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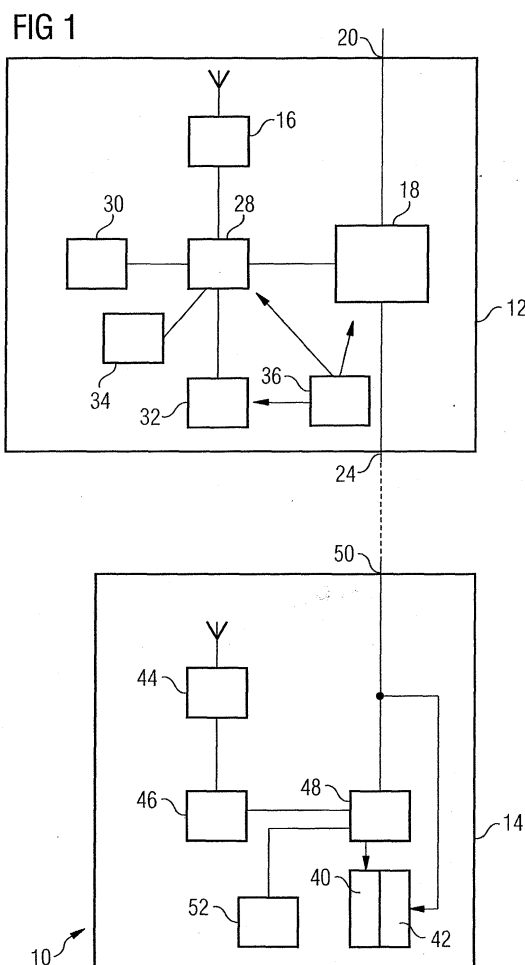
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(54) **Improvements in or relating to utility meters**

(57) The present invention relates to utility meters. In particular, but not necessarily restricted thereto, the present invention relates to pre-payment utility meters such as pre-payment gas meters. Credit transfer in metering systems for metering the supply of a service such as gas, electricity, water etc., to a customer is well known. Pre-payment utility meter systems are known whereby the consumer pays in advance for the provision of a utility supply, or makes, for example, periodic payments against an allowed credit limit. In gas systems including such pre-payment mechanisms, the gas meter apparatus at the consumer's premises incorporates a cut-off valve, which valve is controllable to cut off the gas supply. The valve can thus be controlled to cut off the supply when the consumer's credit has expired. Whilst a reaction to the social desirability of pre-payment systems which cut-off a supply to a consumer is not unusual, there is a belief that a complete cut-off from a particular utility service is undesirable or even totally inhumane from a social-economic point of view. The present invention addresses this problem and provides a meter having a remote cut-off facility.



Description

FIELD OF INVENTION

[0001] The present invention relates to utility meters. In particular, but not necessarily restricted thereto, the present invention relates to pre-payment utility meters such as pre-payment gas meters.

BACKGROUND TO THE INVENTION

[0002] Credit transfer in metering systems for metering the supply of a service such as gas, electricity, water etc., to a customer is well known. In the following, particular reference will be made to gas metering systems, though it is to be understood that the invention can be applied in metering systems for other services.

[0003] Pre-payment gas meter systems are known whereby the consumer pays in advance for gas consumption, or makes, for example, periodic payments against an allowed credit limit. In such systems, the gas meter apparatus at the consumers premises incorporates a cut-off valve which is selectably controllable to cut off the gas supply. The valve can thus be controlled to cut off the supply when the consumer's credit has expired, and to restore the supply when further credit has been purchased and the meter credited appropriately. Preferably the cut-off means or actuator is not utilised since the consumer will top-up the registered payments in the meter before exhaustion of the previous amount of credit. Whilst such systems were originally implemented by coin operated payment meters, more recently some form of portable data storage device, and in particular, interactive cards such as magnetic swipe cards and smart or memory cards, have been employed to transfer credit amounts to the meter. With these card operated systems, the consumer is generally required to take the card to a remote point of sale where payment is made and the pre-payment card is loaded with the purchased credit. The card is then taken back to the consumers premises and inserted into a card reader of the metering apparatus whereupon the amount of recently purchased credit is read from the card and the gas supply controlled accordingly.

