

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 545 549 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **92310024.2**(51) Int. Cl.⁵: **G07F 15/00**(22) Date of filing: **02.11.92**

(30) Priority: **30.11.91 GB 9125568**
25.02.92 GB 9203946

(43) Date of publication of application:
09.06.93 Bulletin 93/23

(84) Designated Contracting States:
AT BE CH DE DK ES FR GR IE IT LI NL PT SE

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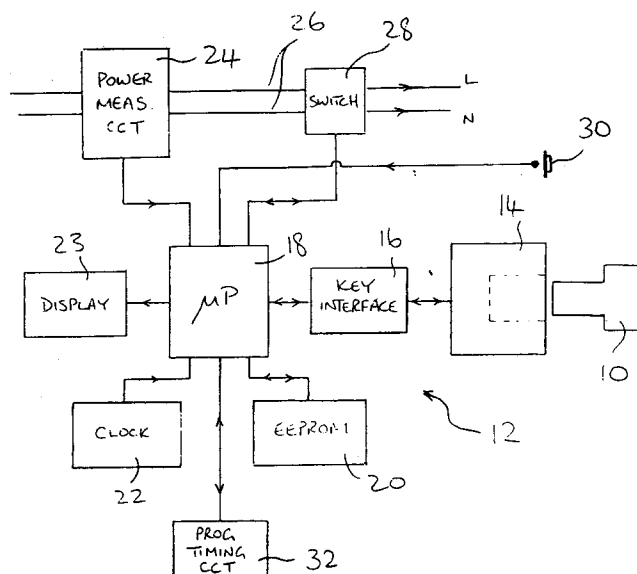
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(54) **Prepayment systems.**

(57) A prepayment system for controlling the supply of electricity, gas or water to a consumer comprises a metering or timing unit having a receptacle for receiving a prepayment token in the form of a key having a memory containing credit data. The metering or timing unit permits the supply of the com-

modity until the credit represented by the credit data in the key memory is exhausted. The system is provided with a push-button operated emergency supply facility, which permits the supply to continue for a predetermined time, typically four or five days, after the credit is exhausted.

**EP 0 545 549 A1**

This invention relates to prepayment systems permitting access to a commodity, typically electricity, gas or water, and is more particularly but not exclusively concerned with prepayment systems of the kind disclosed in our United Kingdom Patents Nos. 2 153 573 and 2 191 622.

The prepayment systems described in our United Kingdom Patent Nos 2 153 573 and 2 191 622 comprise a prepayment token in the form of key having a memory, a receptacle for the key (the receptacle typically forming part of a meter arranged to meter the commodity), and a circuit (also typically forming part of the meter) for allowing access to the commodity only when authorised by predetermined data read from the key memory. The data in the key memory is typically entered into the memory by inserting the key into a receptacle in a vending machine, normally located at the commodity supplier's premises, the machine then entering the data in return for payment, eg via a coin or bank note accepting unit forming part of the machine. The data typically includes credit data representative of the monetary amount paid, and data representative of tariff information and one or more unique identification codes.

In use, the circuit in the meter reads the data in the key memory, and permits supply of the commodity to continue until the credit represented by the credit data is exhausted, at which point it discontinues the supply, eg by means of a contactor in the case of an electricity supply or by means of a solenoid-operated valve in the case of a gas or water supply.

The systems manufactured by the Applicant under the aforementioned patents also include an emergency credit facility, which, when operated, effectively enters a fixed further amount of credit into the meter circuit and so restores the supply. This is to cater for the situation where the supply is discontinued at an inconvenient time, eg during the night, and a token with fresh credit data has not already been obtained. However, when the further (or emergency) credit is exhausted, the supply is again discontinued, and remains discontinued until a token with fresh credit data is obtained.

Although this emergency credit facility serves its purpose well in most circumstances, there remains the possibility that the supply could be discontinued at the start of a bank holiday period, when it may not be convenient or easy to obtain a token with fresh credit data quickly and when normal usage of the commodity may soon exceed the amount which would exhaust the fixed emergency credit. It is therefore an object of the present invention to provide a prepayment system which can more readily cater for this possibility.

According to one aspect of the present invention, there is provided a prepayment commodity

supply system comprising a prepayment token having a memory, a metering unit for metering the commodity, a receptacle for receiving the token and a circuit coupled to the receptacle and to the metering unit and responsive to credit data read from the token memory to discontinue supply of the commodity when an amount of the commodity determined by said credit data has been supplied, further comprising selectively operable emergency supply control means operative to permit the supply of the commodity for a predetermined time after said amount of the commodity has been supplied.

