

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIRECCIÓN DE NUEVAS CREACIONES

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HUMBERTO RUBIO CAMACHO

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



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Act. 519 TRASLADOINFORME Folios: 1

ASUNTO	Radicación	07-33659
	Trámite	011
	Evento	378
	Actuación	430
	Oficio	06679
	Folios	016

Patente de Invención	☒	Patente de Modelo de Utilidad	☐
Vía Nacional	☐		
Vía PCT (fase nacional)	☒	Cap.I	☒
		Cap. II	☐
No. Sol. Internacional	PCT/MX2005/000088		
Fecha de Presentación Internac.	2005-09-30		

Como resultado del examen de fondo, realizado con fundamento en el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica:

1. Documentos estudiados

Descripción: Folios: 76 a 98 memorial del 2009-07-27

Reivindicaciones: Folios: 99 a 100 memorial del 2009-07-27

Dibujos: Folios: 42 a 46 como se presento originalmente.

Rta. del solicitante: Folios: 73 a 101

2. Objeto de la invención

La presente solicitud se titula "SISTEMA DE PREPAGO PARA MEDIDORES DE ENERGÍA ELÉCTRICA POR TARJETA INTELIGENTE SIN CONTACTO CON DISPOSITIVO AUTOMATICO DE CORTE DE SUMINISTRO", Folio N° 1.

La presente solicitud se refiere al uso de un medidor de una sola pieza, cubierto y sin contacto con el exterior, que incorpora un sistema de prepago y un método para controlar el suministro de energía eléctrica y obtener información del medidor mediante tarjetas inteligentes sin contacto.

De otra parte, el pliego reclama un sistema de prepago y control de suministro de energía eléctrica utilizando una tarjeta inteligente sin contacto para medidor electrónico, relacionado en las reivindicaciones 1 a 5.

El objeto de la solicitud definido anteriormente se clasificó en la IPC G06F 17/60,

3. De la solicitud de Patente

3.1. Descripción (artículo 28 D. 486)

El contenido de la descripción calificada no permite identificar de forma clara y completa la forma de ejecución de la mejora que se pretende proteger. La descripción se enfoca en presentar algunos elementos y el uso o efecto del uso de los mismos pero no se expone la forma de ejecutar (fabricar) el sistema reclamado.

Por otra parte, en la nueva descripción se corrigieron los errores con respecto a la confusión de la figuras, sin embargo en el folio 87 sigue apareciendo una referencia a la figura 2 que no es clara.

Como es bien sabido, es deber del solicitante proporcionar una descripción que revele la mejor manera que conozca para ejecutar (fabricar) la invención, lo cual supone que en esta se exponga claramente como se disponen y/o se acoplan los diferentes componentes del sistema de energía prepago, de modo que una persona capacitada en la materia pueda llevar a cabo el invento y evaluarlo.

La descripción presentada se limita a enumerar unos componentes del sistema tales como un punto de venta, un servidor, unos módulos de seguridad y demás. Pero no se indica en ninguna parte cual es la relación estructural o funcional entre estos componentes, solo se dan indicaciones relacionadas con el procesamiento de datos tales como: *"los módulos de seguridad 24 y 25 proporcionan funciones de encriptado y desencriptado para la transmisión de datos entre el servidor 21 y la terminal de punto de venta 20"*, características que no divulgan la manera de ejecutar la invención, de manera que no es posible evaluar el aporte de la invención al estado de la técnica.

La oficina deja en claro que, el solicitante está obligado a divulgar la invención pues de lo contrario la patente podrá ser denegada. Dicha obligación se considerará cumplida, cuando la descripción contenga todas las indicaciones, que necesita la persona de nivel técnico medio, para ejecutar la invención, en especial, aquellas indicaciones que no estén comprendidas en el estado de la técnica.

Puesto que la información de la descripción calificada **no** permite ni evaluar ni ejecutar la invención, no cumple los requisitos exigidos por el Art. 28 de la decisión.

3.2. Reivindicaciones (artículo 30 D 486)

Las reivindicaciones calificadas no permiten establecer cual es la contribución técnica de la solicitud al estado del arte, dado que tales reivindicaciones se redactaron en términos de uso y de resultados a alcanzar.

La reivindicación 1 no es clara porque se limita a enumerar una serie de componentes de un sistema de prepago y control de energía, sin establecer las relaciones estructurales o funcionales existentes entre tales componentes. Exponer características como un microcontrolador para controlar, o una tarjeta de control prepago encargada de detectar y validar una tarjeta prepago, **NO** son características funcionales, simplemente se esta relacionando el uso de estos componentes, más no la relación funcional entre ellos.

De otra parte, es importante recalcar que el sistema de prepago y control, es un sistema de carácter electrónico, de manera que debe definirse como tal, es decir, este sistema debe estar definido por medio de características estructurales, del tipo:

conexiones, acople, cableado y demás. Características que permiten establecer el verdadero aporte de la solicitud y las diferencias de ésta con el estado del arte.

Las reivindicaciones dependientes 2 a 5 no aclaran ni delimitan ninguna característica técnica del sistema prepago y de control de energía, por cuanto se refiere a usos resultados a obtener tales como proporcionar información, detectar una tarjeta o abrir o cerrar un relevador, características que al no tener carácter técnico NO son permitidas.

Por los motivos anteriores, el pliego reivindicatorio calificado no cumple con los requisitos exigidos en el artículo 30 de la Decisión.

4. Determinación del Estado de la Técnica

Considerando que la solicitud reclama prioridad del 12 de Octubre de 2004, se buscaron documentos del estado de la técnica relacionados, con fecha de publicación anterior a esta. Se realizó búsqueda de documentos relevantes dentro del estado de la técnica, entendiendo como estado de la técnica la definición provista en el Art. 16 D 486, y las excepciones fijadas en el Art. 17 de la misma.

No obstante, la solicitud presenta problemas de claridad y usos, se realizó una búsqueda parcial la cual se complementara una vez se realicen los ajustes a la solicitud.

