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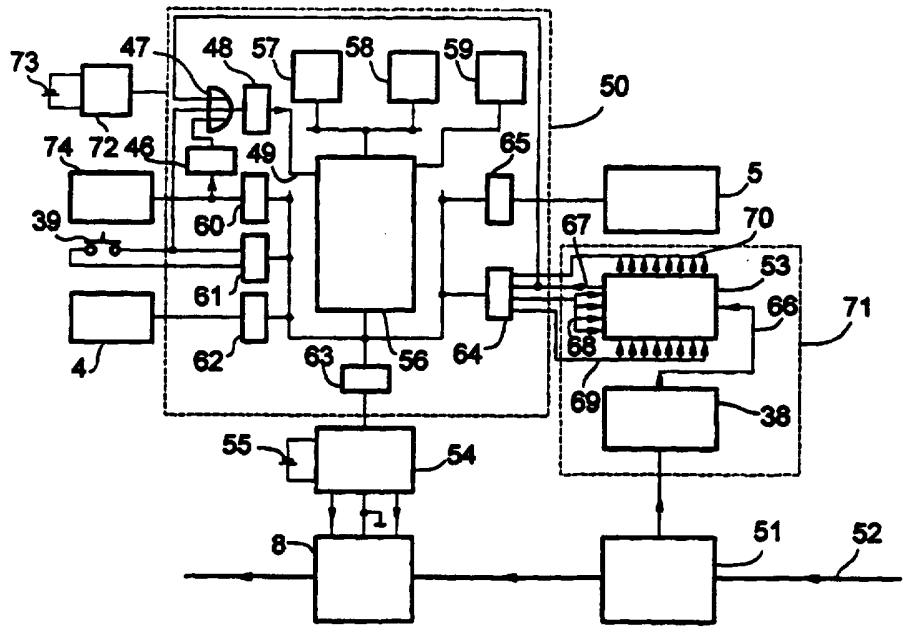
(54) Title: APPARATUS FOR METERING AND DISPENSING A COMMODITY



(57) Abstract

An apparatus for metering and dispensing a commodity, comprising metering means (51) to measure consumption, a shut-off device (8) inserted into a conduit (52) of the commodity, a card reader unit (4) for reading data cards storing data corresponding to a predetermined quantity of the commodity, and a control unit (50) having a microprocessor for controlling the shut-off device (8) according to the consumption and to the signals read from the data card. The control unit (50) is switched from a standby state to an active state upon reading the data card or upon receiving a consumption signal corresponding to signals of the metering means (51), in said active state the control unit (50) processes the signals read from the data card and the consumption signals received and in a predetermined case controls the shut-off device (8), then returns to the standby state.

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Apparatus for metering and dispensing a commodity

TECHNICAL FIELD

The invention relates to an apparatus for metering and dispensing a commodity such as gas, electricity, water, district heating.

BACKGROUND ART

In conventional metering systems of public utilities local consumption meters are checked in order to take the reading at regular intervals by a person authorized to collect the tariff, and on this basis the bill corresponding to the consumption is issued. This approach is labour intensive, requires accurate records and is subject to errors in taking the reading and also in further handling of the data. Consumption always precedes the taking of the reading and so the service provider gives a credit to the consumer.

Apparatus to allow the consumption or the service only after the payment of the charge have been known for a long time. In U.S. Patent No. 4,838,404 a microcomputer system is described, which is operated by a token, upon the inserting of which the power corresponding to the period of the token

is supplied to a device, for example a TV set. The optical detector of the apparatus, receiving the token, is designed in a way that a token of predetermined shape and coding can be inserted into the device in any position.

Gas meters and electricity meters operated by coins or a special coin, have also been used for utilities consumption. However, these have not become so popular for industrial and household consumption, because collecting the coins is troublesome and abuse may not be prevented. For household electricity, gas and water consumption, the above described subsequent reading and billing are still generally applied.

In Hungarian Patent No. 191,762 an electronic consumption metering system was described, in which the utilities consumption is measured on site by counting the number of pulses proportional to the consumption, followed by forwarding the measuring results automatically to a data processing center at regular periods, for example every month, through a telecommunication system. In this way human reading can be absolutely omitted. For this system, however, the data network must be built for each individual consumption meter, which is extremely costly for example in the case of household consumption.

For metering of electricity consumption and for dispensing consumption against preliminary payment, an electronic system has been recommended whereby the consumer must purchase from the service provider in advance a consumption data card or memory chip. On the basis of the data stored on the data card, the apparatus enables the consumption of a specified quantity of energy. Such systems are described for example in the following patents: US 4,162,530, GB-A 2,096,370, GB-A 2,111,280, GB-A 2,128,792, EP-A3 0,092,436 and EP-A2 0,131,331. In these systems, the auxiliary power (supply voltage) necessary for operation is available, because electric consumption is involved. If, however, the task is to meter and dispense another utility,

e.g. gas, the auxiliary electric power is not always available, and even if it is, the implementation of an electric link-up is troublesome and/or expensive. Furthermore, it is not advantageous if the consumption metering and the dispensing of one utility becomes impossible in case another utility eventually breaks down.

