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Description

This invention relates to commodity meters through which a flowing commodity is supplied, the meter measuring the volume of commodity for payment or other purposes.

Such meters have commonly been arranged as prepayment meters into which coins are inserted, thus freeing the meter to supply a specific volume of the commodity. Such meters are liable to attempts at theft of the money in them and efforts have been made to meet this problem by replacing the coins with tokens of negligible intrinsic value. However, meters using tokens are liable to attempts to avoid payment.

Specification GB-A-2144566 discloses a metering apparatus arranged to operate on a prepayment system, having metering elements and a contactor arranged to control the availability of a commodity, and a separate token operated device adapted to control the opening and closing of the contactor. However there is no security against tampering.

Specification CA-A-963577 discloses the use of a valve from controlling the availability of a commodity.

This invention provides a metering apparatus for a flowing commodity of the kind arranged to operate on a prepayment system, having metering elements enclosed in a casing, valve means located in the same casing in the flow path of the commodity so as to control the availability of the commodity, a separate token-operated device adapted to provide an electrical credit signal to credit storage means, which credit storage means controls the opening and closing of the valve means and an electrical connection extending between the token-operated device and the casing, characterized by sensing means for sensing tampering or damage to the apparatus, the sensing means being adapted to provide a 'valve close' signal, and by electrical drive means for said valve means arranged to cause the valve to close in response to both a zero credit signal and a 'valve close' signal produced when tampering or damage is sensed. Preferably the electrical drive means includes an electric motor and a self-holding solenoid, said solenoid having a release circuit which is adapted to be operated by a zero credit signal and when damage to the said connection is sensed.

The credit storage means may comprise an electronic memory controlling the electrical drive means which opens and closes the valve means. The memory receives data from the metering elements which progressively reduces the credit recorded in the memory until at zero credit the valve means is caused to close.

By using an internal valve means with an external token-operated device it is found that a higher degree of security can be achieved than at first appears. Attempts to interfere with the device simply stop further

credit being inserted without causing the valve means to stay open.

Preferably the commodity meter is a gas meter.

One embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 comprises a representation of a token-operated gas metering apparatus, and

Figure 2 is a three dimension representation of part of the apparatus of Figure 1.

A gas meter 11 is of the kind comprising flexible diaphragms driven back-and-forth by flowing gas, which is of proven accuracy and reliability. The meter has a mechanical counter mechanism of conventional kind providing a read-out of the measured volume of gas which has passed through the meter, and also has means for providing an electrical reproduction of the read-out, either as a series of electrical pulses or as a coded representation of the number. Suitable examples of such means are described in our patent specification GB-A-2187010 and GB-A-2187011.

Located in a main gas flow path through the meter is an on/off valve 14. Valve 14 is located in the same meter casing as the metering elements.

A card reader and eraser unit 30 is located at a position convenient to a user and may be remote from the gas meter 11. It is connected to the meter 11 by a multicore cable 21. The unit has a slot into which a gas card may be manually inserted. The gas card carries a magnetic code relating to its face value.

When the unit 30 has read the card, it erases the magnetic code so that the card cannot be used again. The magnetically coded gas cards may be purchased at appropriate retail outlets, and discarded when used. Alternatively, the same card may be re-activated at the retail outlet on payment of the face value. Thus there is nothing to be collected from the meter, neither money nor token.

The apparatus described has a high degree of in-built security against fraud. The valve 14 will close when the device is tampered with or when the prepaid gas is used up and all that will happen is that the user is unable to insert more credit into the meter. The valve 14 being mounted inside the meter has the same degree of security as the meter index. The valve 14 is driven to an open position by a DC motor 40 mounted on the outer surface of the meter. When a gas card is inserted into the unit 30, the face value is read and transferred to an electronic credit storage unit 41 which is also mounted inside the unit 30. When credit is thus established, a signal to motor 40 causes it to open valve 14. As the gas is used, the meter 11 produces electrical pulses which are sensed by the credit storage unit 41 and subtracted from the credit stored. When the credit has returned to zero, another signal releases a solenoid 42 to close valve 14 as described hereinafter. In this arrangement, both the card reading unit 30 and the meter have their own re-

placeable dry batteries 34 and 34'.