Se encontró como anterioridades los documentos relacionados a continuación que pueden afectar la patentabilidad del objeto de la presente solicitud

N°	Documento*	Título	Fecha de publicación
D1	WO99/58987	METHOD FOR TRANSMITTING AND STORING VALUE AND VALUE STORE ELECTRIC POWER METER USING THE SAME	1999-11-18
D3	US6529883	PREPAYMENT ENERGY METERING SYSTEM WITH TWO-WAY SMART CARD COMMUNICATIONS	2003-03-04

*los documentos mencionados se anexan al expediente

5. Análisis de patentabilidad (artículo 14 D486)

En cumplimiento del Art. 14 D486 se procedió a evaluar los requisitos de novedad, nivel inventivo y aplicabilidad industrial, con el fin de establecer la patentabilidad de la invención reivindicada de la solicitud en estudio.

5.1. Novedad (artículo 16 D486)

El requisito de novedad se evaluó por comparación entre lo solicitado y los documentos encontrados en el estado de la técnica y que se relacionan con el objeto reivindicado

La presente solicitud de patente se refiere a un sistema de prepago y control de suministro de energía eléctrica caracterizado porque comprende:

- Una tarjeta de medición de energía eléctrica
- Una tarjeta de control de prepago sin contacto y corte de suministro de energía

- Un dispositivo de corte de suministro de energía
- Una antena
- Donde la tarjeta de medición comprende un modulo de medición de energía, un microcontrolador con una memoria flash.
- Una pantalla de cristal líquido
- Una fuente de alimentación independiente
- Un elemento lector escritor
- Un generador de radiofrecuencia
- Un microcontrolador
- Un detector de cruce por cero de voltaje CA
- Un elemento de corte de suministro
- Una fuente de alimentación de la tarjeta de control

La anterioridad D1 se refiere a un medidor de potencia eléctrica en el cual el servidor de un proveedor de energía eléctrica transmite un valor que es almacenado en un modulo de almacenamiento de valores o en una tarjeta inteligente lo que permite adelantar los pagos sin requerir de una medida de energía. El sistema se caracteriza por (ver figura 5):

- Un circuito de medición de consumo de potencia eléctrica **9**
- Una tarjeta de control de prepago formada por una unidad reprocesamiento **162**, un modulo de acceso seguro **164** y un modulo de almacenamiento de valor **166**.
- Un relee de corte de energía **1**.
- Una pantalla de cristal líquido **17**.
- Una fuente de alimentación independiente **14**.
- Un elemento lector escritor de tarjetas inteligentes **12**.
- Una unidad central de procesamiento **162**.
- Un sensor de consumo de energía **3**.

Como se puede ver la anterioridad D1 comprende los mismos elementos reclamados en las reivindicaciones de la solicitud.

La anterioridad D2 se refiere a un sistema prepago de medición de energía que tiene un tarjeta inteligente de comunicaciones que tiene dos vías, la cual transporta datos desde el proveedor del servicio hasta la terminal del usuario y también lleva información desde la terminal de usuario al proveedor del servicio. Este sistema comprende los siguientes elementos:

- Un modulo de medición de energía eléctrica **60** (Fig. 5)
- Una tarjeta de control de prepago y corte de suministro de energía **40** (Fig. 4)
- Un dispositivo de corte de suministro de energía **65** (Fig. 5)
- Donde el modulo de medición comprende un controlador **63** y una memoria **64** (Fig. 5).
- Una pantalla **42** (Fig. 4)
- Una fuente de alimentación independiente **72** (Fig. 5)
- Un lector escritor de tarjetas **41** (Fig. 4)
- Un controlador de la tarjeta de control **46** (Fig. 4)
- Un controlador del elemento de corte de suministro **63** (Fig. 5)
- Una fuente de alimentación de la tarjeta de control **50** (Fig. 4)

Como se puede ver el documento **D2** también contiene todos los elementos característicos de la invención afectando la novedad de la misma.

Las reivindicaciones 2 a 5 se refieren a usos de los elementos anteriores, de manera que también se ve afectadas por la materia especificada en los documentos D1 y D2 del estado de la técnica.

En conclusión, dados los motivos expuestos anteriormente, se considera que la solicitud no cumple con el requisito de novedad.

6. Conclusión:

Los requisitos de patentabilidad de la presente solicitud se encuentran afectados así:

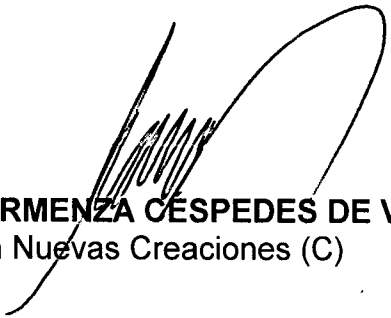
N°	Documento N°	Reivindicaciones afectadas	Requisito que afecta
D1	WO99/58987	1 a 5	Novedad
D3	US6529883	1 a 5	Novedad

Si ha pesar de todo lo dicho anteriormente el interesado considera que su solicitud tiene algo patentable, deberá presentar una descripción y una o más reivindicaciones que definan la materia que se desea proteger, en forma clara, concisa y acorde a lo que establece la ley.

Se recomienda, que tenga en cuenta que el replanteamiento de esos apartes NO podrá implicar una ampliación de la protección que correspondería a la divulgación contenida en la solicitud inicial, de acuerdo a lo que establece el artículo 34 de la Decisión 486.

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta días contados a partir de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única N° 10 de 2001.