DISCLOSURE OF THE INVENTION

It is an object of the present invention to establish an apparatus for metering and dispensing a commodity, which can be used in a multifaceted way for various utilities consumption, with an electric power consumption lower than that of the known apparatus, therefore the apparatus can be operated for a long time without maintenance using batteries available from trade.

Thus, the invention is an apparatus for metering and dispensing a commodity, comprising metering means to measure consumption, a shut-off device inserted into a conduit of the commodity, a card reader unit for reading data cards storing data corresponding to a predetermined quantity of the commodity, and a control unit having a microprocessor for controlling the shut-off device according to the consumption and to the signals read from the data card. The invention is characterized in that the control unit is switched from a stand-by state to an active state upon reading the data card or upon receiving a consumption signal corresponding to signals of the metering means, in said active state the control unit processes the signals read from the data card and the consumption signals received and in a predetermined case controls the shut-off device, then returns to the stand-by state.

According to the invention, the apparatus is in a stand-by state in most of its operating period, and in the stand-by state the electric power consumption is very low, in fact only a fraction of that in the active state.

In an advantageous embodiment of the invention, the apparatus comprises means for enabling the reading of the data card and a unit for generating the consumption signals on the basis of the signals of the metering means, said enabling means and consumption signal generating unit are connected to the control unit in a way that their sinals result in switching the control unit into the active state. The enabling means are preferably realized by a pushbutton. It is advantageous if the control unit has an activating input for switch over into the active state, and that the enabling means and the consumption signal generating unit are connected to the activating input via means performing a logic OR-function.

In a further advantageous embodiment the control unit adds the quantity corresponding to the signals read from the data card by the card reader unit to a stored quantity available for consumption, reduces the stored quantity in accordance with the consumption signals and if the stored quantity decreases to zero, closes the shut-off device and in case the stored quantity is higher than zero, keeps the shut-off device open or opens it. It is a benefit of the invention that the data card giving eligibility for consumption is available for reading both during and before/after consumption.

For informing the consumer, it is advisable to connect a display unit to the control unit for indicating the stored quantity available for consumption and error messages corresponding to the state of the control unit. The currently stored quantity is continuously displayed, and error messages eventually arising during operation appear only for a short period, e.g. for some seconds. The constant operation of the display unit, because of its low power demand, does not represent a substantial consumption.

It is advantageous when the control unit only adds the quantity corresponding to the signals read from the data card to the stored quantity available for consumption if the

increased quantity is lower than a predetermined limit value, otherwise no addition is carried out and a first error message is issued. This is because in the given case it is not desirable for example due to tariff hikes that the consumer is enabled to accumulate an excessively large consumption quantity in his apparatus.

From a safety aspect it is advisable for the control unit to turn off the shut-off device and to issue a second error message if the value of consumption per unit of time is over a predetermined value. In this way, for example in the case of a high gas leakage or electric over-consumption, the apparatus automatically shuts off the gas and switches off the electric network.

A utilities consumption system easy to handle can be established if the control unit has a data memory for storing a meter identifier for matching the apparatus and the applicable data card and a sequence number of the data card read most recently, and that the control unit only adds the quantity corresponding to the signals read from the data card to the stored quantity available for consumption, if the meter identifier read from the data card corresponds to the stored meter identifier and its sequence number is higher than that of the data card read most recently. In this system, the utilities company increases the data card's sequence number by one, each time the data card is "validated" against payment. Through the matching of the apparatus and the data card, the service provider receives information on the consumption of each consumer and security is also granted against the use of the data card at another consumer if it is lost or stolen.

It may happen that the consumer does not have a reserve data card and the quantity available for consumption runs out exactly at the time (for example over the week-end or on a holiday) when it is impossible to "validate" the data card. In such a case, again in accordance with the invention, through the reuse of an already used data card it

is possible to consume "under credit" a predetermined quantity, on a one-time basis. To this end, in case the meter identifier read from the data card corresponds to the stored meter identifier and its sequence number is not higher than that of the data card read most recently, the control unit adds a constant quantity to the stored quantity available for consumption, if the shut-off device is closed and a data card of a sequence number not higher is read for the first time, otherwise no addition is made and a third error message is issued. Monitoring whether the reuse of a data card already used for such a reserve purpose happens for the first time prevents any abuse.

In a further advantageous embodiment of the invention, the unit for generating the consumption signals comprises a digital counter of adjustable division rate for generating the consumption signals in pulse form from pulse signals corresponding to the signal of the metering means by division. A tariff changing according to the time of day, for example day and night, can be automatically taken into consideration if the apparatus comprises a real-time digital clock, and that upon a predetermined time signal of the real-time digital clock the control unit is switched from the stand-by state to the active state, further the division rate of the digital counter is readjusted and the actual content of the digital counter is rewritten in accordance with the readjustment of the division rate by the control unit. Using this solution, even when the tariff changes, the consumption is accounted for in an accurate way.