Referring now to the detail of Figure 2, the DC motor 40 drives cam 44 through a gear train 45. A roller 46 mounted on a pivoted cradle 47 runs on the cam so that cradle 47 rocks. A shaft 48 is secured at one end to a closure member 49 of the gas valve 14 within the meter and extends out through the wall of the meter (not shown) to extend freely through bearings in the cradle 47. A lever 50 is secured at one end to rotate with the shaft 48 and at the other end carries an armature 51 which co-operates with solenoid 42. As shown in full lines in the Figure, a valve closing spring 52 is urging the lever 50 upwards so as to rotate shaft 48 in the sense to maintain the gas valve 14 in the closed position. In order for the valve to be opened, armature 51 must take up the position shown in dotted lines. Solenoid 42 is of the 'self holding' type, incorporating a permanent magnet strong enough to hold the valve open, but also having means for producing a flux in opposition to the holding flux which thus cancels it and releases the armature 51.

When credit is established in storage unit 41 an electrical signal actuates motor 40. This drives cam 44, rocking cradle 47 first to raise solenoid 42 from the position shown in dotted lines until it contacts armature 51. The permanent magnet then carries the armature down as the solenoid returns to the position shown in dotted lines, thus opening the valve. The cam 44 rotates until homing microswitch 53 is operated, indicating that the cam has completed a full circle, at which point motor 40 ceases to operate. The valve then remains open until an electrical 'release' signal is received by the opposition flux circuit of the solenoid 42. This releases the armature 51 so that spring 52 can lift lever 50 and close the valve. On cessation of the release signal, the armature 51 is too far distant from the solenoid for the holding magnet to attract it against the spring force. Thus the valve can only be opened when cam 44 again rotates and lifts solenoid 42 into close proximity to the armature 51.

The 'release' signal is produced on the occurrence of several different situations. The main one is of course when the credit in storage unit 41 runs out, but it is also used for safety features. In the event of tampering with the gas meter, for instance tilting or cutting of the electrical connection wire 21, or tampering with the card reading and erasing unit 30, a 'release' signal is produced which causes the valve to close. It will be noted that the release will work even whilst credit has been added and the motor is opening the valve.

The battery 34' may be a long life, high density primary cell or a rechargeable battery or a low leakage capacitor charged by external means.

Although a gas card with magnetic information is described above, it is within the invention to use other tokens for inserting credit. For instance, rechargeable tokens each incorporating a micro-processor which

can be programmed to represent any credit sum desired may be used.

The apparatus can incorporate an emergency supply system in which the user is allowed a limited free supply on demand, payment for which is then deducted from the next credit input. This may be provided by a button-operated circuit in the card reader 3C, which provides one only free credit input to the motor and then deducts the same credit from the next card inserted. Alternatively, this is provided by a special memory section of the credit store 41 which provides one only free credit and then deducts this from the next input from the card reader 30.

In another apparatus (not shown) the valve 14 is driven to open and shut positions by the same DC motor under the control of the credit storage unit. The motor and credit storage unit may be mounted within the meter casing.

Although the invention has been described in relation to gas meters, it may be used in any other kind of meter in which a flowing commodity is controlled by a valve.

Claims

1. A metering apparatus for a flowing commodity of the kind arranged to operate on a prepayment system, having metering elements enclosed in a casing, valve means (14) located in the same casing in the flow path of the commodity so as to control the availability of the commodity, a separate token-operated device (30) adapted to provide an electrical credit signal to credit storage means (41), which credit storage means controls the opening and closing of the valve means (14) and an electrical connection (21) extending between the token-operated device and the casing, characterized by sensing means for sensing tampering or damage to the apparatus, the sensing means being adapted to provide a 'valve close' signal, and by electrical drive means (40) for said valve means (14) arranged to cause the valve to close in response to both a zero credit signal and a 'valve close' signal produced when tampering or damage is sensed.
2. A metering apparatus according to claim 1 characterized in that the electrical drive means includes an electric motor (40) and a self-holding solenoid (42), said solenoid having a release circuit which is adapted to be operated by a zero credit signal and when damage to the said connection (21) is sensed.
3. A metering apparatus as claimed in claim 2, further characterized in that said motor (40) is arranged to move the solenoid (42) in the sense to

cause the solenoid to hold the valve means (14) open, while said release circuit, when energized causes the solenoid to release the valve means so that it returns to a closed position.

