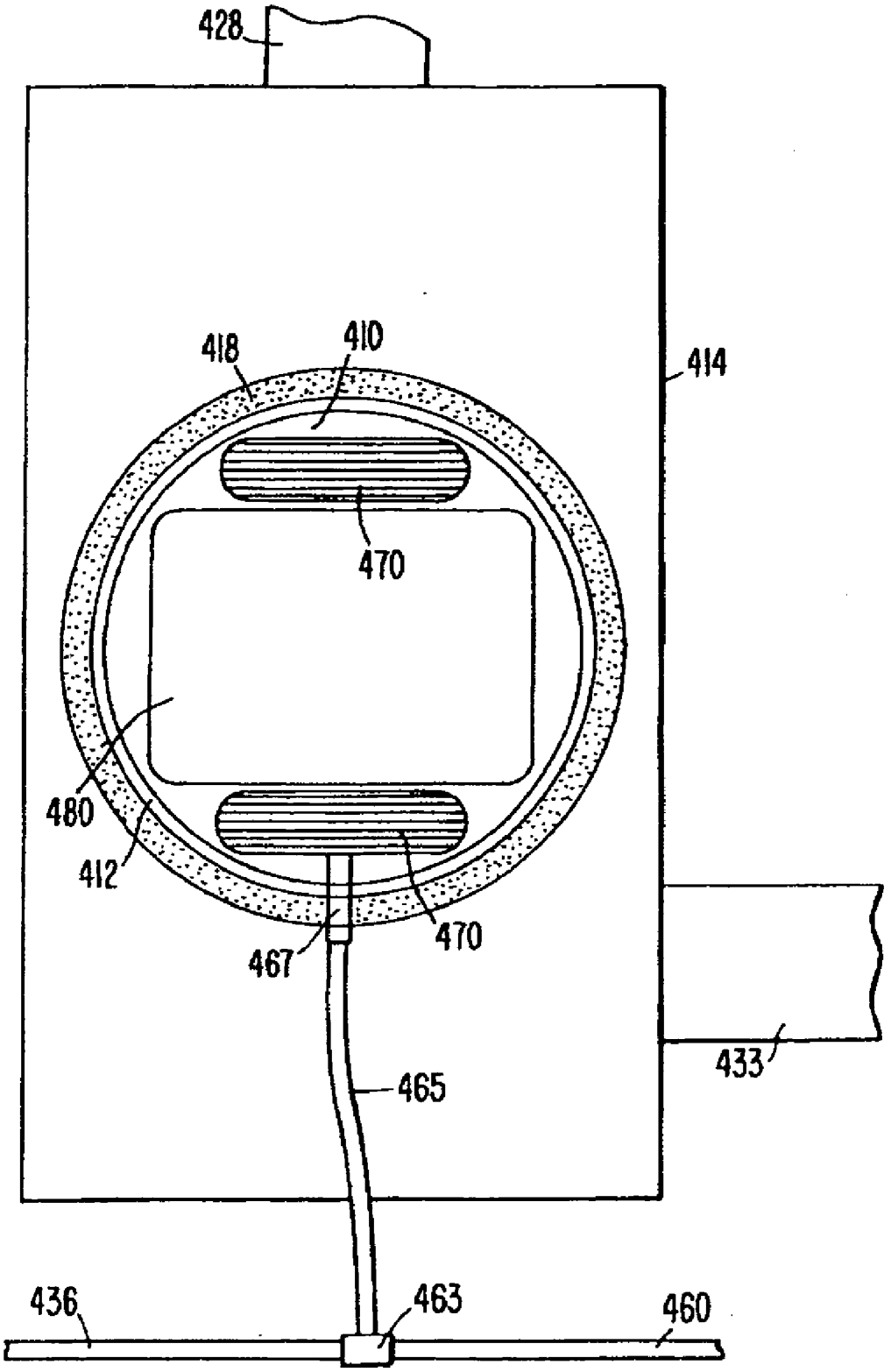


Fig. 5a

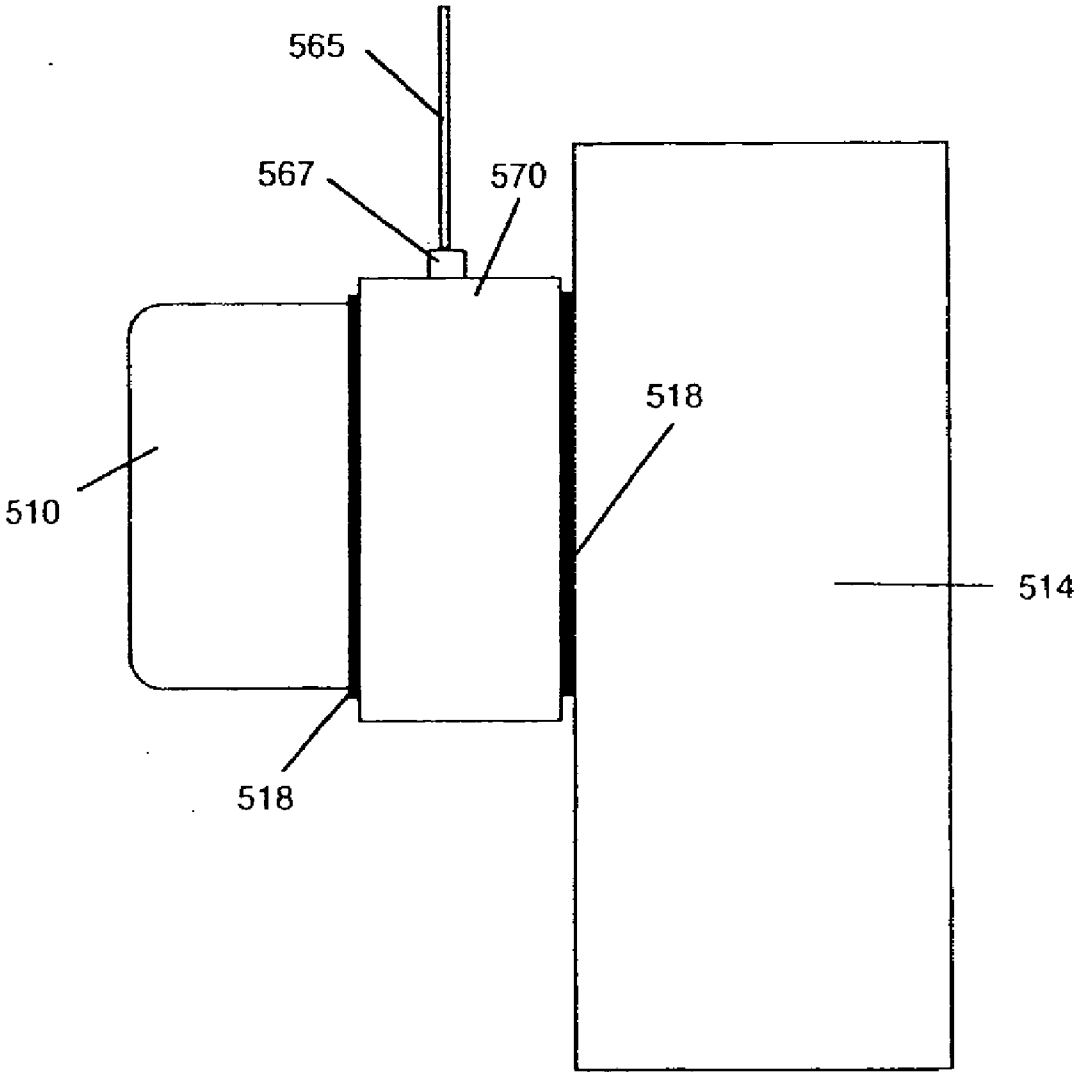


Fig. 5b

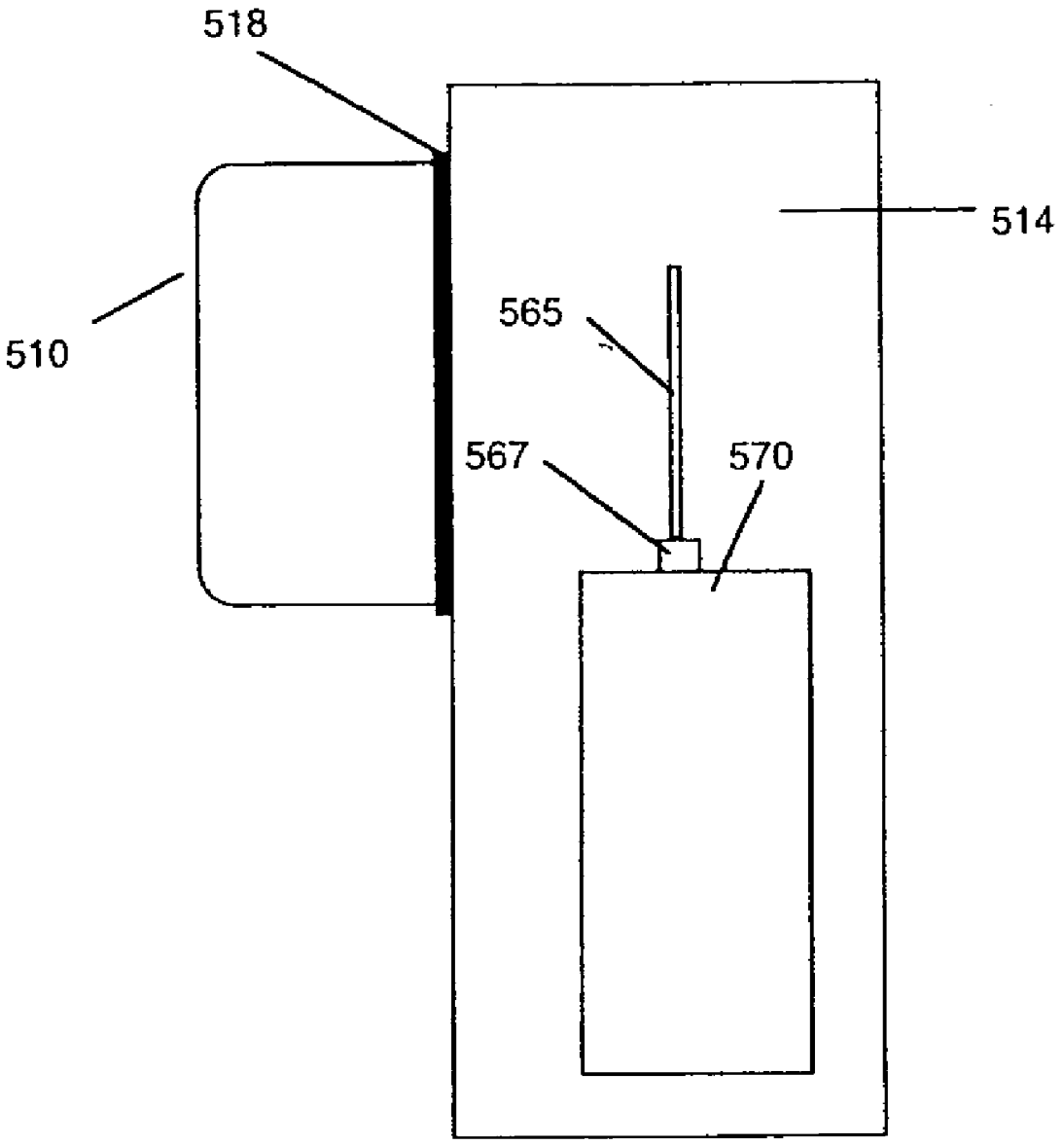