In a further advantageous embodiment the control unit comprises a central unit to which the card reader unit, the display unit, the unit generating the consumption signals, the enabling means and the digital clock are connected through I/O registers, and the unit generating the consumption signals, the enabling means, the digital clock, the latter through a digital comparator, are also connected to the activating input of the central unit through the

means performing a logic OR-function.

It is advisable that the control unit comprises software means for resetting the control unit from the active state to the stand-by state. In this way, after each activation, having carried out the given data handling and processing task, the control unit is immediately pushed into the stand-by state. This action results in the lowest possible auxiliary power consumption.

The invention can be used very favourably for a gas consumption meter where the shut-off device comprises a valve actuated by a stepping motor in order to ensure as low an electric consumption as possible. Thereby, neither in open nor in closed situation is there any electricity consumption. To provide the electric control of the stepping motor and to separate the gas space, the valve is located in a casing of the gas meter, the stepping motor is located outside the casing, and that there is a magnetic coupling to transfer rotation between the stepping motor and the valve. Similarly, the metering means are located in the casing of the gas meter, and a magnetic pulse transmitter with an electric output part located outside the casing is connected to the metering means.

In a utilities network installed with the apparatus according to the invention, it is not necessary to take the reading of the meter located at the consumer, and this is beneficial for both the service provider and the consumer. Registering consumption is also much more simple than in the conventional system. And, furthermore, the service provider does not advance the cost of consumption which on the one hand encourages the consumer to exercise austerity in consumption, and on the other debates about the price to be paid can be substantially reduced and litigation initiated due to price arrears can be eliminated.

BRIEF DESCRIPTION OF DRAWINGS

Furthermore, the invention will be described on the basis of advantageous embodiments depicted on the drawings, where

Fig. 1 is a front view and partly a sectional view of an embodiment of the apparatus according to the invention designed as a gas meter,

Fig. 2 is a side view of the apparatus as per Fig. 1,

Fig. 3 is a simplified block diagram of the apparatus according to the invention and

Figs. 4A, 4B and 4C are flow diagrams depicting the operation of the apparatus according to the invention.

In the drawings, identical elements or those of an identical function are shown by the same reference signs.

MODES FOR CARRYING OUT THE INVENTION

Figs. 1 and 2 show a gas meter 1 designed according to the invention. The gas meter 1 has a casing 2 consisting of an upper part 2A and a lower part 2B which are joined to each other by a flange 3. The lower part 2B is designed in a way already well known. The gas to be metered enters the gas meter 1 in the direction of arrow 17 at a connection stub 15 and exits in the direction of arrow 18 at a connection stub 16. The flowing gas proceeds through metering means well known, counter 13 of which is secured to the upper part 2A by fastening bolts 14. The counter 13 has a numerical display 40 per se known, which shows the quantity of the consumed gas in m^3.

According to the invention, the gas meter 1 is fitted with a card reader unit 4 suitable for reading a data card. The card reader unit 4 has an aperture 20 in which the data card not shown here is to be inserted. In the embodiment shown, the apparatus must be enabled prior to reading the data card, i.e. a pushbutton 39 must be pressed, leading the control unit 50 of the apparatus (Fig. 3) being switched to an active state and then, the data card is to be pulled

along in the aperture 20 in the direction of arrow 41. Another approach is also possible, whereby the enabling is carried out by inserting the data card, in which case the enabling means are realized by a unit sensing the insertion of the data card. The data card can be any type of card suitable for storing digital data, such as magnetic card, a card with magnetic strips, optical card. Preferably, use may also be made of an active memory card, which is not only suitable for storing and rewriting data, but is also fitted with a microprocessor for data processing. The card reader unit 4 is integrated with a display unit 5 having an alphanumeric display 6, and they are fixed to the casing 2 by spacers 7. A battery for providing electric supply and an electronic control unit 50 of the apparatus described in association with Fig. 3 are located in the card reader unit 4 and/or display unit 5.

The gas meter 1 also has a shut-off device 8 inserted according to the invention in the way of the flowing gas. The conventional controlled shut-off devices, like for example magnetic valves, consume a substantial rate of power, so they could not be operated for a long time from an electric battery. There are known relatively low consumption shut-off devices activated by the gas flowing through the consumption meter, however, these are not appropriate here because they do not meet the requirement of leakproof sealing which is imperative for security reasons. As per the invention, a new type of low consumption shut-off device 8 is used, which includes a stepping motor 9, a magnetic coupling 10, an actuating mechanism 11 and a valve 12. Electric control of the stepping motor 9 covered with shield 21 is performed by the control unit 50 (Fig. 3) through an electric cable guided in a cable tube 19. To separate electric parts from the inner space of the gas meter 1, the turning of the rotor of the stepping motor 9 is conveyed to a cam disk 25 running on a shaft 24 by the magnetic coupling 10 containing magnetic disks 22 and 23 which face each

other. Wall section 42 of the casing 2 between the magnetic disks 22 and 23 is made of a non-ferromagnetic material e.g. copper. To ensure as low a friction as possible, the shaft 24 runs in a ball bearing. When the cam disk 25 turns, arm lever 28 running on shaft 26 displaces a valve body 29, and so it is pressed against a valve seat 30 when valve 12 is shut, and upon opening the valve 12 it is raised. In order to ensure as low a friction loss as possible, the arm lever 28 is supported against the cam disk 25 by a roller, and pressing is provided by a spring 27.