According to another aspect of the present invention, there is provided a prepayment commodity supply system comprising a prepayment token having a memory, a timing unit, a receptacle for receiving the token and a circuit coupled to the receptacle and to the timing unit and responsive to credit data read from the token memory to discontinue the supply of the commodity when a time period determined by said credit data has elapsed, further comprising selectively operable emergency supply control means operative to permit the supply of the commodity for a predetermined time after said time period has elapsed.

In preferred embodiments of either aspect of the invention, the emergency supply control means includes programmable means, for example a programmable read only memory (PROM), for determining said predetermined time. The programmable means is advantageously programmable to define times from zero to of the order of 99 days, and is conveniently preprogrammed by the commodity supplier to a time of four to five days.

The invention will now be described, by way of example only, with reference to the accompanying drawing, which is a simplified block diagram of a prepayment electricity metering system in accordance with the present invention.

The prepayment electricity metering system shown in the drawing is intended for installation in an electricity consumer's premises, and is closely based on the system described in our United Kingdom Patent No. 2 191 622 (which was in turn a development of the system described in our United Kingdom Patent No. 2 153 573).

Thus the system comprises a key 10, known as a customer key, containing a non-volatile memory such as an EEPROM, and a multi-rate electricity meter 12 having a receptacle 14 for receiving the key 10. The physical form of the key 10 and the receptacle 14 can be as described in our United Kingdom Patent No. 2 191 883.

Associated with the receptacle 14, within the meter 12, is a key interface circuit 16 coupled to a microprocessor 18. The microprocessor 18 is coupled in turn to another non-volatile memory 20

in the form of an EEPROM, to a clock 22, to an LCD display 23, to a power measuring circuit 24 connected in the consumer's electrical power distribution circuit 26 and to a switch unit or contactor 28 also connected in the distribution circuit 26.

The system operates substantially as described in our United Kingdom Patents Nos. 2 153 574 and 2 191 622. In particular, the consumer takes the key 10 to a vending machine, typically located in or near the electricity supplier's premises, and inserts the key 10 into a receptacle, similar to the receptacle 14, in the machine. The consumer then inserts coins or bank notes into the machine, which, having read the key memory, responds by writing credit data representative of the amount of credit purchased into the key memory, along with tariff data representative of the current electricity supply tariffs and pass number data indicative of how many times the key has been used. The key memory typically already contains identification data uniquely identifying the key, the meter in which it is to be used and the consumer, all of which identification data was entered when the key 10 was first issued to the consumer.

Having charged the key 10 with credit, the consumer returns home and inserts the key into the receptacle 14. This causes the microprocessor 18 to read the contents of the key memory, to perform checks to see if these contents indicate a valid key as described in United Kingdom Patent No. 2 153 173, and if they do, to write them into the memory 20. The microprocessor 18 also writes the current readings of the meter 12, which are stored in the memory 20, along with the time and date to which the readings relate, into the key memory, substantially as described in United Kingdom Patent No 2 191 622.

Once the microprocessor 18 has accepted the key 10 as valid, and has written the credit data into the memory 20, the contactor 28 closes to permit the supply of electricity. Supply is allowed to continue until an amount of electricity equal in value to the monetary amount represented by the credit data received from the key 10 has been supplied, whereupon credit is exhausted, and the contactor 28 re-opens to discontinue the supply.

The principal difference between the system of the present invention and the system of our earlier United Kingdom Patents Nos. 2 153 573 and 2 191 622 (aside from the storage of monetary credit and tariff information in the key memory rather than an amount of energy purchased) lies in the way in which an emergency supply of electricity is obtained once credit is exhausted.

Thus in the system of the present invention, an emergency supply of electricity is obtained by operating a push-button 30, which instead of permitting the emergency supply of a fixed amount of

electricity (or providing a fixed amount of credit, which would have a basically similar effect), closes the contactor 28 for a predetermined time period, typically four to five days. This is a sufficient length of time to cover most bank holiday periods of the kind where a bank holiday immediately precedes or follows a weekend, and therefore maintains the supply until the consumer is able at the end of the holiday period to re-charge the key 10 with credit.