Fig. 5c

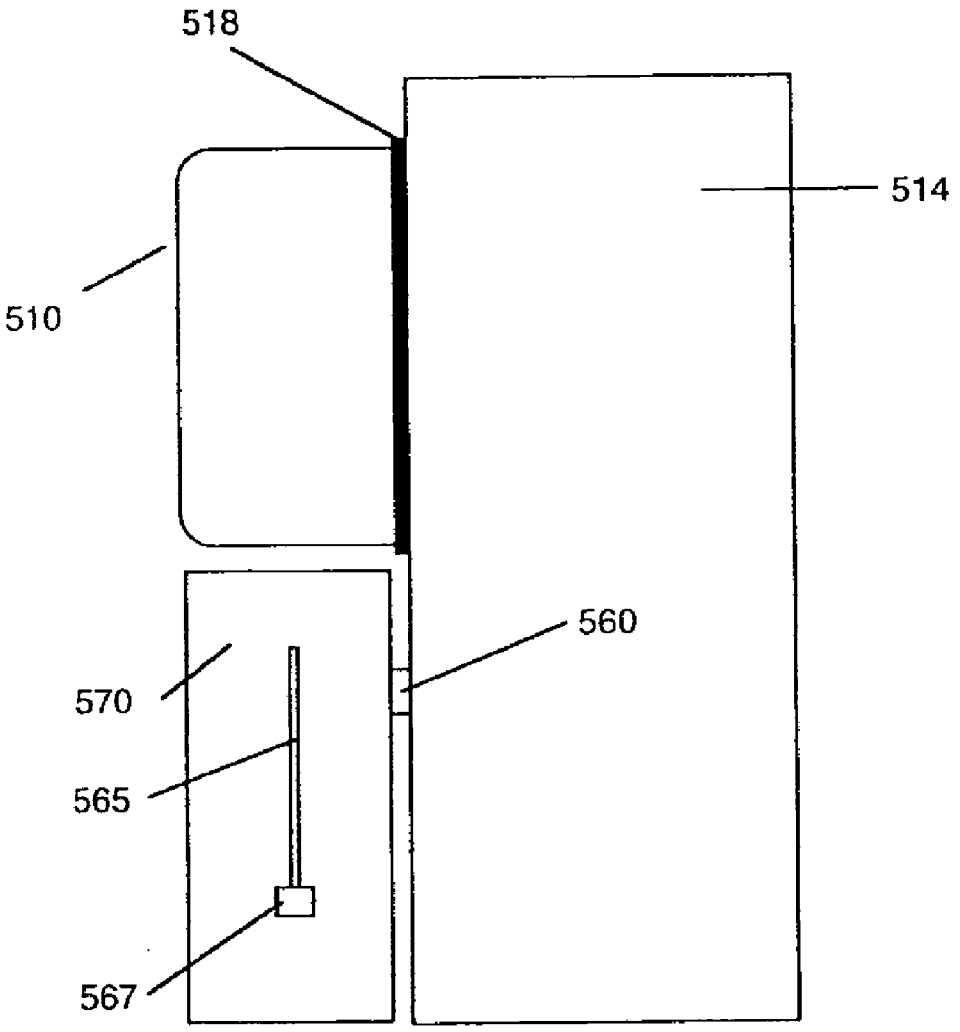


Fig. 5d

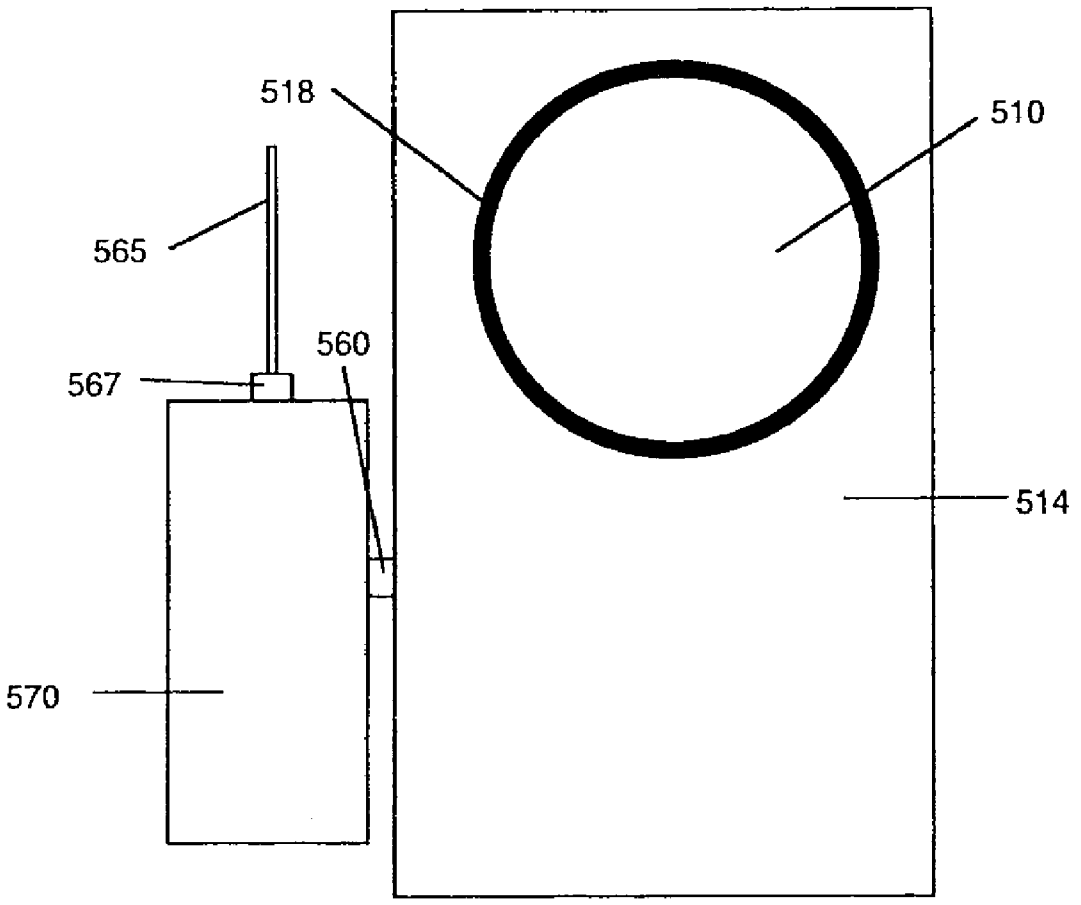


Fig. 5e