4. A metering apparatus as claimed in any of claims 1 to 3, further characterized by the credit storage means comprising an electronic memory (41).
5. A metering apparatus as claimed in any of claims 1 to 4 characterized in that the electric motor (40) is located in the casing.
6. A metering apparatus as claimed in any of claims 1 to 5 characterized in that it is a gas meter.

Patentansprüche

1. Eine Verbrauchsmessvorrichtung für ein Gut der zum Betrieb in einem Vorauszahlungssystem geeigneten fließfähigen Art, mit in einem Gehäuse umschlossenen Meßelementen, einer in dem gleichen Gehäuse in dem Strömungspfad des Gutes angeordneten Ventilanordnung (14), um so die Verfügbarkeit des Gutes zu steuern, eine getrennte steuermarkenbetriebene Einrichtung (30), die dazu eingerichtet ist, ein elektrisches Guthabensignal für eine Guthabenspeichereinrichtung (41) bereitzustellen, wobei die Guthabenspeichereinrichtung das Öffnen und Schließen der Ventilanordnung (14) und eine elektrische Verbindung (21) steuert, die sich von der steuermarkenbetriebenen Einrichtung zu dem Gehäuse erstreckt, gekennzeichnet durch eine Sensoreinrichtung zum Erfassen von Eingriffen oder Beschädigungen an der Vorrichtung, wobei die Sensoreinrichtung dazu eingerichtet ist ein Ventil-Schließen"-Signal abzugeben, und durch elektrische Antriebseinrichtungen (40), um die Ventilanordnung (14), die dazu eingerichtet ist, das Ventil in Abhängigkeit von einem Kein-Guthaben-Signal und einem "Ventil-Geschlossen"-Signal zu schließen, wenn ein Eingriff oder eine Beschädigung erfaßt wird.
2. Verbrauchsmessvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die elektrische Antriebseinrichtung einen elektrischen Motor (40) und einen selbsthaltenden Solenoiden (42) aufweist, wobei der Solenoid einen Freigabeschaltkreis hat, der dazu eingerichtet ist, bei einem Kein-Guthaben-Signal, und wenn eine Beschädigung an der Verbindung (21) erfaßt wird, betätigt zu werden.
3. Verbrauchsmessvorrichtung nach Anspruch 2, die des weiteren dadurch gekennzeichnet ist, daß

der Motor (40) dazu eingerichtet ist, den Solenoiden (42) in dem Sinn zu bewegen, daß der Solenoid veranlaßt wird, die Ventilanordnung (14) offenzuhalten, während der Freigabeschaltkreis, wenn dieser mit Energie beaufschlagt ist, den Solenoiden veranlaßt, die Ventilanordnung freizugeben, so daß diese in eine geschlossene Stellung zurückkehrt.

4. Verbrauchseinrichtung nach einem der Ansprüche 1 bis 3, des weiteren dadurch gekennzeichnet, daß die Guthabenspeichereinrichtung einen elektronischen Speicher (41) aufweist.
5. Verbrauchsmessvorrichtung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß der elektrische Motor (40) in dem Gehäuse angeordnet ist.
6. Verbrauchsmessvorrichtung nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß sie eine Gasmeßvorrichtung ist.