Typically, the push-button 30 becomes operable just before the credit represented by the credit data read from the key 10 is exhausted. Thus, when a given relatively small amount of credit, say £1.00, is left, an audible alarm (not shown) sounds for about one minute. Additionally, a low credit warning symbol, eg a warning triangle, starts flashing in the display 23, and continues to flash until credit is exhausted (whereupon the supply cuts off and the warning symbol is displayed continuously). To avoid cut-off of the supply, the consumer can operate the push-button 30 at any time while the low credit warning symbol is flashing. In this case, an "emergency credit selected" symbol also starts to flash in the display 23, and emergency supply commences automatically (ie without interruption) as soon as the remaining credit is exhausted, and the emergency credit selected symbol is displayed continuously.

The microprocessor 18 is programmed to respond to subsequent operations of the push-button 30 while the meter 12 is already in the emergency supply condition to cause the display 23 to display the minimum amount of credit that must be purchased to pay for the electricity supplied by use of the emergency supply facility.

The duration of the predetermined period (in the absence of a re-charged key 10 being inserted in the receptacle 14 and so restoring normal supply) is determined by a programmable timing circuit 32, which in practice can be constituted by the microprocessor 18 and the clock 22 working in conjunction with part of the EEPROM 20. The electricity supplier typically pre-programs the circuit 32 (or the relevant part of the EEPROM 20) with the aforementioned time of four to five days, and the microprocessor 18 operates in conjunction with the clock 22 to re-open the contactor 28 once the pre-programmed time has elapsed.

The circuit 32 or its equivalent is re-programmable, for example by means of the key 10 or a special key, to any time between zero and at least 99 days. The former time effectively serves to cancel the emergency supply facility altogether, while the latter can be used to convert the system into a credit metering system, where the consumer receives a key when he pays his quarterly bill, and this key enables the next quarter's supply to be obtained simply by use of the push-button 30.

Many modifications can be made to the described embodiment of the invention.

For example, the key 10 need not have the physical form of a key, but can instead be constituted for example by a so-called "smart card" or by a magnetic card. Also, although all the elements of the drawing (except the key 10) are described as being contained within a single housing, they can if desired be contained in two separate housings, one containing the power measuring circuit 24 and the contactor 28, and the other containing the other elements (except the key 10).

Additionally, although the invention has been described in relation to an electricity metering system, it is equally applicable to other commodity metering systems, for example gas or water metering systems. In the case of gas and water metering systems, the power measuring circuit 24 and the contactor 28 are simply replaced by a flow measuring device and a solenoid-operated valve respectively, which are connected in flow series in a pipe through which the gas or water flows, and the electrical/electronic circuitry of the systems can if necessary be battery-powered.