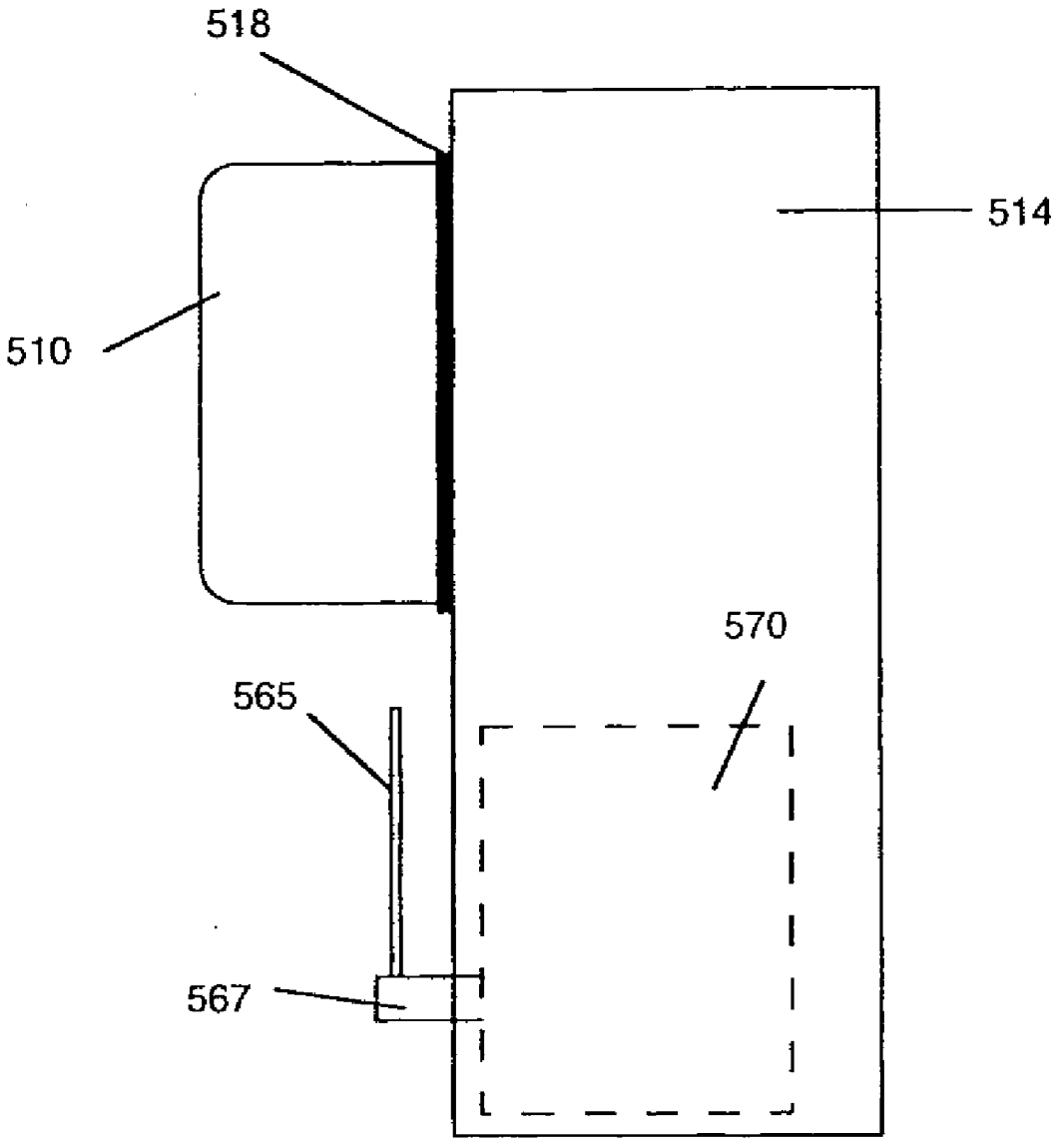


Figure 6

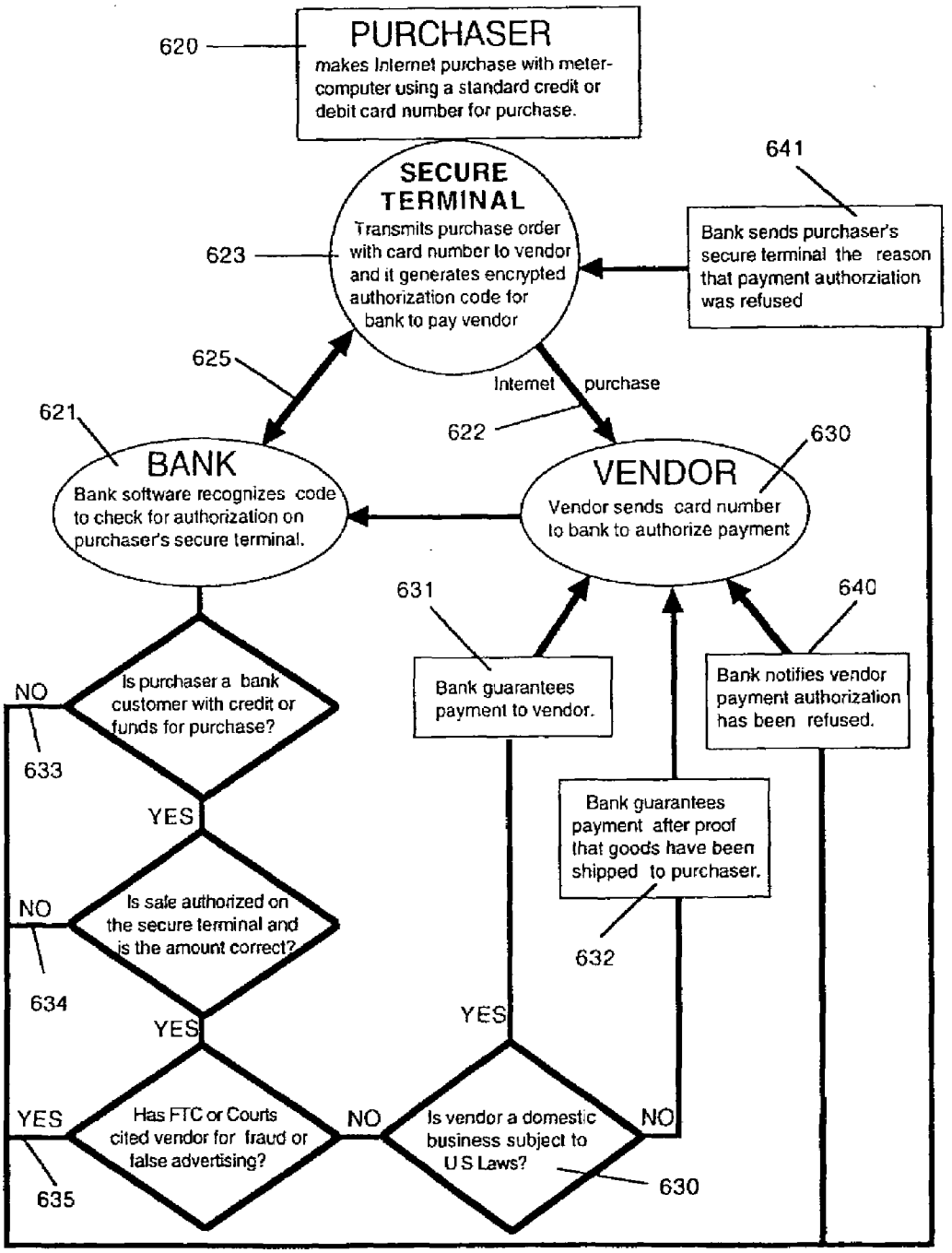
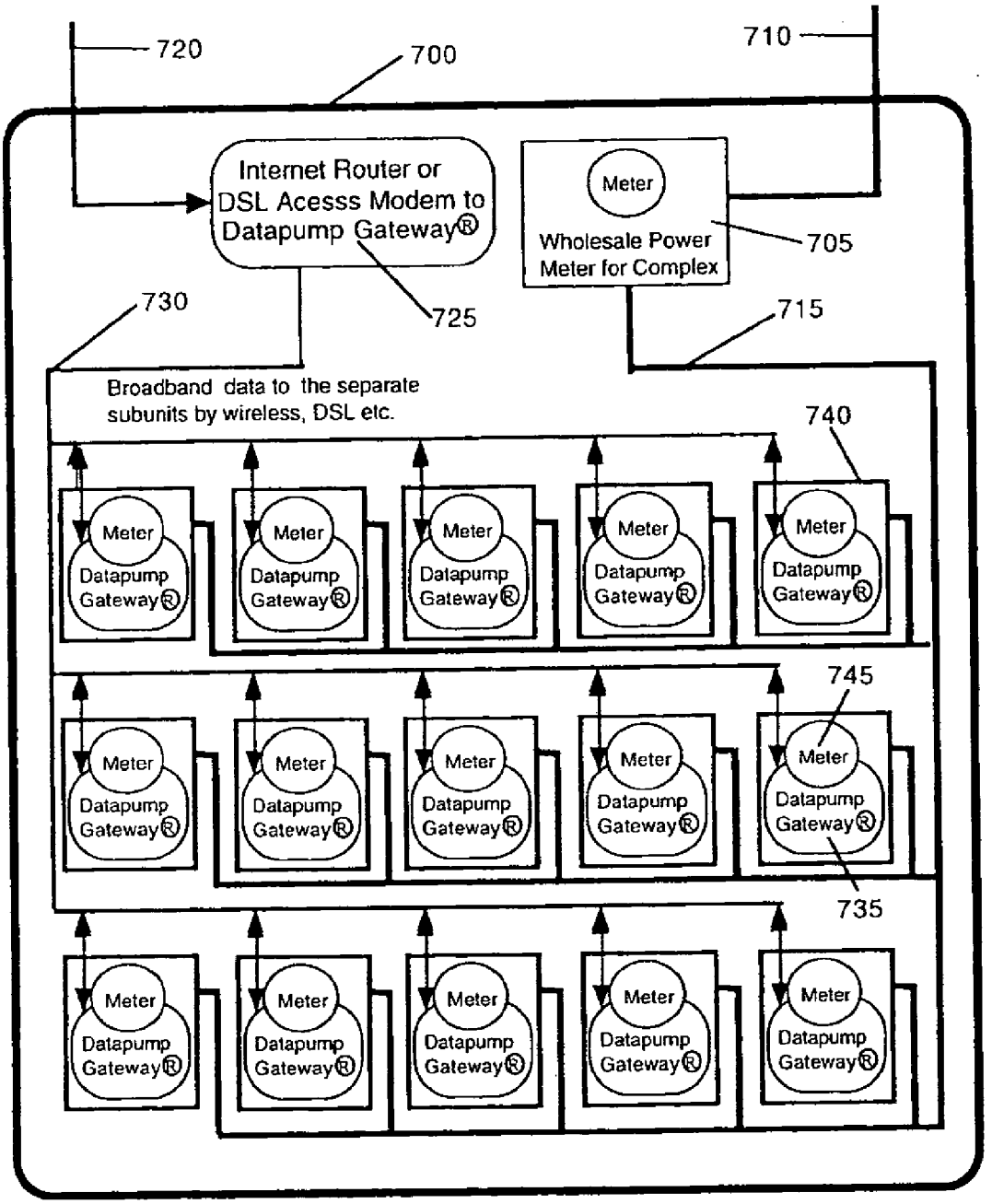