ALIX CARMENZA CÉSPEDES DE VERGEL
Directora Nuevas Creaciones (C)

El anterior requerimiento fue notificado por fijación en lista, de fecha
_____ 21 MAYO 2010

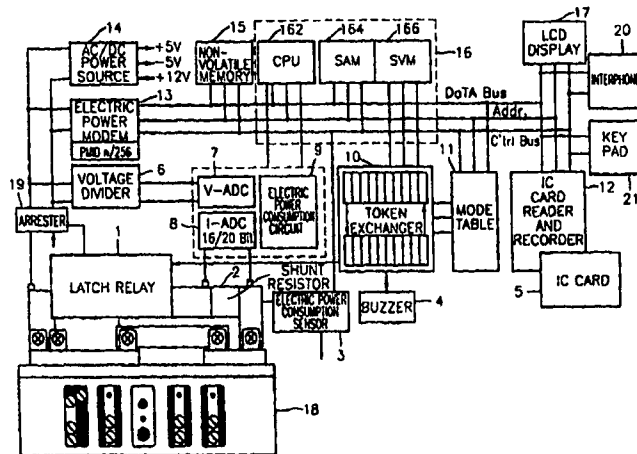
CONCEPTO TÉCNICO No. 1667	EXAMINADOR TÉCNICO Código No. 202082
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : G01R 1/30, 11/00, 11/02, 11/04, 11/32, 21/133, 22/00		A1	(11) International Publication Number: WO 99/58987
			(43) International Publication Date: 18 November 1999 (18.11.99)
(21) International Application Number: PCT/KR99/00233		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 12 May 1999 (12.05.99)			
(30) Priority Data: 1998/16964 12 May 1998 (12.05.98) KR			
(71)(72) Applicant and Inventor: TAK, Seung, Ho [KR/KR]; 4-105 Plaza Apt., Kil-dong, Kangdong-gu, Seoul 134-010 (KR).			
(74) Agent: LEE, Young, Pil; The Cheonghwa Building, 1571-18 Seocho-dong, Seocho-gu, Seoul 137-073 (KR).		Published With international search report.	

(54) Title: METHOD FOR TRANSMITTING AND STORING VALUE AND VALUE STORE ELECTRIC POWER METER USING THE SAME



(57) Abstract

A value store electric power meter is provided. The server of an electric power supplier, an electric power seller, or an electric power reseller transfers value through an electric power line through a built-in electric power modem, stores value received through the electric power modem inside the value store electric power meter in a value store module, reduces a value according to the amount of electric power consumption, omits processes of visually reading a meter, calculating the amount of use, printing and mailing a bill, settling up, and paying an uncollected amount and arrears. Accordingly, it is possible to save electric power supplying costs, to reduce the electric power rate by a user, and maximizing the profit of the electric power supplier. The electric power meter is used for IC card payment type gas and water meters in which the IC card having credit value is transferred and stored in an off-line state. Accordingly, the electric power value and the added value measurement is easily and rapidly performed. Therefore, it is convenient for the user and remarkably reduces all the costs.

period of hours, days, months, or seasons.

When a circuit breaker breaks the supply of electric power due to the stored credit value becoming exhausted, a break by over current, a break in a special case, or the use of the electric power by tapping a
5 power source at the front end of the meter, the abnormal use of electric power, is detected by a method of checking the presence of a load voltage.

The credit value is transmitted and stored in the electric power meter, the gas meter, the water meter, and the calorimeter via the power
10 line modem. The electric power credit value is stored in the SVM and the remaining values are stored in the respective regions of the IC card electronic purse.

Hereinafter, the structure and operation of the electric power meter, made considering the above items, will be described in more detail with
15 reference to FIGs. 5 through 7.

FIG. 5 shows the electric power meter which transmits and stores value information through the electric power line modem. In FIG. 5, a latch relay 1 is an on/off latch type relay switch for breaking the supply of the electric power. A shunt resistor 2 measures an alternating current
20 (AC) by a manganese (Mn) resistance of 0.1mΩ. When the latch relay 1 is broken, a power consumption sensor 3 senses normal use when the output of the sensor is "0" and that terminals 1s and 1L are bypassed and the electric power is surreptitiously used when the output of the sensor is "1". A buzzer 4 requests a new token of credit value to the SVM after the
25 balance of a token exchanger 10 is consumed and generates an audible alarm, thus guiding the credit value transmission and storage by an electric power user. A credit value/added value storage IC card 5 registers the card serial number (CSN) of a subscriber IC card on a management database by the master key of the electric power re-seller
30 managing the credit value store electric power meter according to the present invention and checks the presence of a registered legal CSN when the server is requested to transmit credit value, thus preventing the

illegal use of electric power.

A voltage divider 6 adjusts 117, 220, and 240V AC voltages to be within the input voltage range of a voltage analog to digital converter (V-ADC). The range of the voltage is selected by the ratio of two resistors which are serially connected. A V-ADC 7 is a circuit for converting an AC voltage analog signal into a 16 bit digital signal. A current analog to digital converter (I-ADC) 8 is a circuit for converting an AC current signal which flows through the shunt resistor 2 into a 16 or 20 bit digital signal. An electric power consumption operating circuit 9 calculates the electric power (Watt) by multiplying the digital signal of the V-ADC 7 by the digital signal of the I-ADC 8 and converts the multiplication result into a pulse number and width signal. The electric power consumption operating circuit 9 compares the phase of the voltage with the phase of the current, calculates an angle by which the two phases are different, and outputs a phase difference as a signal, thus applying differential charges to the things which temporarily use induction load. The token exchanger 10 reduces tokens according to the amount (Watt/hour) of the electric power consumed per unit time, requests new tokens from a ten unit token tank when the tokens inside the token exchanger 10 are consumed, and reduces the new tokens according to the amount of power consumption. If the ten unit token tank is consumed, 100 unit tokens are requested for the SVM to be described later and the 10 unit token tank is filled again. The tokens requested for the SVM 166 can be received through the authentication process of the SAM 164. An RTC and power consumption table 11 performs a differential operation of multi-step electric power charges according to an electric power supply and demand situation of 50%, 75%, 100%, 150%, and 200% based on a real time clock comprised of year, month, day, hour, minute, and second (YYMMDDHHMMSS).