Measures aimed at reducing friction losses make sure that stepping motor 9 actuates the valve 12 with as low an electric power consumption as possible. In one embodiment, the torque requirement of opening the valve 12 is approx. 0.016 Nm and with a low pressure gas network in the closed position of the valve 12 the gas load is 0.002 l/h. Upon a closing or opening the consumption is 0.2 A . 4 s = 0.8 As, which favourable rate is due to the ball bearing, the roller design and the relatively long closing/opening period. The valve 12 is protected by a protecting net 31 towards the connection stub 16 from any unauthorized intervention through the connection stub 16 and also from eventually dropped objects.

The gas meter 1 has a conventional metering mechanism having a mechanical counter 13 driven by a worm 32 to which also a pulse transmitter 38 is connected. The pulse transmitter 38 issues pulses to the control unit 50 the number of which is proportional with the gas quantity consumed (Fig. 3). The pulse transmitter 38 has a permanent magnet 36 secured in the central bore of a plastic block 35, a detector 34 located in an extreme bore and sensitive to magnetic field, and a shielding sleeve 37 to provide external magnetic shielding. The worm 32 holds nib 33 of ferromagnetic material, e.g. steel, and this a nib 33 reaching between the permanent magnet 36 and the sensor 34. Therefore, the detector 34 issues a pulse to the control

unit 50 (Fig. 3) each time the nib 33 turns around. The detector 34 can be preferably implemented by two reed relays and with an associated logic circuit. The reed relays are located in a misaligned way, so that when nib 33 turns around, always one and then the other reed relay makes. By this arrangement, the uncertainty of emitting the pulse can be eliminated in the limit position of the nib 33. The pulse transmitter 38 is designed in a way that the electric circuit of the detector 34 is totally separated from the components in the casing 2 of the gas meter 1. The pulse transmitter 38 may also be designed in other ways, for example by using a permanent magnet fixed to the worm 32 and moving in circles, and by a Hall-sensor located along the circular track. It is also possible to establish an electric pulse output for the measuring mechanism of the gas meter 1, in which case the pulse transmitter 38 is not necessary.

Fig. 3 depicts the digital central control unit 50 of the apparatus according to the invention, and its link to other parts of the apparatus. The control unit 50 includes a microprocessor, which could be for example a microprocessor of type 8051. The microprocessor in the well known way includes a central unit 56, further a data memory 57, a program memory 58, a clock signal generator 59 and I/O registers 60, 61, 62, 63, 64 and 65 connected to it. A real time digital clock 74 is connected through the I/O register 60. Enabling means actuated prior to the reading of a data card for activating the control unit 50 are connected through the I/O register 61. In the embodiment shown the enabling means are implemented by a pushbutton 39. Through the I/O register 62 a card reader unit 4, through the I/O register 63 a switching amplifier 54 for actuating a shut-off device 8, through the I/O register 64 a unit 71 for generating consumption signals on the basis of signals from the metering means 51, and through the I/O register 65 a display unit 5 are connected.

The central unit 56 has an activating input 49, and when a signal is supplied to this input, the central unit 56 is switched from stand-by (power down) state to an active state. In the stand-by state only the most essential circuits, the internal RAM and some internal data registers as well as the display unit 5 and the digital clock 74 - which latter have very low consumption - are supplied by power, and so the consumption is much lower (some μA) than in the active state (some mA). The activating input 49 is connected to the output of an activating unit 48, the input of which is linked to the output of a gate circuit 47 which ensures a logic OR-function. The three inputs of the gate circuit 47 are in turn connected to a pulse output 67 of a counter 53 of the unit 71, one conduit leading to the pushbutton 39, and to the output of a digital comparator 46 linked to the output of the digital clock 74. The digital comparator 46 provides a signal at its output, when the real time signal of the digital clock 74 corresponds to a tariff change-over time. It is possible to have such a design where the gate circuit 47 has further inputs connected to emergency signal emitting sensors not shown, for example to temperature and magnetic field sensors. After being activated the central unit 56 determines through I/O registers 60, 61 and 64 what has caused the activation, and will operate accordingly as detailed below. Having completed the operation, the software resets the central unit 56 to its stand-by state.

The supply of the control unit 50 is ensured by a power supply 72 fed from a battery 73. This battery 73 could be for example a long life alkali battery.