620
PURCHASER
makes Internet purchase with meter-computer using a standard credit or debit card number for purchase.
641
SECURE TERMINAL
Transmits purchase order with card number to vendor and it generates encrypted authorization code for bank to pay vendor
623
Bank sends purchaser's secure terminal the reason that payment authorziation was refused
625
Internet purchase
622
621
BANK
Bank software recognizes code to check for authorization on purchaser's secure terminal.
630
VENDOR
Vendor sends card number to bank to authorize payment
631
640
Bank guarantees payment to vendor.
Bank notifies vendor payment authorization has been refused.
NO
Is purchaser a bank customer with credit or funds for purchase?
633
YES
Bank guarantees payment after proof that goods have been shipped to purchaser.
632
NO
Is sale authorized on the secure terminal and is the amount correct?
634
YES
YES
Has FTC or Courts cited vendor for fraud or false advertising?
NO
Is vendor a domestic business subject to U S Laws?
NO
YES
635
630

Figure 7



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Controller for Internal Applicances

MULTIFUNCTION DATA PORT PROVIDING AN INTERFACE BETWEEN A DIGITAL NETWORK AND ELECTRONICS IN RESIDENTIAL OR COMMERCIAL STRUCTURES

RELATED APPLICATIONS

[0001] The present application for a U.S. patent is a continuation of U.S. patent application Ser. No. 09/667,408, filed Sep. 21, 2000, which is a continuation-in-part of now abandoned U.S. national phase patent application Ser. No. 09/508,998, filed Jun. 15, 2000, based on international application number PCT/US1997/016426, filed Sep. 17, 1997, from which priority is claimed; and claims priority from U.S. provisional patent application Ser. No. 60/155,069, filed Sep. 21, 1999. The present application incorporates by reference the foregoing patents and applications.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The invention is related to a data port and, more particularly, to a multifunction intelligent data port having a computer interface between a digital service network and a utility user's home electronics. The invention further relates to remote utility meter reading and remote load management, as well as telecommunications, Internet access and methods to provide secure digital transactions.

[0004] 2. Related Art

[0005] A customer of an electric company typically has an electric meter located at the customer's structure or site of distribution of electrical power. The customer's structure may be, for example, the customer's home or office. The electric meter is owned by the electric company and is installed in a meter box, which holds the electric meter. The meter box may be provided and owned by the building owner, the utility or the landlord.

[0006] The prior art includes a number of references that disclose utility meters with associated electronics.

[0007] U.S. Pat. No. 4,455,453 issued to Parasekvakos et al., incorporated herein by reference, discloses an apparatus for remote meter reading, wherein a remote unit, preferably located inside a house, periodically initiates a telephone call to a utility company and communicates power usage information.

[0008] U.S. Pat. No. 4,803,632 issued to Frew et al., incorporated herein by reference, discloses a utility meter having a CPU, a display, and associated circuitry which may be located in the conventional meter location. Frew also discloses a remote unit located inside the house which displays the meter information and allows the customer to pay his bill by credit card. The remote unit communicates with the CPU over the house's power lines. The meter in Frew can be read by a meter reader either through the house's power lines or via optical coupling at the meter, but does not contain a multifunction data port with a voice and video interface, or other attendance electronics to provide broadband digital services with the utility and/or the Internet Service Provider (ISP) as taught by the subject invention. Similarly, Karlsson et al (U.S. Pat. No. 4,442,492) has disclosed a limited data port interface and computer than can read a meter an transmit this information back to the utility over the power lines. Karlsson can also receive a change in power rates from the utility and transmit both the cost and power use to a device in the user's household. Furthermore, Frew et al. (U.S. Pat. No. 4,803,632) has disclosed a device in the home that can read credit or debit cards and allows the customer to pay their power bill over the communication network. Combining Karlsson and Frew teaches a device or devices that include(s) a computer and two-way communication of utility use and billing data between the utility and its customer. The Frew and Karlsson devices have electronics primarily directed to meter reading and processing utility billing data. The purpose of the Frew patent, as stated, is "utility meter system having all of the functions and providing all of the information of interest to customers and to the utility company." The 16 digit alphanumeric display in the Frew patent is refreshed 1024 times/second. These very small data rates are orders of magnitude lower than the required rates for the multifunction data port of the present invention, and do not teach the very significant elements of the subject invention including the voice and video processor and other multiple interfaces to both the utility and the utility user's internal electronics and appliances. The specifications in the current patent application describe features in the multifunction data port that clearly distinguish it from a device like the combination of Karksson and Frew, or either such device.

[0009] The present invention distinguishes between the limited data rates and electronics needed for automatic meter reading and the broad band Internet communication rates specified for the multifunction data port. While one potential function of the multifunction data port in the present invention is receiving and communicating data from the utility meter, it is the other features of the invention that make it unique in the art. The multifunction data port in the present invention can analyze, store and report meter and load usage information as well as communicate with the utility user's internal electronics and appliances through voice and video interfaces. The current cost to an electric utility to read their meters on-site can be as low as $12-20 per year, while potential revenues from other features offered by the multifunction data port to the utility user can easily be over 100 times larger. The subject invention with its multiple interfaces differ in purpose, design, utility, novelty and data rates from other remote reading meters and devices such as Karlsson and Frew.

[0010] U.S. Pat. No. 4,804,957 issued to Selph et al, incorporated herein by reference, discloses a utility meter using a microprocessor-based circuit and Hall effect current sensors to measure power usage. In Selph, the meter may be read by either remote interrogation via a telephone link or serial communication. Selph also discloses a networked submetering arrangement useful in apartment buildings and the like.

[0011] U.S. Pat. No. 4,904,995 issued to Bonner et al., incorporated herein by reference, discloses a remote meter reading apparatus which is designed to retrofit existing electric meters with a transponder capable of communicating power usage information to the electric company over the electric power distribution system.

[0012] It is also known in the art to utilize a house's power lines for communication between a variety of devices.

[0013] U.S. Pat. No. 4,174,517 issued to Mandel, incorporated herein by reference, discloses a central system for controlling remote devices over a house's power line. A central control unit is plugged into a wall outlet for communicating over the power lines with remote units which are also plugged into wall outlets.

[0014] U.S. Pat. No. 4,200,862 issued to Campbell et al., incorporated herein by reference, discloses an appliance control system wherein a data transmitter communicates with slave units over a house's power lines by using digital address and operation signals. In Campbell, the data transmitter and various slave units are plugged into wall outlets.

[0015] U.S. Pat. No. 5,066,939 issued to Mansfield, Jr., incorporated herein by reference, discloses a circuit for communicating over a house's power lines in which extension telephones are connected to a conventional electrical wall outlet. A master station connector is plugged into a wall outlet and is also connected to the telephone line to facilitate full duplex communication between the extension telephones and the house's telephone line.

[0016] It is further known in the art to provide digital network services to a house. U.S. Pat. No. 4,332,980 issued to Reynolds et al., incorporated herein by reference, discloses a multiple service system which delivers a variety of services to a subscriber over telephone lines. The services disclosed in Reynolds include remote meter reading and load management. In Reynolds, a subscriber data subsystem is placed in the subscriber's house and communicates with peripheral devices over a subscriber data bus. The subscriber data bus is accessed via dedicated wiring and separate data service wall jacks.

[0017] U.S. Pat. No. 5,101,191 issued to MacFayden et al., incorporated herein by reference, discloses a house wiring arrangement for controlling the distribution of energy and communications within a house. MacFayden provides a gateway terminal as an interface for communicating outside the house over the public telephone network or power lines.

[0018] An article entitled "Country Road Warrior" and written by Todd Lappin, published in the August 1995 issue of WIRED on pages 46 and 50, incorporated herein by reference, discloses an electric company which provides digital network services to its customers using conventional communication technology over a coaxial cable network. The network was installed for remote meter reading and later adapted to deliver high-bandwidth data services.

[0019] None of the prior art discloses a utility meter or data port which provides an interface between a digital service network and home electronics.

[0020] In Parasekvakos, Frew, Selph, and Bonner, the electronics associated with the utility meter are directed primarily to meter reading functions.

[0021] In Mandell, Campbell, and Mansfield, communication over the power lines is directed primarily to communication with devices within the house. Also, in Mandell, Campbell, and Mansfield, a separate "master" unit must be located inside the house and plugged into a wall outlet.