An IC card reader and recorder 12 conforming to ISO 7816 is a communication port comprised of eight terminals defined by ISO 7816 Part 2 including Vcc, Cik, DIO, Reset, and Gnd for synchronously and asynchronously communicating with the IC card. Multi-purpose credit

values for things such as electric power, gas, water, hot water, heat energy, and pay-TV are recorded on one IC card by inserting a normally issued IC card into the electric power meter in an on line/off lines state. After recording the value transmitted from the gas service server through
5 the value transmit and store electric power meter on the IC card, the IC card is taken out, inserted into the gas meter and the value information is transmitted to the gas meter, thus reducing the value information on the card according to the amount of gas use. Accordingly, the value transmit and store electric power meter can be operated in an off-line state.

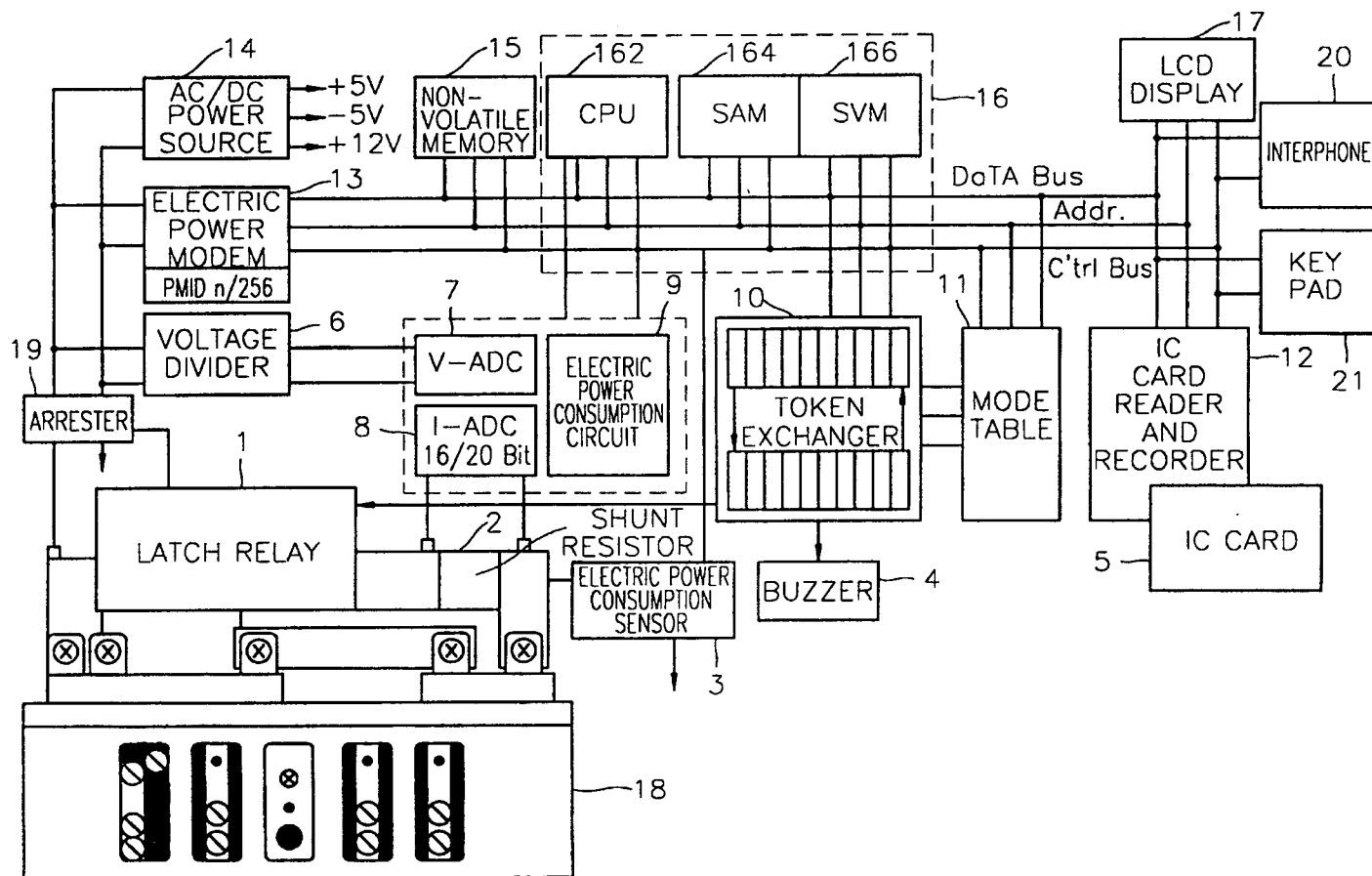
10 A power line modem 13 performs data communication through the power line. Each modem is set by one among 256 power line modem ID addresses (PLMID). An AC/DC power source 14 supplies an operation voltage required by the value store electric power meter according to the present invention. The three byte ID which is an intrinsic number of the
15 value store electric power meter is recorded on a ROM during production. A non-volatile memory 15 comprised of a flash memory records an electric power consumption situation during a certain period, i.e., the details of the electric power consumption for 24 hours are found by recording the amount of electric power consumption of the value store
20 electric power meter as 16 bit information every sixty seconds, the details of the electric power consumption for a week by adding seven total amounts of the daily electric power consumption together, and the details of the monthly electric power consumption by adding thirty total amounts of the daily electric power consumption to each other, monitors the
25 surreptitious use of electric power or the abnormal consumption of electric power from a remote distance, and performs the electronic sealing. A scrambled bus 16 including a central processing unit (CPU) 162, a secure access module (SAM) 164 for keeping an encryption key and an encryption algorithm for storing credit value, and a store value module
30 (SVM) 166 for storing credit value, prevents the fabrication and use of credit value information, and hacking and excludes a cryptographical attack. A liquid crystal display LCD 17 displays the balance of the credit

value, a transmission state, a real time electric power consumption situation, and an accumulative electric power consumption situation so as to be distinguished visually by a user. A power line input and output terminal 18 is comprised of 1s, 2s, 2L, and 1L for connecting the input
5 and output lines of the electric power to each other and a cover for preventing physical tapping. An arrester 19 is a circuit for absorbing lightning or a surge voltage.