A conduit 52 representing the gas flow includes metering means 51 and the shut-off device 8. The output pulses of a pulse transmitter 38 linked to the metering means 51 are supplied to the stepping input 66 of a digital counter 53 designed as a division unit, and a pulse output 67, an adjusting input 68, a data input 69 and a data output

70 of the digital counter 53 are connected to the I/O register 64. The digital counter 53 operates as a pulse divider circuit with a rate of division corresponding to the setting on its adjusting input 68, in accordance with the adjustment signal received from the control unit 50. For example, if a household gas meter emits a pulse after each 2.5 litres, at a division rate of 400, one consumption pulse corresponds to 1 m^3 of consumed gas on the pulse output 67.

Division has two advantages. On the one hand, regardless of the frequency of pulses received from pulse transmitter 38, the frequency of consumption signals, that is of the pulses to be processed by the control unit 50 can be adjusted. In this approach, efforts must be made to ensure that the control unit 50 is to switch from its stand-by state to its active state as rarely as possible, i.e. it should be in the active state for as short a period as possible, because in the active state it has a much higher electric consumption.

On the other hand, if the consumption tariff depends on the time of day, for example on whether it is day or night, the control unit 50 can adjust the rate of division according to the currently applicable charge on the basis of the time signal received from the real time digital clock 74, and so the consumption pulses every time represent the rate of consumption. When changing the rate of division in order to ensure accurate billing, the control unit 50 rewrites the actual content of the counter 53. This is carried out in a way that the actual content is read out on the data output 70, this is multiplied with a factor which corresponds to the changeover of the rate of division and then the value so obtained is rewritten as a new content into the counter 53 through the data input 69. For the time of changing the rate of division and rewriting the content, the control unit 50 inhibits the issuing of consumption pulses.

In the embodiment shown the shut-off device 8 is driven

by a stepping motor 9 (Fig. 1) to ensure as low an electric consumption as possible. A switching amplifier 54 supplied by a battery 55 serves for generating the drive signals for the stepping motor 9. For shutting and opening the valve 12, the command is issued by the control unit 50 via the I/O register 63.

The operation of the apparatus as per Fig. 3 is depicted on the basis of the flow diagram shown in Figs. 4A, 4B and 4C. When Figs. 4A, 4B and 4C are placed side by side, they make up one complete figure. If the control unit 50 of the apparatus is in START state 79, i.e. it can be triggered, upon start-up 78 it switches from stand-by state to active state in step 80, and the program is launched. In steps 81, 93 and 111, the control unit 50 examines what caused the start-up 78. The start-up 78 can be caused by the arrival of a consumption signal (pulse) at pulse output 67, by pressing of the pushbutton 39 prior to inserting (pulling) of the data card, by a signal arising on the output of the digital comparator 46 at a predetermined real time, when the tariff is to be modified, or by an emergency signal issued by a unit not shown in Fig. 3, for example by a magnetic field sensor or a temperature sensor.

If the start-up 78 was caused by the consumption signal, in step 82 the quantity corresponding to the consumption signal is deducted from the stored quantity still available, the real time rate T is read in from the digital clock 74 and operations T2 = T1 and T1 = T are carried out. The initial values of T2, T1 and T are zero. The period T1 - T2 identifies the time which has elapsed since the last consumption signal. In step 83 it is examined whether the duration of T1 - T2 is longer than a predetermined TM period. Since the consumption signal represents a predetermined consumption quantity, the period T1 - T2 is inversely proportional with the consumption per one unit of time. For a safety aspect it could be advisable (e.g. in the case of a gas leakage) to define a maximum

value, e.g. double the nominal rate for consumption per one unit of time and to shut off the gas meter 1 above this rate in such a way that it can only be put into operation again by a mechanic. The period TM must be determined according to the permissible maximum rate. If the period T1 - T2 is not longer than period TM, the control unit 50 generates an error code E4 in step 88, turns off shut-off device 8 in step 89, displays the error code E4 on display unit 5 in step 90 and then the control unit 50 is reset in step 91 in its stand-by state and simultaneously in the STOP state 92, from which only a special data card can bring it to the START state 79 again. Only an authorized person, e.g. a mechanic, is supplied with this special data card. The mechanic is able to check - with the special data card - the accumulated consumption, the number of shut-offs, the identifier of consumption and the particulars of the data card used most recently.

If the period T1 - T2 is longer than period TM, the apparatus tests in step 84 whether the still available quantity is higher than zero, i.e. whether consumption is still possible. If not, it closes shut-off device 8 in step 85 and if it is higher, no shut-off takes place. Next, in step 86, the still available quantity or in the given case one of the error codes is displayed, and then in step 87 the control unit 50 is brought to stand-by and into START state 79. The display unit 5 indicates the quantity still available for consumption in consumption units, which in the case of uniform tariffs advisably corresponds to the still consumable m^3 volume. If the apparatus uses different charges (tariffs) in various times of day, the consumption unit advisably corresponds to the still consumable m^3 volume under the peak consumption tariff, and off the peak time more than 1 m^3 of gas can be consumed against one consumption unit.