[0022] In both Reynolds and MacFayden, a house must be wired with a special wiring configuration to accommodate the specific bus structures and communication methods disclosed. Reynolds and MacFayden also require some type of interface unit located inside the house. The network described by the Lappin article does not use a computer in the meter as an interface with the digital network, but rather requires installation of a special jack for connection to the network.

SUMMARY OF THE INVENTION

[0023] It is an object of the present invention to overcome the above and other disadvantages in the prior art. Specifically, it is an object of the invention to provide a data port with associated electronics to perform functions beyond meter reading, including functions such as providing an interface between a digital services network and home electronics.

[0024] It is an object of the invention to provide a digital service network interface which is not located inside the house and does not plug into a wall outlet.

[0025] It is an object of the invention to provide digital data services into a house without rewiring the house and without requiring special wiring.

[0026] It is an object of the invention to provide conventional meter capabilities in conjunction with associated electronics and broadband access to digital networks.

[0027] It is an object of the invention to provide a multifunction data port device in a secure sealed location where installation or removal requires breaking the utility's meter seal.

[0028] Yet another object of the invention is to provide a data port which provides a secure banking and Internet browsing capability.

[0029] The above and other objects of the invention are accomplished by a data port having a standard electric power meter and associated electronics within a meter enclosure and having a standard base suitable for mating with a standard meter box. The associated electronics include a computer having a network interface and a house interface.

[0030] The computer may include a video processor and/or descrambler for television services, a modem processor for data services, and a voice processor for telephone services. The computer may also include a meter interface for remote meter reading. The meter interface may be coupled to a circuit breaker box equipped with triacs or solid state switches for load management. The computer may further include a personal computer (PC) interface coupled to the other various processors and interfaces.

[0031] The network interface may be coupled to a digital service network, which communicates, for example, via satellite, wireless communication, fiber optic cables, coaxial cables, or twisted pair telephone lines. The house interface may be coupled to the house's internal wiring including the house's power lines, telephone lines and television coaxial cables. The house interface may communicate with home electronics via wireless communication through, for example, short range microwave signals such as those used by cordless telephones. The network interface may be directly coupled to the house interface and/or coupled through the various other processors and interfaces.

[0032] Additional objects and advantages of the invention will be set forth in the description, which follows, and in part will be obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentality and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate presently preferred exemplary embodiments of the invention, and, together with the general description given above and the detailed description of the preferred embodiments given below, serve to explain the principles of the invention.

[0034] FIG. **1** shows a perspective view of a first embodiment of the multifunction data port according to the invention which provides an interface between an electric company and a house.

[0035] FIG. **2** shows a block diagram of a second embodiment of the data port attached and connected to an electric meter and said data port encased within a meter box containing said electric meter according to the invention which provides an interface between an electric company and a house.

[0036] FIG. **3** shows a block diagram of a third embodiment of the data port connected to an electric meter according to the invention which provides an interface between an electric company, a digital service provider and a house.

[0037] FIG. **4***a* shows a side view of a fourth embodiment of the multifunction data port within an electric meter housing wherein a connection is made to a communication line according to the invention.

[0038] FIG. **4***b* shows a front view of the fourth embodiment of the multifunction data port within an electric meter housing wherein a connection is made to a communication line according to the invention.

[0039] FIG. **5***a* shows a side view of an embodiment of the invention with a multifunction data port located between the utility meter and the meter box,

[0040] FIG. **5***b* shows a side view of an embodiment of the invention with the utility interface apparatus or multifunction data port attached to the side of a meter box.

[0041] FIG. **5***c* shows a side view of an embodiment of the invention with the utility interface apparatus or multifunction data port attached to the front of a meter box.

[0042] FIG. **5***d* shows an embodiment of the invention with the utility interface apparatus or multifunction data port attached to the side of a power pole and thence connected to a meter box.

[0043] FIG. **5***e* shows a side view of an embodiment of the invention with a utility interface apparatus or multifunction data port located inside the meter box.

[0044] FIG. **6** shows a flow diagram of an embodiment of a method using said data port interface apparatus according to the invention to provide for secure financial transactions.

[0045] FIG. **7** shows an embodiment of a system and apparatus for the distribution of broadband communication, other utility services and electrical power to multifamily living units and commercial buildings with the said multifunction data port.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0046] FIG. **1** shows a first embodiment of **110** a data port **165** according to the invention connected to a standard meter box **114** and an electric meter **110**. An electric company **120** provides electrical service to a house **130** over external power lines **128** suspended by utility poles **124**. Alternatively, the electric company **120** may provide electric service to the house **130** via power lines buried under the ground.

[0047] According to the invention, electric company **120** provides a digital service over a network communication line **160**, which may be, for example, fiber optic cable, coaxial cable, wireless, power lines or twisted pair cable. The data port **165** provides an interface between the digital service network and the internal house wiring **134**. Internal house wiring **134** may include, for example, power lines, telephone lines, and television coaxial cables. An electronic interface device **150** can plug into a wall outlet **138** to access said digital service network. Device **150** may, for example, provide video, multimedia and game signals to television or monitor **142**.

[0048] As previously discussed, the electric meter **110** is owned by the electric company **120** and is installed in the meter box **114** which is provided by the building owner or by the utility. The data port **165** according to the invention includes the addition of a video connection and various computer electronics and switches and in this embodiment, the data port **165** is attached by wire and/or wirelessly **164** to said meter **110**. The electric meter **110** continues to measure power consumption by standard means. The addition of the data port's **165** signal processing permits the electric company **120** and/or the ISP **161** to provide, for example, both video and telephone communication in addition to electrical service.

[0049] The data port **165** according to this embodiment of the invention may also provide remote meter **110** readings and load control, simultaneously with interactive communication, and a household computer connection at very little extra cost. The use of the data port **165** to read the electric meter **110** is advantageous because the electric company can justify the costs to a regulatory agency on the basis of remote meter readings, load control, and customer billing and communication at times of power outages and other emergencies. The data port **165** according to the invention also can be quickly installed in the sealed meter box **114**. The invention thus permits a regulated electric utility **120** to have an unregulated subsidiary that can deliver broadband access to digital and analog data and be in the telephone, video or multimedia business.

[0050] Further advantages may be realized because many electric companies already run fiber optic or coaxial cables or wireless connections to their major switching stations. Typically, utility companies have easements and own the utility poles. Therefore the electric company can easily extend these cables or wireless connections to each household.

[0051] The electric utility also has the option to work with a cable company to use the cable company's previously existing coaxial lines. For example, the previously-existing coaxial cable may be run directly to the data port **165** according to the invention and thereafter supplied to the house with multiple functions supplied by the data port **165**. Data port **165** may be installed and attached to existing coaxial cables quickly without access to the internal wiring of the house. The utility **120** may be in a good position to negotiate with the cable company because it has the alternative of running its own coaxial cable and offering Internet and digital cable service competing directly, like the electric company in the Lappin article.

[0052] FIG. **2** shows a block diagram of an embodiment of a multifunction data port **270** in an electric meter case **210**, according to the invention providing a connection to an electric company **220** and digital service provider **261** which provides digital service over network communication line **260** to a house **230** using house power line **232** and/or communication line **236**. The meter case **210** is coupled to the sealed meter box **214** and protects data port **270**. Said data port **270** is connected to network communication line **260** through a network interface **272**. Said data port also includes a house interface **274** and meter interface **384** to read a standard electric power meter **280**, both of which are coupled with network interface **272**. Network interface **272** and house interface **274** may comprise signal-processing computers that can function as a router for access to the Internet or other digital services networks.

[0053] Electric company **220** supplies electrical power over external power lines **228** which are connected to standard electric power meter **280** and house's internal power lines **232**. House interface **274** is also coupled to house's internal power lines **232** and the house's other internal communication wiring **236**. The house interface **274** may communicate with devices such as those described in the prior art references. The house interface **274** may also transmit and receive telephone and computer signals over the internal power lines **232** and the network interface **272** may receive and transmit these signals over the network communication line **260**. This configuration puts the digital service providers **261** in communication with home electronics over the network communication line **260**, through the data port **270**.

[0054] The electric utility **220** and/or digital service providers **261** may, for example, compete with a local telephone company by providing a telephone device adapted to communicate over the internal power line **232** or communication line **236** to the house interface **274** and through the data port's **270** network interface **272** to a digital switching service **261**. Thus, the voice processor **394** shown in FIG. **3** may be a commercially available voice processor adapted for transmitting and receiving analog or digital voice information directly over the house internal power lines **332**. The electric company **220** could further provide a direct connection to various long distance companies and Internet digital service providers **261**. The electric utility also has the option to contract with the local phone companies and make use of their existing switching systems.

[0055] In another example, said data port **270** with network interface **272** may function as a computer switch and Internet router and communication line **260** may comprise a fiber optic or coax cable or wireless. A computer switch or router operating in conjunction with connection **260** to a digital service provider **261** can receive several hundred channels of information, and broadband data transmission. House interface **274** may be in communication with a home electronic device, such as a video monitor, and may, in response to a request from the home electronic device, function to select a desired channel for transmission over the internal power lines **232** and/or other internal wiring **236** to the home electronic device. Network interface **272** with data port **270** may be further operative to descramble signals, function as a firewall, and provide billing information. Because of the ease of installing a data port **270** according to the invention, connection to a digital service provider **261** is relatively inexpensive.

[0056] The meter box **214** is typically located near a junction of the internal telephone and cable lines **236** and power lines **232**, all of which belong to the house owner **230**. An electric meter case **210** containing a data port **270** according to the invention, by being installed in the sealed meter box **214**, puts the electric company **220** in an advantageous position to control the flow of multimedia information. Because of the advantageous location, the invention provides convenient access to the utility user's electronics.