An electric power meter for measuring electric power of a particular kind was described above. However, the electric power meter according
10 to the present invention can measure the electric power of at least two kinds by including the voltage divider 6, the V-ADC 7, the I-ADC 8, the latch relay 1, and the shunt resistor 2 according to the kind of the electric power. Namely, when the voltage divider, the V-ADC, the I-ADC, the latch relay, and the shunt resistor are combined so that at least two kinds
15 of power sources with different voltages can be selectively or simultaneously used, the respective amounts of current being additionally measured and operated.

The operation of the value store electric power meter having the above structure is described as follows. As mentioned by the electric
20 power supplier or the electric power re-seller, the credit value from the host is stored in the SVM 166 of each terminal through the power line modem 13 using the credit value store method, each electric power meter calculates charge according to the amount of electric power consumption operated on by the electric power consumption operating circuit 9,
25 compares the calculated charge with the balance of the credit value information stored in the SVM 166, and calculates the charge through the token exchanger 10. When a balance of not more than a certain amount is left in the SVM 166, the user is informed of the balance state by sounding a buzzer. When the balance is insufficient, the credit value is
30 transmitted from the host to the SVM 166 by the above-mentioned credit value store method or the power supply is broken by operating the latch relay 1. The credit value information can be stored in the SVM 166 by

FIG. 5



5/6



US006529883B1

(12) **United States Patent**
Yee et al.

(10) **Patent No.:** US 6,529,883 B1
(45) **Date of Patent:** Mar. 4, 2003

(54) **PREPAYMENT ENERGY METERING
SYSTEM WITH TWO-WAY SMART CARD
COMMUNICATIONS**

6,300,881 B1 10/2001 Yee et al.

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Primary Examiner—Edward R. Cosimano

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(73) Assignee: **Motorola, Inc.**, Schaumburg, IL (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/378,357**

(22) Filed: **Aug. 20, 1999**

(51) Int. Cl.⁷ **G06F 17/60**

(52) U.S. Cl. **705/63; 705/400; 705/401**

(58) Field of Search **705/17, 63, 400,
705/412**

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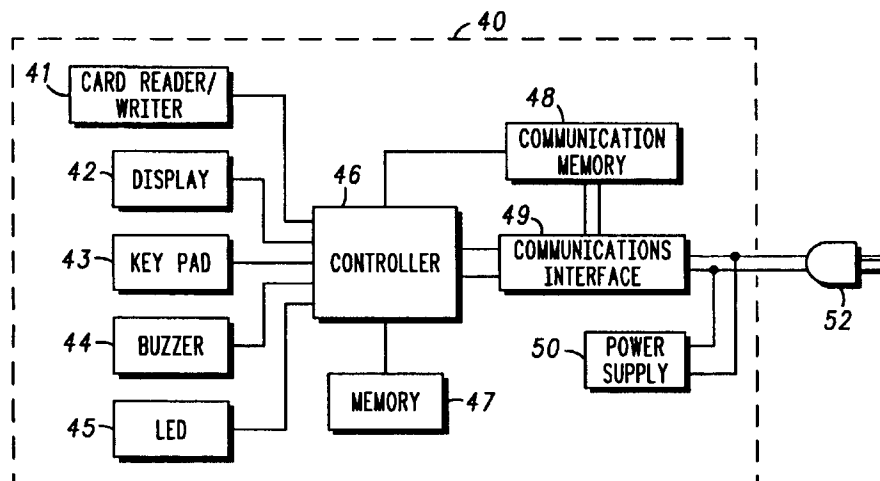
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(57) **ABSTRACT**

A pre-payment energy metering system uses two-way smart card communications. Secure power line carrier communications are provided at the consumer locations communication between a customer terminal and the utility meter. Two-way secure communication of data is provided through the use of a smart card or memory card which conveys data from the utility service provider to the customer's terminal and also conveys information from the customer's terminal back to the utility. The pre-payment power system of the present invention allows consumers to pay for electricity prior to consumption through the use of the smart card which is loaded with funds at a fully automatic point-of-sale (POS) terminal or at the utility service providers staffed customer service center. Back office software interfaces between the POS terminals and customer service centers, and utility service providers customer information systems.