If in step 93 the apparatus finds out that start-up 78 was caused by the pressing of the pushbutton 39, a pause of

5 s is kept for the data card to be inserted and pulled along. This operation is represented by the closed loop consisting of steps 94 and 101. If the data card is not inserted (pulled along) within this period, an error code EE is generated in step 106 and then the operation continues with step 86. If the data card is inserted (pulled) within the given period, the identifier of gas meter 1, the sequence number of the data card, the quantity represented by the data card and the quantity still available for consumption (stored by the control unit 50) is read in step 95. After this, in step 96, the apparatus examines whether the sequence number read in is higher than the sequence number obtained upon the read-in of the previous data card. In this way it is prevented that someone makes use of a data card twice, without "validation", i.e. without the payment of the tariff. Upon the payment of the charge, the sequence number of the data card is increased by one. If the sequence number is not higher and the shut-off device 8 is open (this will be described below in connection with step 102), the apparatus generates an error code E1 in step 107, and then the operation continues with step 86. If the sequence number is higher, the apparatus checks in step 97 whether the quantity represented by the data card can be added to the stored quantity available for consumption, i.e. whether the quantities can be accumulated. For practical reasons, it is advisable to limit the quantity available for consumption in the gas meter 1. For example if the average annual gas consumption of a household is 1000 to 1500 m^3, the above limitation can be 2500 m^3 and the maximum of consumption quantity represented by one data card can be 1000 m^3. If the quantity resulting from accumulation exceeds this limit, the apparatus does not allow accumulation, generates an error code E2 in step 108 and then operation continues with step 86. The data card may only be used if the stored quantity decreases so much that the result of the accumulation remains below the limitation above. If accumulation is

permitted, the apparatus checks in step 98 whether the data card is associated with the gas meter 1, i.e. whether the identifier read from the data cards is identical with the identifier of the gas meter 1. If not, an error code E3 is generated in step 109 and then operation continues with step 86. If they are identical, accumulation takes place in step 99 and the sequence number stored is rewritten by the sequence number of the data card. Next, in step 100 the apparatus examines whether the shut-off device 8 is open. If not, it is opened in step 110, and then operation continues with step 86. If the shut-off device 8 is open, the opening step 110 is omitted.

In the case of the apparatus described, if the user has consumed the total quantity available, the gas meter 1 automatically shuts off. In practice a case may arise that the user does not have a data card at home validated for further consumption and, in the given case (because it is a week-end or holiday), he cannot validate his data card for a time. In order to make sure that no pause occurs in such cases in the use of a utilities device, it is advisable to allow the re-use of the most recently applied data card without validation, on a one time basis, for a "credited" consumption of a predetermined reserve (e.g. 10 m^3). To this end, if the sequence number of the inserted data card is not higher than that of the card used before, it is examined in steps 102 whether the shut-off device 8 is closed. If it is open, there is no justification yet to allow the use of the reserve and the step 107 described above takes place. If it is closed, however, in step 103 the apparatus examines whether a first use of the reserve is now intended. If not, step 107 takes place. If there is a first use of the reserve, the apparatus checks whether the identifier read from the data card is the same as the identifier of the gas meter 1. If not, step 109 above follows. If it is the same, in step 105 the reserve quantity is added (accumulation) and the fact of using the reserve is written in. Then, operation

continues in step 110 with the opening of the shut-off device 8.

If start-up 78 happened due to the change-over of tariff, the real time data is read in step 112, in step 113 the issuing of consumption pulses is suspended from the counter 53, in step 114 the actual content of the counter 53 is read and in step 115 according to the change-over the new content of the counter 53 is calculated, in step 116 the new content is rewritten into the counter 53, in step 117 the rate of division of the counter 53 is readjusted, and then in step 118 the suspension of the issuing of consumption pulses is stopped. Next, operation follows with step 86.

If in step 111 it is found out that start-up 78 did not take place for the change-over of tariff, the only case remaining is when start-up 78 has been caused by a kind of emergency signal. Such an emergency signal may be generated for example when someone attempts to manipulate the gas meter 1 by strong external magnetic field. To this end, at an appropriate place a magnetic field sensor, e.g. reed relay or a Hall-probe, is located, which communicates with the central unit 56 through a further I/O register not shown. A temperature sensor triggered in the case of fire may also emit emergency signal. Upon an emergency alarm, in step 119 an error code E5 is generated and operation continues in step 89 with the closing of the shut-off device 8.

In one embodiment of the invention as gas metering and dispensing apparatus, the durations of the active states of the control unit 50 in the most unfavourable case are the following: 5 s when pressing the pushbutton 39, 2 s after starting the insertion of data card, 4 s upon opening or closing the valve 12, and 0.025 s when the consumption pulse corresponding to 1 m^3 arrives or when the tariff is changed over. Therefore, 50 openings and 50 closings on an annual average result in 50 . (5+2+4+4) = 750 s, an annual consumption of 2000 m^3 entails 2000 . 0.025 = 50 s, and two

tariff change-overs per day result in 2 . 365 . 0.025 = 18.25 s active period per annum, that is a total of 818.25 s ≈ 0.23 h active duration per annum. This total active period has a ratio to the total annual stand-by period as approximately 1 to 40,000.