Revendications

1. Appareil de comptage pour un produit liquide du type conçu pour être mis en oeuvre par un système de prépaiement, ayant des éléments de comptage inclus dans un boîtier, un moyen formant clapet (14) situé dans le même boîtier sur le trajet d'écoulement du produit afin de commander la disponibilité du produit, un dispositif séparé fonctionnant par jetons (30) conçu pour fournir un signal électrique de crédit pour créditer un moyen de mémoire de crédit (41), ledit moyen de mémoire de crédit commandant l'ouverture et la fermeture du moyen formant clapet (14) et une liaison électrique (21) s'étendant entre le dispositif fonctionnant par jetons et le boîtier, caractérisé par des moyens de détection pour détecter les fraudes ou les avaries de l'appareil, les moyens de détection étant conçus pour fournir un signal "clapet fermé", et par des moyens de commande électrique (40) pour ledit moyen formant clapet (14) disposés pour provoquer la fermeture du clapet en réponse à la fois à un signal de crédit nul et à un signal "clapet fermé" produits lorsqu'une fraude ou une avarie est détectée.
2. Appareil de comptage selon la revendication 1, caractérisé en ce que les moyens de commande électrique comprennent un moteur électrique (40) et un électroaimant (42) à auto-maintien, ledit électro-aimant ayant un circuit de déclenchement qui est conçu pour être mis en oeuvre par un signal de crédit nul ou lorsqu'une avarie sur ladite liaison (21) est détectée.

3. Appareil de comptage selon la revendication 2, caractérisé en outre en ce que ledit moteur (40) est disposé pour déplacer l'électro-aimant (42) dans le sens qui amène l'électro-aimant à tenir le moyen formant clapet (14) ouvert, tandis que ledit circuit de déclenchement, quand il est activé, amène l'électro-aimant à déclencher le moyen formant clapet de telle façon qu'il retourne à la position fermée.
4. Appareil de comptage selon l'une quelconque des revendications 1 à 3, caractérisé en outre en ce que le moyen de mémoire de crédit comprend une mémoire électronique (41).
5. Appareil de comptage selon l'une quelconque des revendications 1 à 4, caractérisé en ce que le moteur électrique (40) est situé dans le boîtier.
6. Appareil de comptage selon l'une quelconque des revendications 1 à 5, caractérisé en ce qu'il s'agit d'un compteur à gaz.

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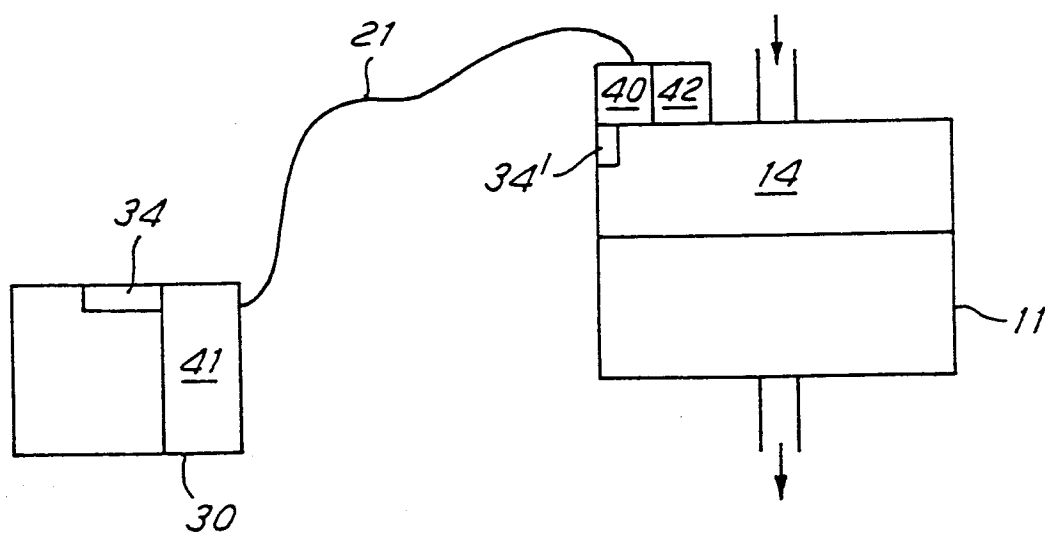