22 Claims, 2 Drawing Sheets



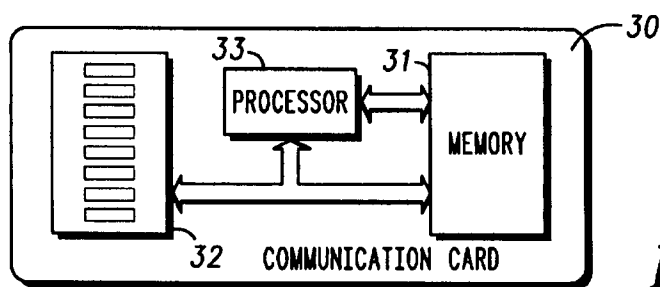


FIG. 3

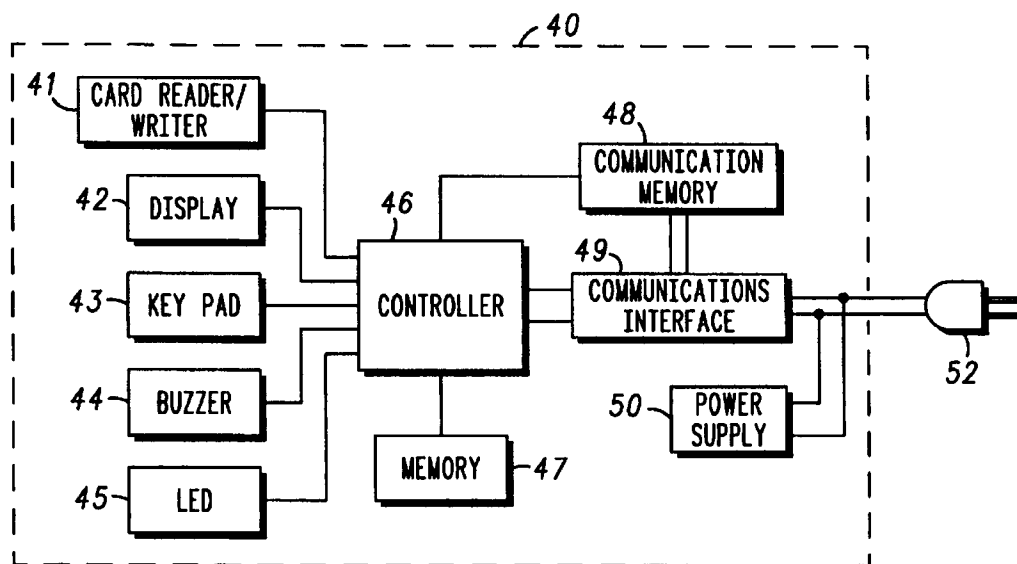


FIG. 4

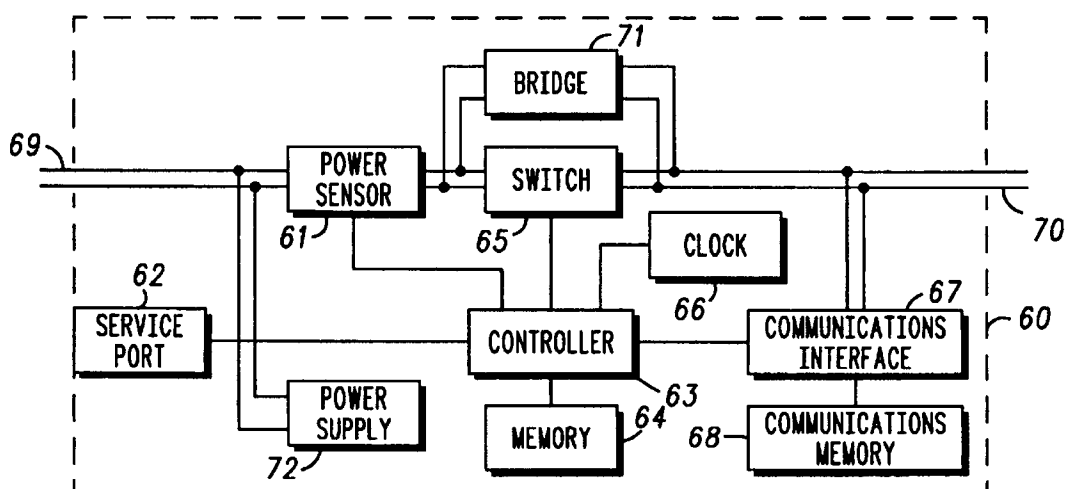


FIG. 5

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serves two purposes: providing power to consumer terminal and providing a communication path with utility meter 12.

FIGS. 1 & 2 also illustrate service terminal 26 which is used by a service technician to diagnose, among other things, utility meter 12 and update software in utility meter 12 and customer terminal 11. Link 27 may be an infrared link, a direct cable connection or an RF link, or alternatively be implemented via a power line carrier communications.

Prepayment energy metering system preferably includes point-of-sale (POS) terminals such as automatic teller machine (ATM) 16 and payment terminal 21 which may be located within a utility office, or utility service provider's office building 20. ATM 16, prepayment terminal 21 and teller terminal 22 interface with the utilities billing system 23 which keeps track of consumers accounts and information stored in the utility data base 24. Connection 17 is an interface between ATM 16 and utility billing system 23.

Security module 19 provides security for communications between utility billing system 23 and utility data bases 24. Security module 19 also provides security for transactions with communication cards for communications with utility meters. Preferably, encryption and decryption functions are provided by security module 19 which, for example, include key management for public and private keys. Security module 19 also provides the encryption and signature information written on the communication cards. Security module 19 also provides for decryption and validation of information communicated via the communication cards between and meters and the utility.

Service terminal 26 is comprised of a computer system, which is a primary tool for a service technician for installing, servicing, calibrating and communicating with utility meters 12. The service terminal 26 reads and writes data items from a memory device such as a disk. The service terminal, among other things, retrieves transaction history and meter health information from utility meter 12 and can store this information on its disk. The information on this disk may be transferred to the utility service provider either by coupling the service terminal directly to the utilities information systems or by communicating over a LAN or Internet type of system. LAN terminal 25 may be used for this purpose. In accordance with the preferred embodiment of the present invention, an access pass is issued when a service technician receives a work order. The access pass preferably remains valid for a predetermined period of time to limit the time period available to access a meter. The access pass is preferably digitally signed with a system private key. This reduces risk of a lost or stolen service terminal and reduces system vulnerability to theft of services. The access pass is consumed when a service technician logs onto a particular utility meter. In another embodiment, the access pass preferably comprises a sequential number and an expiration date, both of which are signed digitally with the systems private key. The utility meter stores the sequential number and verifies that this number, among other things, is greater than a previously used access number. Other security measures may also be included for service terminal access and communications with the meter. The service unit enables a service technician to read or change a meter's identification number, a prepayment identifier, a utility account number and rate tables. Additionally, the service terminal enables the service technician to change credit on the meter, switch on or off the meter, read kilowatt consumption, calibrate the meter, change the meter's mode from prepayment mode to non prepayment mode, read tamper information from the meter, etc. Service terminal 26 also allows a service technician to place the meter into clone mode which is used for replacement of a meter.

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ATM 16 accepts, reads and writes data to and from a communication card specified for the utility metering system as instructed by back office software. ATM 16 accepts dollar amounts provided by the ATM and communicates this transaction back to the utility service provider upon approval by back office software. The information is written back to the communication card, preferably with the security features discussed above. A customer information manager coupled with utility billing system 23 provides for the administrative functions of the system and provides access authorization by password and preferably retains a record of system access.

In the alternate utility embodiments, meter 12 is, for example, a gas meter or water meter, or other utility meter coupled by a link to customer terminal 11. In this embodiment, the link may be any suitable link such as an RF link, a power line carrier link or a combination thereof.