[0057] The electric company **220** can also provide the home owner **230** a unique advantage by integrating the various functions described herein into the data port **270** in the electric meter case **210** according to the invention. Because the electric company owns and can replace the previously-existing electric meter with an electric meter **280** and data port **270** according to the invention, the invention eliminates the need for any installation on the part of the customer **230**. The invention is advantageous even in new construction situations, because no additional installation is required. The invention provides a further advantage by not requiring a dedicated wall outlet or special wiring to provide access to a digital service network.

[0058] FIG. **3** shows a third embodiment of associated electronics for a data port **370** connected to an electric meter **380** through a meter interface **384** according to the invention with a detailed block diagram of said data port, comprising a signal processing computer-router **398** which comprises and provides an interface between an electric company **320**, a digital services provider **360** and a house **330**. The data port **370** may be located in the electric meter case (not shown) or may be located at a distant location from the meter **380** and in communication with said meter through meter interface **384**. The electric company **320** and/or the ISP **360** provides digital data services via network wireless transceiver device **361** and over fiber optic cables **364**, coaxial cables **366**, and twisted pair cables **368**, or directly over power lines **328**. The computer router **398** is coupled to the digital data services **360** through network interface **372**.

[0059] Network interface **372** provides a remote wireless transceiver device **362** to communicate via wireless transmission **361**. Such communication might include transmitting and receiving signals over a selected microwave frequency channel, or the publicly owned Industrial, Science and Medical (ISM) band broadcasting. Data transmission on the selected frequency channel might also include such techniques as token ring data transmission, spread spectrum transmission, and/or packet data transmission. Alternatively, wireless transmission media might include infrared, optical, cellular, or satellite communications.

[0060] Said data port **370** provides a video processor **390**, a modem processor **392**, and a voice processor **394** and a meter interface **384**, all of which are coupled to network interface **372**, house interface **374**, and router computer **398** for both receiving and transmitting their respective signals. Said data port **370** also provides a battery backup **376** to supply power to the data port with its attendant electronics and multiple interfaces **370** in the event of a power failure, and a hard disk drive **399** or alternative storage device.

[0061] Data port **370** may notify electric company **320** in the event of power failure. Likewise, the data port **370** may store customer service messages from the power company **320** on hard drive or memory storage device **399**. In the case of a power outage as detected by the meter interface **384**, the data port **370** could retrieve a customer service message from drive **399** and use it to telephone and reassure the customer that the utility is aware of said power outage and is working to solve the problem. Typically, the utility customer service telephone lines are overloaded at times of power problems and the recorded message should help to reduce the number of telephone calls.

[0062] Video processor **390** operated by the data port **370** is further coupled to de-scrambler **396** for providing de-scrambled video signals to house interface **374**. For example, the video processor **390** may be an a commercially available MPEG-2 decoder chip, with both audio and vide decoding capability. Alternatively, multi-chip or software MPEG-2 decoders can be employed, or decoders based on other audiovisual standards, such as motion JPEG, MPEG-1, MPEG-4, H.261 or H.263 may be utilized.

[0063] The data port's **370** hard drive **399** may also be written with educational or commercial materials previously requested by the customer via messages received by proces-

sors **390**, **392** & **394** at times when there is little demand for telephone usage. Such capability allows the customer fast access to materials recorded on the drive **399** without the need for high speed broadband access, in the case where such access is not available. A full feature movie or other lengthy audiovisual materials could be ordered by a consumer for delivery during off-peak hours.

[0064] House interface **374** is coupled to house's internal wiring including house's internal power lines **332**, and telephone lines or communication wiring **338**, and television coaxial cables **339**. The house interface **374** may also communicate with home electronics via wireless communication **375**. For example, cordless telephones communicate over short range microwave signals, including the IEEE standard 802.11a/b/g. The house interface **374** may utilize similar short-range wireless communication using antennas **378** and **377**.

[0065] Computer-router **398** is coupled to house interface **374** and can provide personal computer functions to users in house **330**. Personal computer peripherals which require user access, such as floppy disk drives, audio speakers, and CD ROM drives, may be provided inside the house **330** and communicate with the data port's computer-router **398** through the house interface **374**. Thus, the data port **370** according to the invention may be used as an Internet router **398**, incorporating all the functions of a personal computer configured for Internet browsing.

[0066] Electric company **320** provides electrical power service over external power lines **328**. External power lines **328** enter the meter box (not shown) **134** to which meter **380** is sealed and then into the house **330** via power lines **332** to circuit breaker box **388**. Meter interface **384** is electrically connected to the power meter **380** and it is electrically connected via power lines **332** to circuit breaker box **388**. Circuit breaker box **388** passes electrical power service to house over the house's internal power lines (not shown) **134**. The embodiment shown in FIG. **3** is advantageous with respect to power management. For example, the electric company **320** may obtain a time of use record of both power use and power factor by communicating periodically with the data port **370** and said data port meter interface **384**.

[0067] Alternatively, the device may be employed to change thermostat settings for air conditioning, heat and hot water functions in the house **330** as a function of changes in the cost and/or availability of electric power. In order to effect such changes, the utility would transmit to the device the current cost of power, which would then be compared to predetermined thresholds set by the home owner and change the temperature settings for the water heater and air conditioner. The house owner can thus select a permitted range of thermostat changes for their electrical services based on the cost of power.

[0068] In addition to reduction in costs for meter reading, the third embodiment of the data port **370** may also detect tampering or attempts at bypassing the meter **380**. Likewise, a global positioning satellite may be employed to monitor the position of the meter via wireless transmission device **362** to detect movement of the device and the location of the device, in the event of a disaster or tampering.

[0069] The data port **370** coupled to electric meter **380** according to the invention can also notify the utility when there is a power outage. Another example is advantageous billing arrangements. If there was a problem with the customer's payments, the electric company **320** could instruct the data port **370** to notify the customer through, for example, a message on the customer's television **142** or by email over the Internet or any digital network as the invention prescribes.

[0070] Regarding load management, the use of triacs or other solid state switches (not shown) in meter **380** or circuit breaker box **388** enables the electric company **320** in communication with the data port **370** to selectively turn on and off the power remotely to specific circuits. For example, the electric company **320** might turn off hot water heater circuits during excess power demands. In another example, the triacs in communication with the data port **370** and the electric company **320** can be used to reduce the voltage if the power company has excess power demands. Triacs or other remotely controlled switches in the meter box **114** (not shown) coupled with the data port **370** could also be used to remotely shut off power if there is evidence of meter tampering, unpaid power bills or a change in the account, such as a request for disconnect made by the house owner through the data port **370**, or communicated to said data port by the electric company **320** and/or the house owner.

[0071] The data port **370** coupled to the electric meter **380** according to the invention also provides advantages for the customer's own energy management. The customer can use the data port **370** coupled to the electric meter **380** according to the invention to change the thermostat settings for air conditioning and the hot water heater and to control the use and operation of appliances. This system will permit the customer to enjoy reduced rates by, for example, running the dishwasher and hot water heater at the times of lowest power demands and reducing the air conditioning load at times of peak demand. The interaction of the TV **142** and internal power lines advantageously permits the power user to control their power use with the TV as a potential monitor or with the house owner's computer peripherals and the data port **370**. For example, the data port **370** according to the invention can be programmed to give different customers an individual choice of lower power rates by controlling the timing of different loads or higher rates with unrestricted use of power.

[0072] The data port **370** and its multiple interfaces **372**, **374**,**384** coupled to electric meter **380** according to the invention also advantageously provides each household with the functional equivalent of a personal computer, which can potentially use a TV **142** as a monitor, and be connected to the house owner's other computers and peripheral electronic devices and microprocessors, forming a home network. The electric company **320** or the ISP **360** may supply or rent software for the personal computer **398** over the said digital service network.

[0073] For example, the electric company **320** might provide a "free" service for school children to use said data port and Internet access for their homework. This has the advantage of improving the public relations with utility customers and the state regulatory commissions as well as getting children used to using the software made available by the electric company **320** and/or the ISP **360**. The data port **370** according to the invention might be used by the house owner to also utilize the computer-router **398** in said data port, coupled to the meter **380** to provide access to the Internet and for conducting secure financial transactions, such as described below in FIG. **6**. The electric company **320** can also provide programming to and through the data port **370** to make it very easy for the consumer to pay their power bills each month.

[0074] A regulated utility, like an electric company **320**, can justify the costs of the data port **370** coupled to the electric

meter **380** according to the invention because it will reduce the costs to read meters, provide better communication between the utility and its customers and it will provide significant help in power management. The unregulated portion of the electric company **320**, which could also be an ISP **360**, can obtain revenues from electronic communications. Recent legislation has reduced regulation in communications and this opens the field for the electric company **320**, which is already connected to every house. The data port **370** coupled to the electric meter **380** according to the invention will enable the electric company to be competition for both the telephone and television cable companies and provides a strong incentive for these companies to work with the electric company **320** by supplying a digital service network over existing telephone and television lines, by fiber optics or wirelessly, or any combination thereof according to the embodiment of the invention described in FIG. **3**.

[0075] FIGS. **4***a* and **4***b* show a side and a front view, respectively, of a fourth embodiment of the data port **470** in an electric meter enclosure **412** according to the invention wherein a connection is made to a communication line **460** & **436**.