[0004] The latter type of system is favoured for various reasons, not least because the meter does not actually hold any money so there is no incentive to destructively open up the meter as was the case with coin operated systems. Another reason is that card operated systems facilitate remote accounting by the service provider. These systems also allow for implementation of security measures, for example to counter fraud by consumers, since various additional data such as coded passwords, transaction numbers, time and date stamps etc, can be recorded on the card. Such data can be used, together with appropriate algorithms and the system equipment to process the data, for authentication purposes, for example in the meter prior to release of

credit for use by the consumer's system.

[0005] Typically, electronic gas meters are battery powered and operation of the actuator for the internal valve can take a significant amount of the available energy. The use of the internal valve actuator more than twice a week a year can reduce the battery life by several years. The replacement of a battery requires the a visit from a representative from the utility provider and is typically a costly process. It is to be noted that the design life typical of batteries for gas meters is often 10 years

[0006] Whilst a reaction to the social desirability of pre-payment systems which cut-off a supply to a consumer is not unusual, there is a belief that a complete cut-off from a particular utility service is undesirable or even totally inhumane from a socio-economic point of view.

OBJECT OF THE INVENTION

[0007] It is an object of the invention to provide an improved utility meter arrangement. It is a further object of the present invention to increase the life expectancy of a storage battery associated with a pre-payment utility meter. It is a still further object to the present invention to provide a socially responsibly method of encouraging utility pre-payment.

STATEMENT OF INVENTION

[0008] In accordance with a first aspect of the invention there is provided a utility pre-payment system, said pre-payment system having a pre-payment credit limit, the pre-payment system comprising: a utility meter operable to meter a supply of utility; an actuator operable to enable/disable a utility supply; wherein the actuator is located proximate to an independent power source independent of a power supply for the meter; wherein the meter is operable to communicate with the actuator whereby, upon a breach of the pre-payment credit limit, the actuator can be enabled so as to disable a utility supply for part of the system during the breach of the pre-payment credit limit. Preferably the part of the metered supply of utility which can be operatively disabled relates to a non-essential or a least essential use of the utility.

[0009] In the case of gas meters and other non-electrical utilities, the problem of draining a meter battery of its energy due to actuation of a supply enable/disable can be overcome. By moving the actuator to a location where there is a plentiful supply of energy, for example, from a mains electricity supply, the use of the actuator does not affect the life expectancy of a power source for the meter. It will be appreciated that meters are calibrated and susceptible to damage: by reducing the need for access to the meter to replace batteries, accuracy and reliability of the meter are improved and operational costs for a utility company can be reduced.

[0010] In accordance with a further aspect of the invention, there is provided a method of providing utility services in a pre-payment system comprising a battery-powered utility meter in communication with an actuator for utility supply enablement/disablement located proximate to a power source independent from a power source for the meter, said pre-payment system having a pre-payment credit limit; said method comprising the steps of: metering a consumption of the utility; communicating with the actuator upon breach of the pre-payment credit limit; and disabling a utility supply for part of the system during breach of the pre-payment credit limit.

BRIEF DESCRIPTION OF THE FIGURES

[0011] The invention will now be described, by way of example only, with reference to the figures as shown in the accompanying drawing sheets, wherein;

Figure 1 shows a first embodiment of a meter made in accordance with the invention; and

Figure 2 shows a second embodiment of a meter made in accordance with the invention.

DETAILED DESCRIPTION OF INVENTION

[0012] There will now be described, by way of example, the best mode contemplated by the inventor for carrying out the invention. In the following description, numerous specific details are set out in order to provide a complete understanding of the present invention. It will be apparent, however, to those skilled in the art, that the present invention may be put in to practice with variations of the specific.