FIG. 3 illustrates a simplified functional block diagram of a communication card 30 suitable for use in accordance with a preferred embodiment of the present invention. Communication card 30 provides for two-way communication of information, for example between utility office 20 (FIG. 2) and meters 11 (FIG. 1). Communication card 30 comprises a memory element 31 and interface element 32 coupled to memory element 31. This communication card may be a commercially available memory card or smart card and is preferably of a size and shape consistent with common credit cards. In accordance with the preferred embodiment of the present invention, the card is of format ISO 7816-1 and 2, and may also be a memory only type card described by ISO 7816-3 through 7816-6. Preferably, interface element 32 has gold contacts for interfacing with a card reader and preferably includes a bus type connection to memory element 31 comprised of bus lines. In accordance with the preferred embodiment of the present invention, the lines include a clock line, a data line, a power line and a ground line. Two way data transfer is accomplished preferably through the use of one data line. Memory element 31 is preferably comprised of a semiconductor memory chip such as flash memory or EE PROM. However, other types of memory are suitable.

In accordance with another embodiment of the present invention, communication card 30 additionally comprises processing element 33.

FIG. 4 illustrates a simplified functional block diagram of customer terminal 40 in accordance with a preferred embodiment of the present invention. Customer terminal 40, for example, is suitable for use for customer meter terminal 11 (FIG. 1). Customer terminal 40 includes card reader and card writer element 41, which accepts cards such as communication card 30 described in FIG. 3. Card reader and writer element 41 provides information to and from communication card from controller 46. Customer terminal 40 is preferably suitable for wall mounting by a homeowner, or alternatively, placement on a flat horizontal surface. Externally, display 42, keypad 43, visual warning 45 and a card reader slot associated with card reader and writer 41 are accessible to the consumer. When a communication card is inserted into card reader and writer 41, the data is transferred to controller 46, modulated and packetized by communications interface 49 and transmitted to a utility meter via power line carrier communications. Communications interface 49 preferably provides for power line signaling in accordance with appropriate communications regulations, for example, FCC Sec. 15.107 entitled "Limits for Current Carrier Systems". An IP address is specified for the meter so that the appropriate meter is addressed. Communications memory

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48 stores specific information required for the power line communications and addressing the particular meter.

Communications interface 49 also receives data over power line from the meter, demodulates and depacketizes the data, transfers the information to controller 46 which may write it to a communication card which may be inserted in card reader/writer element 41. In accordance with the preferred embodiments of the present invention, some data communicated with the meter may be in encrypted form or signed. Information from an inserted communication card and information received over the power line carriers from the meter may also be displayed on display 42. This is discussed below.

A re-chargeable battery, not shown, preferably provides a backup power supply in the event power supply 50 is not coupled with electricity, for example in the case when electricity is turned off at the consumer residence and is not available through plug 52. In this manner, a consumer terminal may be used to switch on electricity even though electricity is not present at the consumer terminal. Additionally, when power is turned off at the meter switch, the rechargeable battery supplies power to communicate with the meter. Buzzer 44 and LED 45 provide a consumer with a warning, for example, when power may be turned off for various reasons, or may indicate other problems with the customer terminal or meter, including when the battery may become discharged. Memory 47 stores messages and provides among other things for buffering for controller 46 and may also include stored application programs in a non-volatile portion of memory. Although memory 47, controller 46, communications memory 48 and communications interface 49 are shown as separate functional elements, it is understood that they may be combined in one or more elements comprised of both hardware and software.

FIG. 5 illustrates a simplified functional block diagram of meter 60 in accordance with the preferred embodiment of the present invention. Meter 60, for example, is suitable for use for meter 12 (FIG. 1). Meter 60 includes power sensing element 61, disconnect switch 65, service port 62 and communications interface 67 coupled to a controller 63. Service port 62 is preferably an ANSI type two optical port for communicating with service units or service terminals discussed above. Communications interface 67 provides for communications over an electric power line with consumer terminals, such as consumer terminal 40 illustrated in FIG. 4.

Data received over power lines 70 which are internal to a consumer residence are demodulated and depacketized by communications interface 67 in accordance with the information stored in communications memory 68. Preferably, the packetized data has an IP address associated with the particular meter. Controller 63 receives data in parallel form from communications interface 67 preferably in 12 byte packets and may store this data in memory 64. Controller 63, among other things, decrypts the data in accordance with decryption techniques and preferably uses a key unique to the meter. Controller 63 also verifies a signature associated with the information. In accordance with the preferred embodiment of the invention, the data was previously signed by the utility service provider when stored on the communication card. The signature is preferably verified with a public key of the utility stored in a memory such as memory 64. The received data preferably includes a transaction ID which is checked by controller 63 with prior transaction ID's and determines if this data has been acted upon previously. If the data has already been acted upon, controller 63 may determine this to be an invalid transaction and store this

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information back to the communication card or provide this information to the consumer using display 42, for example. Once the data has been decrypted and signatures verified, controller 63 may also match the account number and consumer ID from the card with information stored in memory 64 and when this information matches, the information such a dollar credit amount may be credited to the meter and stored in memory 64.

In accordance with the preferred embodiments of the present invention, a card identifier, account number, utility ID, consumer name, consumer ID and meter location ID are all stored on the communication card and digitally signed. This information may be stored in encrypted form. In accordance with the preferred embodiment of the present invention, a digital certificate is also stored on the card and transferred from the back office to the meter which is used to validate the keys. Additionally, two public keys and public key dates are provided on the communication card and transferred to the meter. The public keys are preferably encrypted and signed and the dates indicate the effective date upon which these keys should be used. Rate schedules, public key ID, point-of-sale ID, and other information may also be provided on the communication card.

In accordance with the preferred embodiment of the present invention, consumer data and transaction data which include a balance amount are stored on the communication card and signed. A utility rate schedule may also be provided, and implemented by the meter. In accordance with the preferred embodiment of the present invention, an advertising block of information is also provided on the communication card. This is discussed in more detail below.