With alkali batteries available from trade currently, having a guaranteed lifetime of ten years, the embodiment of the gas meter mentioned above can be operated at least 2000 times. This means that for a period of ten years on an average one operation can take place approximately every two days (reading in of data card, closing etc.). The reason for selecting the ten year period is that it is a specification of the gas industry that household gas meters must be calibrated every ten years, and it is advisable to control supply simultaneously.

An embodiment of the apparatus according to the invention was described in association with a gas meter. Of course, the invention is not limited to gas meters, and it can be applied for any other utility measurable by a consumption meter, thus e.g. for electricity, water etc. In the case of metering and dispensing electric energy, the shut-off device is obviously a switch unit.

CLAIMS

1. An apparatus for metering and dispensing a commodity, comprising metering means to measure consumption, a shut-off device inserted into a conduit of the commodity, a card reader unit for reading data cards storing data corresponding to a predetermined quantity of the commodity, and a control unit having a microprocessor for controlling the shut-off device according to the consumption and to the signals read from the data card, c h a r a c t e r i z e d in that the control unit (50) is switched from a stand-by state to an active state upon reading the data card or upon receiving a consumption signal corresponding to signals of the metering means (51), in said active state the control unit (50) processes the signals read from the data card and the consumption signals received and in a predetermined case controls the shut-off device (8), then returns to the stand-by state.

2. The apparatus according to claim 1, characterized by further comprising means for enabling the reading of the data card and a unit (71) for generating the consumption signals on the basis of the signals of the metering means (51), said enabling means (39) and consumption signal generating unit (71) are connected to the control unit (50) in a way that their sinals result in switching the control unit (50) into the active state.

3. The apparatus according to claim 2, characterized, in that the enabling means are a pushbutton (39).

4. The apparatus according to claim 2, characterized in that the control unit (50) has an activating input (49) for switch over into the active state, and that the enabling means (39) and the consumption signal generating unit (71) are connected to the activating input (49) via means performing a logic OR-function.

5. The apparatus according to claim 2, characterized in

that the control unit (50) adds the quantity corresponding to the signals read from the data card by the card reader unit (4) to a stored quantity available for consumption, reduces the stored quantity in accordance with the consumption signals and if the stored quantity decreases to zero, closes the shut-off device (8) and in case the stored quantity is higher than zero, keeps the shut-off device (8) open or opens it.

6. The apparatus according to claim 5, characterized by a display unit (5) connected to the control unit (50) for indicating the stored quantity available for consumption and error messages corresponding to the state of the control unit (50).

7. The apparatus according to claim 6, characterized in that the control unit (50) only adds the quantity corresponding to the signals read from the data card to the stored quantity available for consumption if the increased quantity is lower than a predetermined limit value, otherwise no addition is carried out and a first error message is issued.

8. The apparatus according to claim 6 or claim 7, characterized in that the control unit (50) turns off the shut-off device (8) and issues a second error message if the value of consumption per unit of time is over a predetermined value.

9. The apparatus according to claim 6, characterized in that the control unit (50) has a data memory (57) for storing a meter identifier for matching the apparatus and the applicable data card and a sequence number of the data card read most recently, and that the control unit (50) only adds the quantity corresponding to the signals read from the data card to the stored quantity available for consumption, if the meter identifier read from the data card corresponds to the stored meter identifier and its sequence number is higher than that of the data card read most recently.

10. The apparatus according to claim 9, characterized

in that in case the meter identifier read from the data card corresponds to the stored meter identifier and its sequence number is not higher than that of the data card read most recently, the control unit (50) adds a constant quantity to the stored quantity available for consumption, if the shut-off device (8) is closed and a data card of a sequence number not higher is read for the first time, otherwise no addition is made and a third error message is issued.

11. The apparatus according to claim 2, characterized in that the unit (71) for generating the consumption signals comprises a digital counter (53) of adjustable division rate for generating the consumption signals in pulse form from pulse signals corresponding to the signal of the metering means (51) by division.

12. The apparatus according to claim 11, characterized in that it further comprises a real-time digital clock (74), and that upon a predetermined time signal of the real-time digital clock (74) the control unit (50) is switched from the stand-by state to the active state, further the division rate of the digital counter (53) is readjusted and the actual content of the digital counter (53) is rewritten in accordance with the readjustment of the division rate by the control unit (50).

13. The apparatus according to claim 12, characterized in that the control unit (50) comprises a central unit (56) to which the card reader unit (4), the display unit (5), the unit (71) generating the consumption signals, the enabling means (39) and the digital clock (74) are connected through I/O registers (62, 65, 64, 61, 60), and the unit (71) generating the consumption signals, the enabling means (39), the digital clock (74), the latter through a digital comparator (46), are also connected to the activating input (49) of the central unit (56) through the means performing a logic OR-function.