[0013] Referring now to Figure 1 there is shown a pre-payment gas metering system (10) comprising a meter (12) and boiler controller (14). The meter is capable of performing pre-payment functions and is provided with a radio communication link. It will be understood that other forms of providing a communication link are possible such as a 2-way fibre optic link or a free-space infrared link. The gas meter (12) comprises a gas input (20), a gas output (24) which provides gas to household appliances generally and, specifically, to a boiler for central heating and/or hot water. Metrology equipment (18) determines the consumption of the gas from the gas supply (20) and provides data to a pre-payment controller (28) which is associated with a credit acceptor (30) which is operable to receive credit from a smart card or the like, a display (32) and a valve open interlock (34). The controller is connected to a radio unit (16) and an electrical power supply from a battery (36) is provided to radio (16) and controller (28). The meter itself may not require electrical energy to determine consumption.

[0014] The boiler controller (14) comprises a gas inlet (50) which provides gas via a valve (48) to a burner (40) and gas to a pilot light (42) directly. The valve is under the control of a timer/controller (46) which in turn is

linked to a radio (44). A mains power supply (52) is available to power the radio, timer/controller and valve actuator. When instructed by the meter radio, the boiler controller will operate the valve fitted in the boiler, turning it on or off as appropriate. Data verification and authentication techniques are preferably employed whereby to combat fraudulent use of the system. Additionally, a "safe to open" interlock (34) is provided on the meter whereby manual actuation is required to enable supply of the gas to the premises once the consumer has attended to all devices where gas may be liberated when the supply is restored in the event that gas supply has been disrupted - for whatever reason.

[0015] The system as described is operable to control a main burner of a heating boiler rather than the gas supply to a premises as a whole. The system can be extended to control other appliances in the home, provided separate controllers are fitted. One advantage with this embodiment is that compared with systems presently installed, pilot lights will remain on even when credit is exhausted. This overcomes perceived safety problems and any inconvenience associated with re-ignition of one or more pilot lights associated with equipment within a consumer's house.

[0016] Referring now to Figure 2 there is shown a second embodiment wherein the boiler controller or similar system, operates to perform a credit acceptor function. The boiler controller system is fitted with a card reading device or similar and is operable to display the amount of credit etc, therefore providing the consumer with a more convenient, easy to read system. It is known, typically, that gas meters are placed in outside enclosures, within a wall box, an outside garage or similar: it is an advantage for a remote meter to be associated with a heating boiler which may be, for example, easily accessible within a kitchen or other advantageous position. In detail, meter unit (62) receives gas from mains supply at inlet (20), use of which is metered by metrology unit (18) and information passed to controller (66). The controller communicates with a display (32) and radio (16). A battery pack (36) is provided to power a radio, the controller and the metrology unit, as appropriate. At the boiler, control unit (64) gas is received at input (50) and flows to burner (40) via valve (48) and flows directly to pilot (42). Valve (48) is under control by timer controller unit (68), which outputs data to a display (70) and receives data from credit acceptor (72) and valve open interlock (74) (optional). Timer controller also receives radio data from the meter unit (62).

[0017] The credit acceptor and boiler control system may relay credits to the remote gas meter, or take over the net credit reckoning function and valve control from the gas meter. In this case the gas meter becomes very simple since it only has to perform basic metrology functions and transmit consumption data via the radio and as a result consumes minimum energy from the battery.

[0018] Whilst it may be considered that with either of the embodiments described above that methods for de-

frauding the system exist, whether the data transfer is provided by radio or other communication links. For example, it may be possible to cover up either of the radio antennas to disrupt communication resulting, in the case of the first embodiment, in the meter radio not being capable of instructing the boiler control system to close the valve after credit has been used up. In the second embodiment, disruption of the communication results in no consumption data being received by the boiler control system and the net credit not reducing, therefore the control system would not know when to close the valve. To overcome this, regular or random communication between the meter and the boiler control system via the radios can be provided. Should this communication stop after establishment of initial communication during commissioning, the boiler control system may be pre-programmed automatically to close the valve, hence cutting off the de-frauder.