Controller 63 also provides information for transmission back to a customer terminal 40. This information preferably comprises a meter read-time clock stamp, a total kilowatt hours consumed, an amount of remaining credit which is preferably encrypted, a meter health block which includes tamper information, a list of the last five transactions, and includes any loss of power events. This information also may include a key status indicating which key is being used. This entire block of information is preferably signed with a digital signature for verification at the back office.

In addition to information sent to the back office via the communication card, meter 60 also transmits information for displaying at consumer terminal 40. Information sent from the meter to the customer terminal for display is preferably sent in clear form and not encrypted. In accordance with the preferred embodiment of the present invention, a standard display message is sent on a regular basis, for example, every ten minutes, or alternatively the consumer terminal may request a message. The information in the display message may include current instantaneous electricity consumption, an amount consumed during the last month or the last day or month to date information which may be both in dollar amounts or kilowatt hour amounts. The display information also may include the amount of dollars remaining and the number of days remaining based on prior usage and the amount of credit available. The display information is stored in memory 64, packetized and modulated through communications interface 67, transmitted over internal power line 70 and received by customer terminal 40. Coding in the display data indicates that the display information is for displaying and furthermore indicates an IP address associated with the particular customer terminal 40.

Clock 66 is preferably a real-time clock, which may use the 60 Hz present on the electric line, or an internal crystal

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when power is not available. A similar clock may alternatively be located in customer terminal 40. Although not shown, clock 66 is preferably coupled to a rechargeable battery for backup when power is not available. Switch 65 is preferably a 200 amp relay controlled by controller 63. Communication data bridge 71 provides for data communication when switch 65 is open. Power sensor 61 is coupled to power lines 14 via leads 69 and provides, among other things, instantaneous and average power measurements while controller 63 stores the cumulative power, remaining power credit, historical power consumption, in non-volatile memory portion of memory 64. Controller 63 provides a verification for operation of switch 65, provides this feedback upon request to a requesting service technician through service port 62, for example. Meter power supply 72 provides energy to meter components, including when switch 65 is open.

Thus a prepayment energy communication has been described having advantages over existing prepayment energy metering systems. In accordance with the preferred embodiments of the present invention, the prepayment energy metering communication system reads a first data set from a communication card at a first consumer terminal. The first data set, among other things, includes a digital signature, an amount of credit, a meter identifier and a transaction identifier. The consumer terminal formats the first data set into packetized data and transfers the formatted first data set over a power line carrier to a utility meter. The utility meter verifies the digital signature, the transaction identifier and the meter identifier and stores the amount of credit in the utility meter.

Additionally, the utility meter provides a second data set, and packetizes and transfers this data over the power line carrier to the customer terminal. The second data set comprises power measurement data, meter read time data, remaining credit amounts and a second digital signature. The customer terminal depacketizes the second data and transfers the second data onto a communication card. The utility service provider is provided this information when the communication card is inserted into an ATM or payment terminal, for example, as discussed above.

Although the preferred embodiment of the invention has been illustrated, and that form described in detail, it will be readily apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

The foregoing description of the specific embodiments will so fully reveal the general nature of the invention that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and therefore such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments.

It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Accordingly, the invention is intended to embrace all such alternatives, modifications, equivalents and variations as fall within the spirit and broad scope of the appended claims.

What is claimed is:

1. A prepayment energy metering communication method comprising the steps of:

reading from a communication card at a customer terminal a first data set, the first data set comprising a digital

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signature, a credit amount, a meter identifier, and a transaction identifier;

the customer terminal formatting the first data set into first packetized data and transferring the formatted first data set over a power line carrier to a utility meter;

the utility meter verifying said digital signature, the transaction identifier and the meter identifier;

storing said credit amount in the utility meter;

the utility meter formatting a second data set into second packetized data and transferring the formatted second packetized data set over the power line carrier to the customer terminal, the second data set comprising power measurement data; a meter read time; a remaining credit amount, and a second digital signature;

the customer terminal depacketizing the second packetized data set and transferring the second data set onto the communication card.

2. The method as claimed in claim 1 further comprising the step of the utility meter digitally signing at least a portion of the second data set to produce the second digital signature.

3. The method according to claim 1 wherein the power measurement data of the second data set further comprises a cumulative power consumption measurement, a meter read time, and a key status.

4. The method according to claim 1 wherein the communication card is comprised of semiconductor memory and a plurality of external electrical contacts, and wherein the reading step, the first data set is provided through at least one of the external electrical contacts,

and wherein the transferring the second data set onto the communication card step further comprises the step, the second data set is provided through said at least one of the external electrical contacts.

5. The method according to claim 1 further comprising the steps of reading the second data set from the communication card by an automated teller machine (ATM) and the ATM transferring second data set to the utility service provider, said ATM accepting a credit amount, communicating the credit amount with the utility service provider, receiving an updated first data set, and writing the updated first data set to the communication card.

6. The method according to claim 1 wherein the reading step includes the step of reading advertising data stored on the communication card, and wherein the method further includes the step of displaying said advertising data at the consumer terminal in response to the reading step.

7. The method as claimed in claim 1 wherein the verifying the transaction identifier step comprises the step of the utility meter comparing the transaction identifier with prior transaction identifiers and wherein the method further comprises the step of refraining from performing the storing the credit amount step when the transaction identifier compares with one of the prior transaction identifiers.

8. The method according to claim 1 further comprising the steps of the utility meter monitoring electricity consumption, and decrementing the remaining credit amount in accordance with rate tables stored in the meter and the electricity consumption.

9. The method according to claim 8 wherein the first data set further comprises new rate information, and wherein the storing step further comprises the step of storing the new rate tables in the utility meter, and wherein the method further comprises the step of the utility meter decrementing the remaining credit amount in accordance with the electricity consumption and the new rate tables.

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Señores

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

Secretaría General

E. _____ S. _____ D. _____

REF: Expediente No.: 07-33659
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Clase: PT
Resolución No.: 53148

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