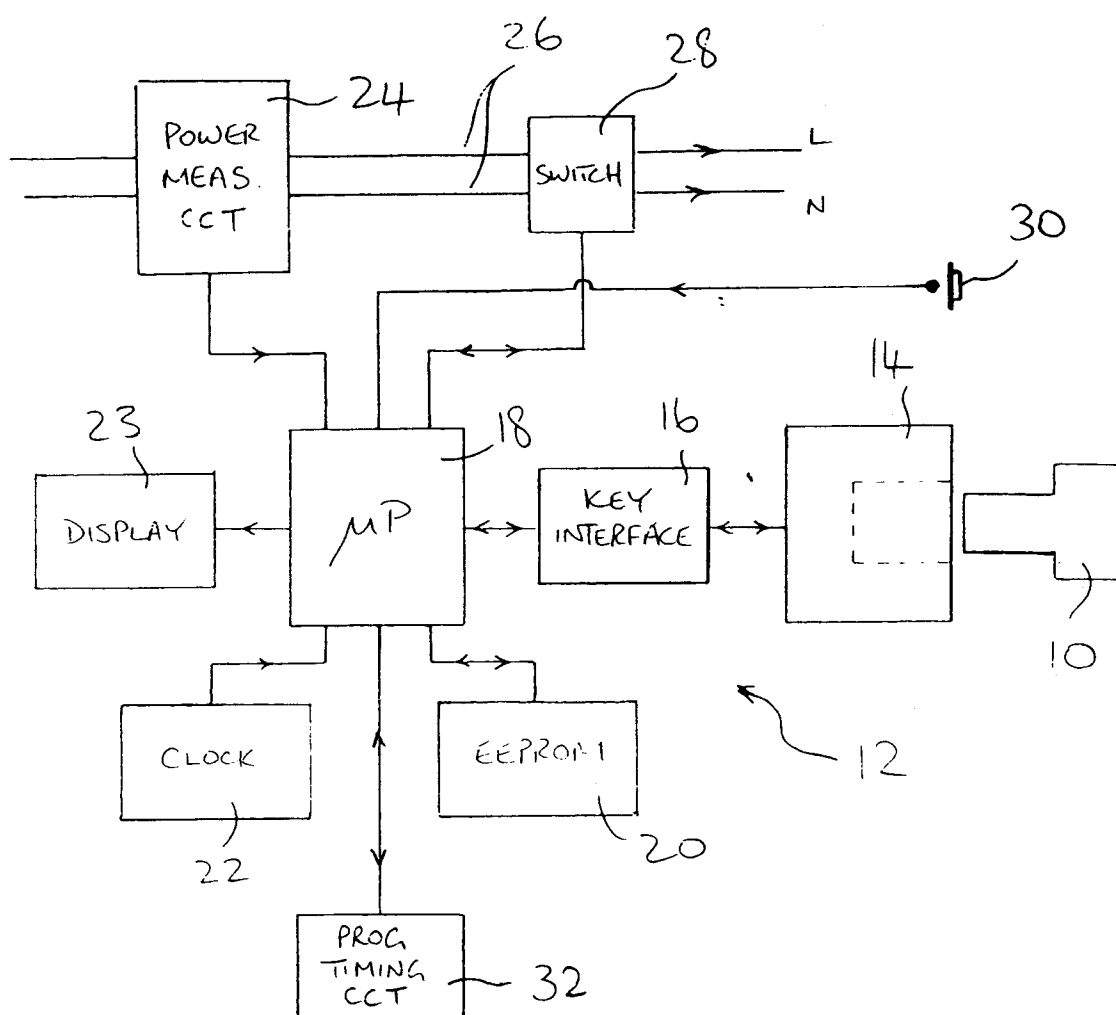
Finally, and particularly where the commodity is water, the commodity supply can be pre-paid for on a timed basis, rather than on a metered basis (ie a given amount of credit permits supply for say a week or a month). In this case, the metering function can still be retained, with the clock 22 and the microprocessor 18 serving additionally to provide the necessary timing function, and with the meter readings still being entered in the key 10 along with time and date information. However, in the limit, the metering function can be omitted altogether, eg by omitting the power measuring circuit 24 or the flow measuring device.

Claims

1. A prepayment commodity supply system comprising a prepayment token having a memory, a metering unit for metering the commodity, a receptacle for receiving the token and a circuit coupled to the receptacle and to the metering unit and responsive to credit data read from the token memory to discontinue supply of the commodity when an amount of the commodity determined by said credit data has been supplied, further comprising selectively operable emergency supply control means operative to permit the supply of the commodity for a predetermined time after said amount of the commodity has been supplied.
2. A prepayment commodity supply system comprising a prepayment token having a memory, a timing unit, a receptacle for receiving the

token and a circuit coupled to the receptacle and to the timing unit and responsive to credit data read from the token memory to discontinue the supply of the commodity when a time period determined by said credit data has elapsed, further comprising selectively operable emergency supply control means operative to permit the supply of the commodity for a predetermined time after said time period has elapsed.

3. A prepayment commodity supply system as claimed in claim 1 or claim 2, wherein the emergency supply control means includes programmable means for determining said predetermined time.
4. A prepayment commodity supply system as claimed in claim 3, wherein said programmable means comprises a programmable read only memory.
5. A prepayment commodity supply system as claimed in claim 3 or claim 4, wherein said predetermined time is programmable between zero and of the order of one hundred days.
6. A prepayment commodity supply system as claimed in any preceding claim, wherein said predetermined time is about four to five days.
7. A prepayment commodity supply system substantially as herein described with reference to the accompanying drawing.





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EUROPEAN SEARCH REPORT

Application Number

EP 92 31 0024

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X A	GB-A-2 208 955 (THE GENERAL ELECTRIC PLC) * abstract * * page 3, line 1-7 * * line 22 - line 35 * ---	1-3 4-6	G07F15/00
X A	EP-A-0 131 331 (MAINMET LTD) * page 2, line 32 - page 3, line 6 * * page 4, line 19 - line 28 * * page 6, line 20 - page 7, line 30; claim 8 * * page 5, line 10 - line 33 * ---	1,2 3-6	
A	US-A-4 731 575 (SLOAN) * abstract * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			G07F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 08 APRIL 1993	Examiner TACCOEN J-F.P.L.
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			