[0019] For gas metering applications, the battery life of the metering apparatus will be extended as there will be no valve within the meter to drain the energy. The valve will no longer be sealed inside the meter, but sited in an accessible position in the boiler, thus allowing it to be maintained. The gas supply, in the event of loss of credit, will not be completely cut-off, pilot lights will remain lit and cooking may be possible, depending upon system configuration, even when the credit is exhausted. The overall system will be safer and easier to use than present systems. Furthermore, a boiler control incorporating a card acceptor is likely to be more convenient for a consumer. It will be appreciated that there are many variations possible in the implementation of a system made in accordance with the invention. For example the system may have a meter display separate from the metering apparatus itself and may be associated with the cut-off valve. The display may also be separate from the cut-off valve and be placed in a convenient position for the consumer. The display associated with the meter may also be duplicated by the provision of displays associated with the cut-off valve or totally separate displays. The card reader may be colocated with the cut-off valve or secondary/remote display. In another variant of the system, the system would be associated with a room thermostat whereby to provide, for example, a "freeze-guard" facility. The system may be associated with an "economy seven" or energy credit facility wherein an increased premium is paid for utility consumed when the consumer is not in credit.

Claims

1. A utility pre-payment system, said pre-payment system having a pre-payment credit limit, the pre-payment system comprising:

a utility meter operable to meter a supply of utility;

an actuator operable to enable/disable a utility supply;

wherein the actuator is located proximate to an independent power source independent of a power supply for the meter;

wherein the meter is operable to communicate with the actuator whereby, upon a breach of the pre-payment credit limit, the actuator can be enabled so as to disable a utility supply for part of the system during the breach of the pre-payment credit limit.

2. A utility system according to claim 1, wherein the part of the metered supply of utility which can be operatively disabled relates to a non-essential use of the utility.
3. A utility system according to claim 1 or 2, wherein the utility is gas.
4. A utility system according to claim 3, wherein the pre-payment control unit is operatively associated with the meter.
5. A utility system according to claim 3, wherein the pre-payment control unit is operatively associated with the actuator.
6. A utility system according to any one of claims 3 to 5 wherein the actuator is operatively associated with a heating control system.
7. A utility system according to any one of claims 1 to 6, wherein a display is colocated with the utility meter.
8. A utility system according to any one of claims 1 to 7 wherein a display is provided remote from both the utility meter and actuator.
9. A utility system according to claim 8, wherein the card reader is colocated with the remote meter.
10. A utility system according to any one of claims 1 to 8 wherein the card reader is provided remote from both the utility meter and actuator.
11. A method of providing utility services in a pre-payment system comprising a battery-powered utility meter in communication with an actuator for utility supply enablement/disablement located proximate to a power source independent from a power source for the meter, said pre-payment system having a pre-payment credit limit; said method comprising the steps of:

metering a consumption of the utility;

communicating with the actuator upon breach of the pre-payment credit limit; and disabling a utility supply for part of the system during the breach of the pre-payment credit limit.

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- 12.** A method according to claim 11, wherein the part of the metered supply of utility which can be operatively disabled relates to a non-essential use of the utility.

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- 13.** A method according to claim 11 or 12, wherein the utility is gas.

- 14.** A method according to any one of claims 11 - 13 wherein the actuator is operatively associated with a heating control system.