[0076] Electric meter-data port **410** has a meter enclosure **412**, which encloses standard electric power meter **480** and associated electronics of the data port **470**. Meter enclosure **412** forms a seal with meter seal ring **418** to provide protection from the elements and is mated with standard meter box **414** and by the seal **418** is sealed to the meter box **414**. External power lines or conduit **428** enter the sealed meter box **414** from the top (or any angle or direction) and power is supplied to a house **330** through a power conduit **433** also coupled and/or connected to the data port **470** which said conduit is shown exiting the meter box **414** from the side.

[0077] Associated electronics **470** are coupled to communication line **460** through a cable **465**. Electric meter enclosure **412** provides a stress relief **467** for cable **465**. Cable **465** is coupled to communication line **460** at connection point **463**, and to the data port **470**. Signals are communicated in the house over internal cable **436** or by power lines **332** in this embodiment.

[0078] According to the fourth embodiment, communication line **460** comprises, for example, a coaxial cable, a fiber optic cable, power line, wireless or a twisted pair telephone line. In the case of a coaxial cable, connection point **463** may be a simple coaxial "T" connection. Connection point **463** may otherwise be a "splice" type connection wherein signals on communication line **460** are passed directly onto internal cable **436** in addition to being processed by the data port and its associated electronics **470** over cable **465**.

[0079] For example, communication line **460** may deliver conventional television signals to the house, some of which are scrambled or in digital format. The conventional signals could be delivered directly to the house for reception on a conventional TV. Concurrently, via a "T" connection, associated electronics in the data port **370** may process the scrambled television signals and deliver de-scrambled television signals over the house's internal power lines for reception by a remote device **150** plugged into an electrical wall outlet. The remote device would put the de-scrambled signals back on conventional television coaxial cable or conventional video and audio cables **339** for reception on the TV **142**. Alternatively, the associated video processor **390** electronics could convert digital TV signals to analog signals and/or may shift and superimpose the de-scrambled television signal onto internal cable **339** for reception on the conventional analog TV **142**.

[0080] The data port **370** according to the invention can provide numerous advantageous applications to the user. For example, the user can request information regarding the user's utility usage and bill. The user may utilize the data port **370** according to the invention for Internet banking or to pay the utility bill and other bills via credit card or other payment arrangements.

[0081] Another example is information access. The data port **370** according to the invention could provide a virtual personal computer for the user that can be interfaced to the user's home electronics and appliances. The personal computer connection feature may provide access to various interactive computer services supplied by the utility **320** or the ISP **360**, or both. For example, the user can utilize the data port and its associated electronics **370** according to the invention to access the Internet and other information sources. The user could use their home television set **142** as a display or monitor. The electric company **320** or the ISP **360** or both may also provide computer software and games for use with the virtual personal computer function of the data port **370**, **470** and its associated electronics and interfaces.

[0082] Both the electric company **320** and the user could use the multifunction data port **370** according to the invention advantageously for load management. The electric company **320** could, for example, suspend electric service to non-essential circuits, such as hot water heaters, during peak demand times. The user could, for example, arrange to have the dishwasher run during lower rate hours. The electric company **320** could also use the data port and its associated electronics **370** according to the invention for remote meter reading and also for detection of tampering by, for example, determining unusual changes in power usage.

[0083] The data port **370** according to the invention can also detect power outages and other problems with the electric company's distribution system. The data port's computer-router **398** may be programmed to calculate the harmonic distortion in the power line using fast Fourier transform analysis. Providing this calculation of harmonics to the power company **320** via network interface **362** can enable the said company to either correct the power factor or harmonic noise or, when appropriate, to charge higher fees when the home owner or power user is creating excessive electrical noise or power factor.

[0084] Alternatively, the data port **370** device may be employed to remotely change thermostat settings for air conditioning, heat and hot water functions in the house **330** as a function of changes in the cost and/or availability of electric power; this may be accomplished by the house owner or the utility or both, though the use of the data port and its associated electronics **370**. Power costs have recently gone as high as $500 to $1,000 per kilowatt-hour at times of reduced generation capacity. In order to effect such changes, the utility **320** would transmit to the data port device **370** the current cost of power, which would then be compared to predetermined thresholds set by the home owner on the computer router **398** of the data port **370**. The amount of the change in thermostat settings could be set as a function of the current cost of a kilowatt-hour. The house owner is able to choose different ranges of thermostat settings at times of reduced generation capacity depending on the cost of electrical power. Both the utility user **330** and the utility company **320** can change

thermostatic settings in this embodiment of the invention remotely over the Internet from any location utilizing the features of the data port **370**. Changing settings on thermostats is a much better way for the utility to shed load than cutting power to whole regions of the city.

[0085] The data port **370** according to the invention provides a further advantage of being able to monitor and collect data on the television **142** viewing habits of the user. Safeguards must insure that this information is only available if the homeowner authorizes it. Likewise, the data port could be used as the means for voting or census taking. Such information can be collected at the home **330** and communicated over the communication network **362**,**364**,**366**, **368**. For example, viewing habit information may be collected by the video processor **390** of the data port **370** and stored on the hard disk or other memory device **399** of the data port **370** by the data port's router-computer **398**, and transmitted to the electric company **320** upon request. Such information is useful to determine the size of the viewing audience for various different television programs. Likewise, voting, census or other information could be collected in the house **330** using a television remote control or other input device coupled to the data port as a sealed secure terminal **623**.

[0086] The data port **370** according to the invention could be used for interactive instructional and job training programs in the home. An instructional program could be viewed on the user's television set and the user could, for example, use a remote control device coupled to the data port **370** to respond to multiple choice questions posed by the instructional program.

[0087] Other advantages of the data port **370** include the ability for the electric company **320** to provide video signals, such as pay-per-view programs, to the user. The signals may be scrambled at the point of distribution and de-scrambled **396** by the data port **370** according to the invention. The electric company **320** may also provide connection to various local and long distance telephone services and the ISP **360** through the data port **370** according to the invention.

[0088] A particularly advantageous use of the data port **370**, **470** according to the invention includes monitoring movement and/or a personal medical alert device worn by a user inside the home. Such a device may, for example, transmit medical data on a periodic basis and be relayed to a physician through the data port **370**, **470** according to the invention. For example, the device **370** could transmit information by way of a wireless connection **361**,**362** to the utility company **320** or digital service provider **360** via the computer-router **398**. Alternatively, said device may be activated by the user to alert emergency medical services through the data port **370**, **470** according to the invention. A similar advantage can be achieved to monitor movements of a user restricted to their homes by, for example, a court order when said user is wearing a wireless homing and/or tracking device coupled to the data port **370**, **470**. Computer **398** in multifunction data port **370** may include global position software (GPS) for detecting a satellite identified location of the personal medical alert device or other such other tracking device using, for example, network wireless transmission **362** which includes GPS satellite communications. Multifunction data port **370** may also be configured to detect security breaches in the seal **418** of said data port with motion sensors (not shown).

[0089] As noted above, the data port **370** according to the invention can transmit and or receive information from digital and analog networks directly over the power lines **128**. Any of the several well-known techniques for using power lines to transmit digital or analog information into the home **330** may be employed. For example, Dr. Sanderson has described a system for distribution of broad band multi-media services over the high-voltage cables of a power distribution network (U.S. Pat. No. 6,040,759), the disclosure of which is incorporated herein, and this 759 patent includes other references to power line carrier technology (PLC) also known as broadband over power line (BPL).

[0090] FIGS. **5***a*-**5***e* illustrate various arrangements for placement of the multifunction data port **570** attached to a meter box or power pole or placed within a utility meter. Thus, in FIG. **5***a*, an embodiment of the invention where a multifunction data port **570** is located between the utility meter **510** and the meter box **514**, via meter seal rings **518**. The multifunction data port **570** is coupled to a wireless communication line through stress relief **567** and antenna **565** in FIG. **5***a*.

[0091] In FIG. **5***b*, the utility interface apparatus or multifunction data port **570** is attached to the side of a meter box **514**, using, for example, a seal ring **518**, which is also shown as seal ring **418**. In some case, a conduit or connector **560** may connect data port **570** to a side of meter box **514**. Conduit or connector **560** may be similar to connection line **460** as is in (FIG. **4**). In FIG. **5***c*, the utility interface apparatus or multifunction data port **570** is attached to the front of a meter box **514**. In FIG. **5***d*, the utility interface apparatus or multifunction data port **570** is attached to the side of a power pole **524** with cross tie **522** and coupled to a meter box **514** of the house **530** owner. Said data port is in a secure location near the transformer **540** under high voltage distribution lines **548** with insulators **545**. Said data port is also shown connected to junction box **542** connecting lower voltage wires **528** to the step down terminals **543** of said transformer. This provides a tamper-resistant location where a potential vandal faces the threat of being electrocuted. The data port **570** in this embodiment is, as similarly illustrated in FIGS. **1**-**4**, also connected to the utility company **520**, the ISP, **561** by wireline **563** and wirelessly **565**, **567**, and thence to the electric meter **514** of the house **530** owner, also by wireline **549**, **528**, and wirelessly **566**. Finally, in FIG. **5***e*, the utility interface apparatus and multifunction data port **570** is located inside of the meter box **514**.