FIG. 1

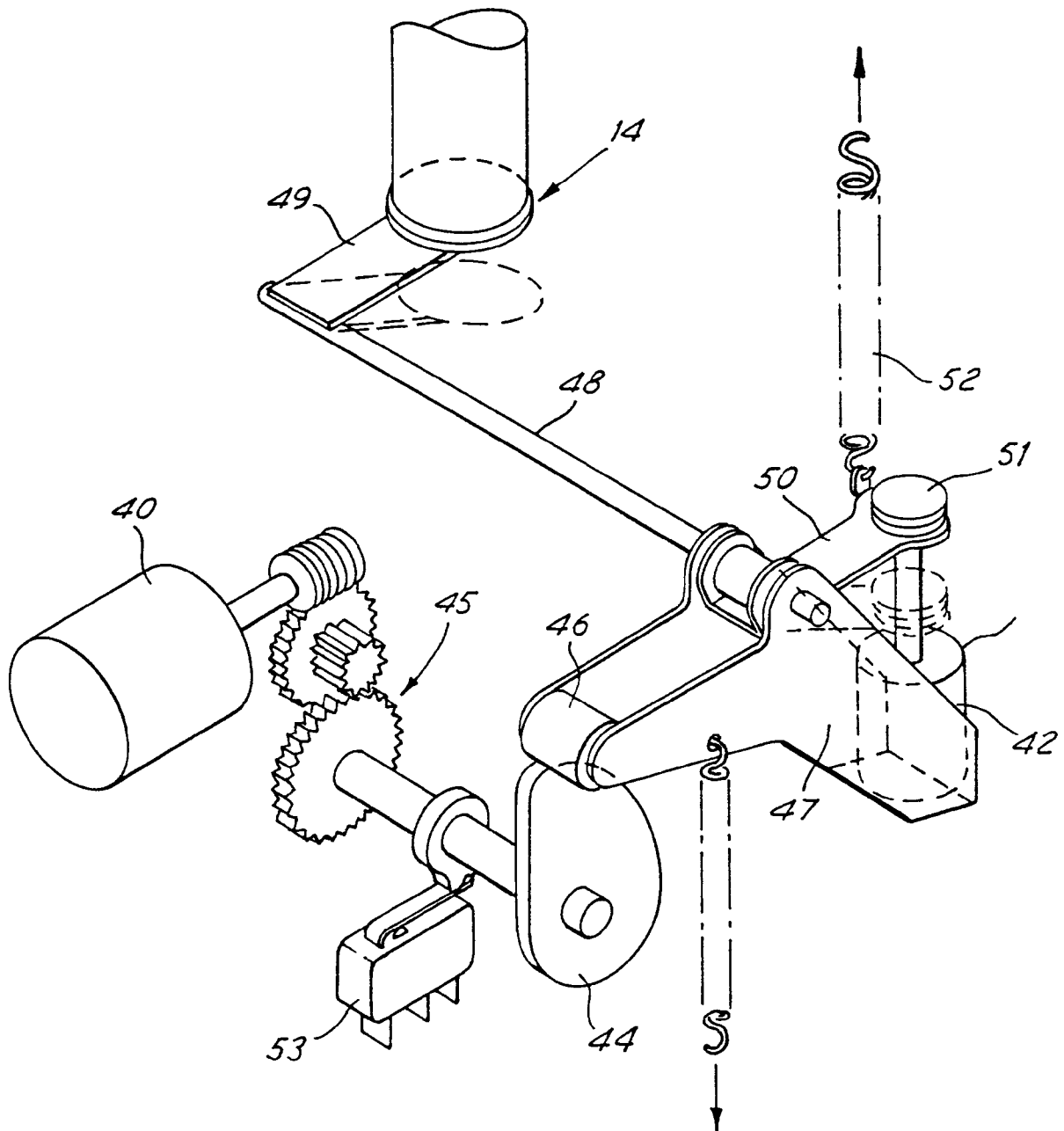


FIG. 2