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FIG 1

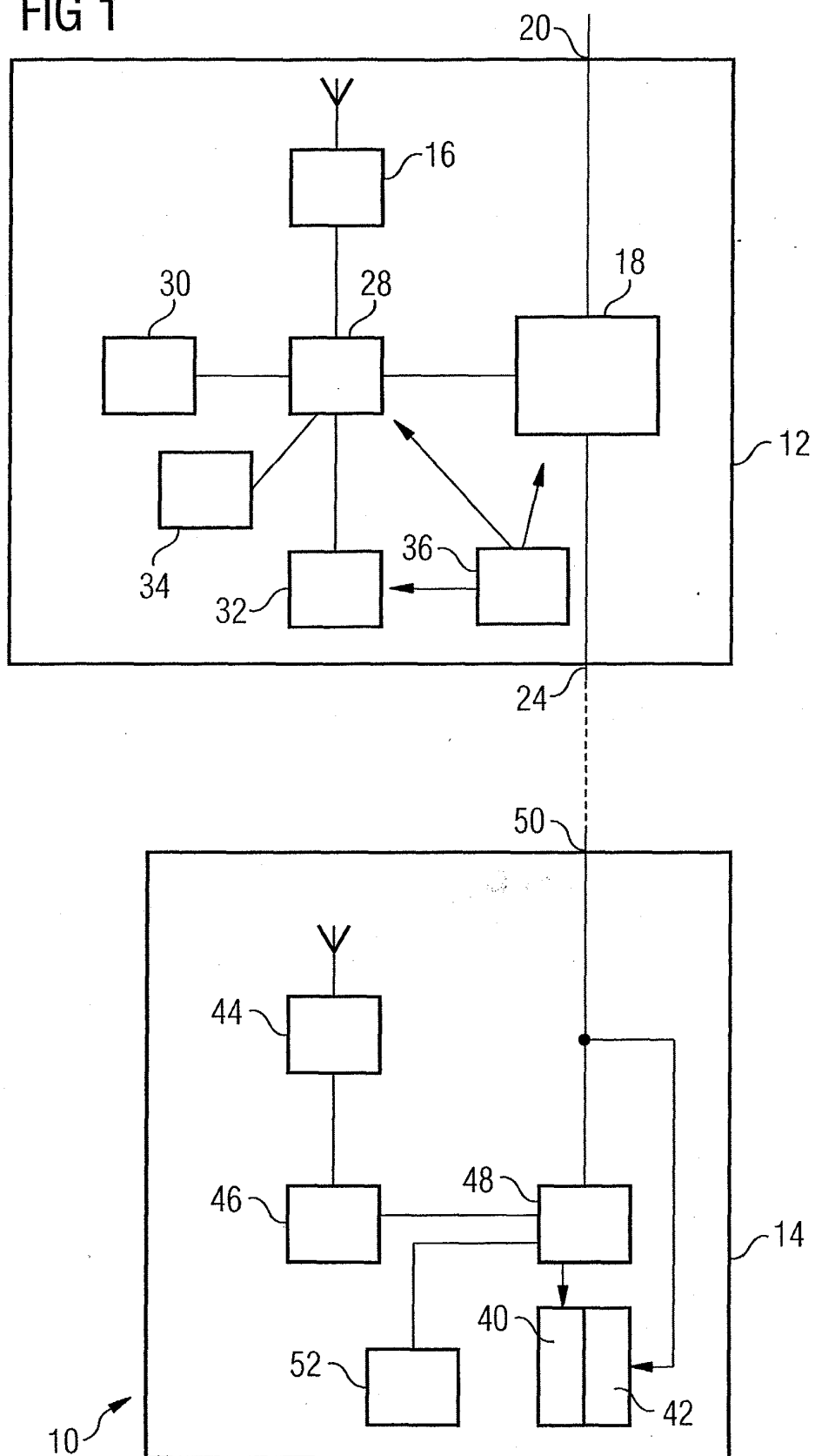
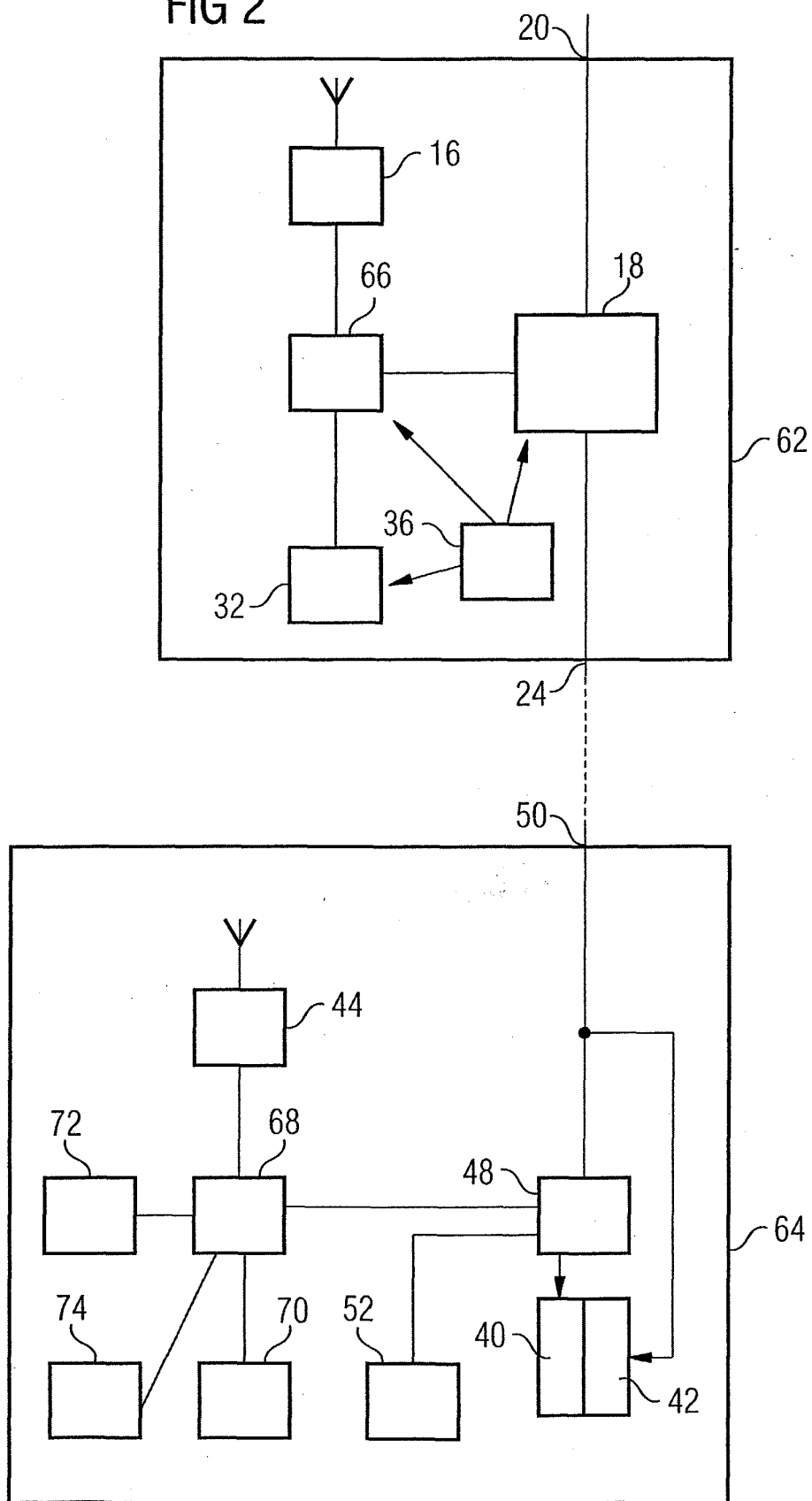


FIG 2





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 07 7376

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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Place of search MUNICH		Date of completion of the search 17 October 2003	Examiner Anastasov, Y
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 03 07 7376

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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