[0092] Referring next to FIG. **6**, a sixth embodiment of the present invention is illustrated, with the data port being used to facilitate secure banking and Internet transactions. As noted above, the data port may be used in connection with a home based input device, such as a television remote control, to enable communication between the electric company and the homeowner. Using a remote control, a wireless keyboard or other input devices (not shown) that are linked to a house electric lines **332**, the present invention likewise permits a homeowner to conduct secure banking and Internet purchasing. In addition bank **621** has the option **635** to check if the vendor is not trustworthy or a suspect company **635** cited for fraud, prior liens or with a poor credit rating and the option to check if the vendor is not a domestic business subject to U.S. laws **630**, in which event additional purchase authorization requirements may be imposed **632**. If vendor **630** is not trustworthy **635** or subject to US domestic laws **630**, bank **621** may require proof that vendor **631** has shipped the goods to purchaser before guaranteeing payment **632**.

[0093] FIG. **6** is a flow diagram illustrating the steps of a method to conduct secure banking and Internet purchasing using the data ports. A purchaser **620** who wishes to conduct

such business may use the data port, acting as a secure terminal **623**, to contact his or her bank **621**. At step **620** router-computer **398** in the data port secure terminal **623** monitors the security of the data port seal **418** and/or network interface **372** for any breaches to the physical firewall **615**. In this embodiment the said data port **622** would be under seal and placed close to electric wires. When a home owner initiates a banking transaction or Internet purchase on data port interface **620**, computer-router **398** it will transmit only the encrypted data port serial number, and encrypted data to the appropriate bank or other financial institution, which has stored the private encryption algorithm or key in said data port with bank customer's permission, via the digital services network **625**. Vendor **630** is only sent an encrypted credit or debit card number designed for one time use and the bank would be the only institution, which has a look up table to associate the data port's **623** serial number with the encryption key required to ultimately decode the message. In this way, a thief would have to gain access to both the serial number and public key table that is only held by the financial institution **621**.

[0094] Returning to FIG. **6**, when a purchaser at the data port interface **620** transmits their credit or debit card information over the Internet **622** to a vendor **630** to make a purchase, the vendor will ordinarily contact **624** the bank **621** that issued the credit card to verify the transaction. The bank then checks to determine whether the purchaser has sufficient funds to conduct the transaction/Internet purchase **622**. In accordance with the present invention, in order to verify that the purchase has originated from the homeowner's secure terminal **623** the bank can also send a query **625** to the home owner's data port secure terminal **623** if the card number is not encrypted and lacks code from card's magnetic strip showing that vendor **630** used said card for the authorization request **624**. If sufficient funds are lacking **633**, or the purchase authorization **634** was not on the secure terminal **623** and vendor **630** did not have physical possession of said card, the bank **621** notifies the vendor **630** that payment has been refused **640** and informs the purchaser **620** the reason that the bank **621** refused payment authorization **641**.

[0095] In addition, bank **621** has the option **635** to check if the vendor is not trustworthy, e.g., because it is a suspect company or the option **636** to check if the vendor is not a domestic business subject to US laws **630**, in which event additional purchase authorization requirements may be imposed **632**. Options **635** and **636** may be exercised sequentially. First exercising option **635**, bank **621** may find that the vendor is untrustworthy (untrustworthy=YES), then bank **621** may refuse authorization (**641**). If the vendor is trustworthy (untrustworthy=NO), bank **621** may then exercise option **636** to check if the vendor is or is not a domestic business subject to US laws. If vendor **630** is subject to US domestic laws, bank **621** may promptly guarantee payment to the vendor (**631**). If vendor **630** is not subject to US domestic laws, bank **621** may require proof that vendor **630** has shipped the goods to the purchaser before guaranteeing payment (**632**).

[0096] Only when all safeties are met will the bank **621** guarantee payment to the vendor **630** and the transaction is consummated **631**. Each secure purchase or secure transaction by the purchaser house owner at data port interface **620** rate will generate a different encrypted key or encryption algorithm for each transaction or purchase. In this way, the purchaser **620** is offered additional consumer protection to prevent transactions initiated by a third party which may have gained unauthorized access to his or her credit card information or in dealings with potentially troublesome vendors **635**.

[0097] FIG. **7** shows the use of the invention to sub-meter electrical power and to provide computer services and Internet access to apartment buildings, military housing, residential and commercial complexes **700**. This invention can be a way to bridge the "digital divide" and bring computer services and access to the Internet for transient populations and low income groups, with benefits to each consumer with meter box **740**, the utility **120** and the telecommunication facility or ISP **161**.

[0098] The municipality or owner of the commercial or residential complex **700** can contract with the utility **120** for wholesale electric power delivered by the power line **710** to the master meter **705** before and this power is distributed over the internal lines **715** to each sub meter **740** in the complex **700**. Each sub-meter box **740** and the multifunction data port **741** are attached under seal (not shown) in the sub meter box **740**. The multiple data ports **741** are in this embodiment acting as slave units to the master data port **725** which is also an Internet router and can have multiple interfaces including video, voice, telephone, thermostatic heating and cooling, messaging and alarming, scrambling and descrambling and digital routing as described in FIG. **3** above. The multiple data ports **741** are capable of being networked with the master data port **725** in order to create a grid computing network, thus leveraging the computing power of the total of the said data ports. The landlord or municipality also can obtain broad band data access to the Internet **720** and digital data via the external signal access connection **720**, which can be wireless, OC1, T1, DSL, coax cable or direct fiber, or power line carrier (PLC) or broadband over power line (BPL), or by any combinations of connections through any technologies or spectra as outlined herein. The internal Internet Router **725** sends this digital data over the internal signal lines **730** to the individual multifunction data ports **741** located in each unit. The internal signal lines **730** can be optic fiber, wireless, twisted pair telephone lines etc. or they can represent use of the internal power lines **715** for data distribution and Internet access **710** via PLC or BPL.

[0099] The electric meter box **740** is a secure sealed location with power for the computer and data port **741** and helps to insure that this invention will remain with the property when the tenant moves and that the data port will always be available for use by future residents. The secure sealed location of the data ports **741** in this embodiment protects against misappropriation of electric power or outright theft of the data port **741**. The municipality or landlord can offer additional services to residents and apartment tenants through the 705 master meter, the slave unit data ports **741** and/or the data port master router-computer-central processing unit **725**. These features of this embodiment of the present invention can be used in apartments, commercial buildings, public and military housing, or sections of a city, to provide the following:

[0100] 1. Data port for telecommunications, multimedia and Internet access

[0101] 2. Education and Internet access

[0102] 3. A secure terminal for e-Banking and e-Commerce

[0103] 4. Job services and job training.

[0104] 5. Medical monitoring and home care.

[0105] 6. Time of use electric rates and energy management

[0106] 7. Computer technology and games

[0107] 8. Descrambler for video and MPEG 2.

[0108] 9. Communication and public safety

[0109] 10. Controller for internal appliances

[0110] 11. Networked grid computing

[0111] Additional advantages and modifications will readily occur to those skilled in the art. For example, an alternative arrangement might include having the associated data port **570** electronics located in a junction box on the utility pole or in another external location, as illustrated and described in FIG. **5**-*d* above. While the foregoing embodiments have been described with reference to a house and multiple dwelling units, one skilled in the art will appreciate that the invention is applicable to other residential and commercial structures and utility infrastructure.

[0112] Therefore, the invention in its broader aspects is not limited to the specific details, and representative devices, shown and described herein. Accordingly, various modifications and alterations may be made without departing from the spirit or scope of the general and specific inventive concepts as defined by the appended claims and their equivalents.

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. An interface, connected between a communications network and a utility user's structure, for use with a utility meter, wherein the utility meter collects utility usage information associated with the utility user's structure, comprising:

a computer coupled to the utility meter for receiving the utility usage information and for providing an interface between the communications network and a device located inside the utility user's structure, wherein the computer is configurable to allow the utility user to control the device.

2. The interface of claim **1**, wherein the communications network is operable to communicate information between a utility company and the computer.

3. The interface of claim **1**, wherein the communication network is selected from the group consisting of: fiber optic cable, a coaxial cable, a twisted pair cable, electric power lines, and wireless transmission media.

4. The interface of claim **1**, wherein the device located inside the utility user's structure is selected from the group consisting of: an air conditioner, a heater, and a hot water heater.

5. The interface of claim **1**, wherein the computer is configurable to detect a power outage and inform the utility company of the location of the utility user's structure.

6. The interface of claim **5**, wherein the computer is configurable to notify the utility user that the utility company has been notified of the power outage.

7. The interface of claim **1**, wherein the utility meter has a housing and the computer is located inside the housing.

8. The interface of claim **1**, wherein the computer is located outside of the utility user's structure.

9. A method of interfacing a communications network and a device located inside a utility user's structure with a utility meter, wherein the utility meter collects utility usage information associated with the utility user's structure, comprising:

providing an interface between the communications network and a device located inside the utility user's structure with a computer coupled to the utility meter, wherein the computer is configurable to allow the utility user to control the device.

10. The method of claim **1**, wherein the communications network is operable to communicate information between a utility company and the computer.

11. The method of claim **1**, wherein the communication network is selected from the group consisting of: fiber optic cable, a coaxial cable, a twisted pair cable, electric power lines, and wireless transmission media.

12. The method of claim **1**, wherein the device located inside the utility user's structure is selected from the group consisting of: an air conditioner, a heater, and a hot water heater.

13. The method of claim **1**, wherein the computer is configurable to detect a power outage and inform the utility company of the location of the utility user's structure.

14. The method of claim **13**, wherein the computer is configurable to notify the utility user that the utility company has been notified of the power outage.

15. The method of claim **1**, wherein the utility meter has a housing and the computer is located inside the housing.

16. The method of claim **1**, wherein the computer is located outside of the utility user's structure.

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