14. The apparatus according to claim 1, characterized in that the control unit (50) comprises software means for

resetting the control unit (50) from the active state to the stand-by state.

15. The apparatus according to claim 1, characterized in that the metering means are a gas consumption meter (1), and the shut-off device (8) comprises a valve (12) actuated by a stepping motor (9).

16. The apparatus according to claim 15, characterized in that the valve (12) is located in a casing (2) of the gas meter (1), the stepping motor (9) is located outside the casing (2), and that there is a magnetic coupling (10) to transfer rotation between the stepping motor (9) and the valve (12).

17. The apparatus according to claim 15 or claim 16, characterized in that the metering means (51) are located in the casing (2) of the gas meter (1), and that a magnetic pulse transmitter (38) with an electric output part located outside the casing (2) is connected to the metering means (51).

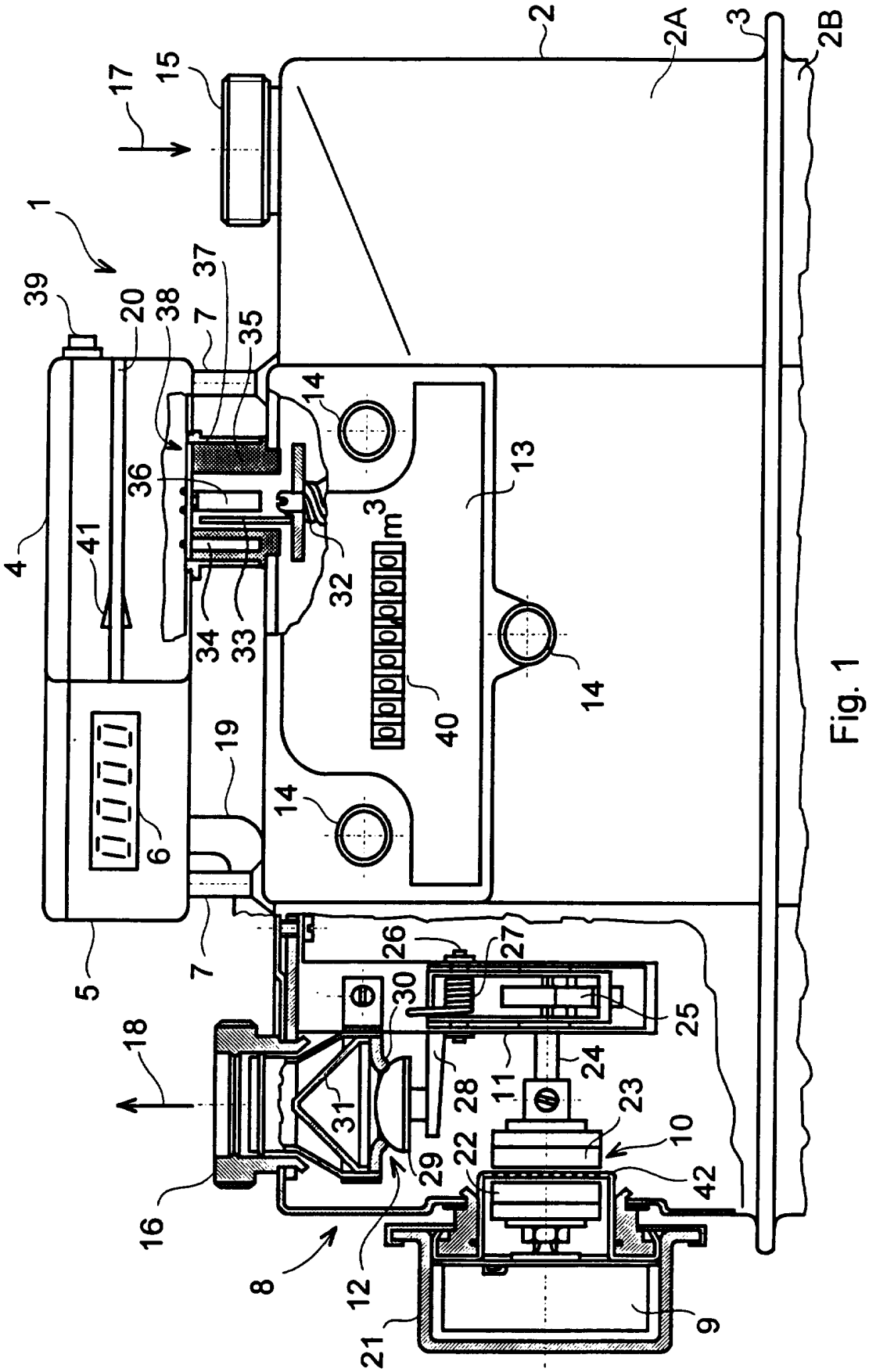
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Fig. 1

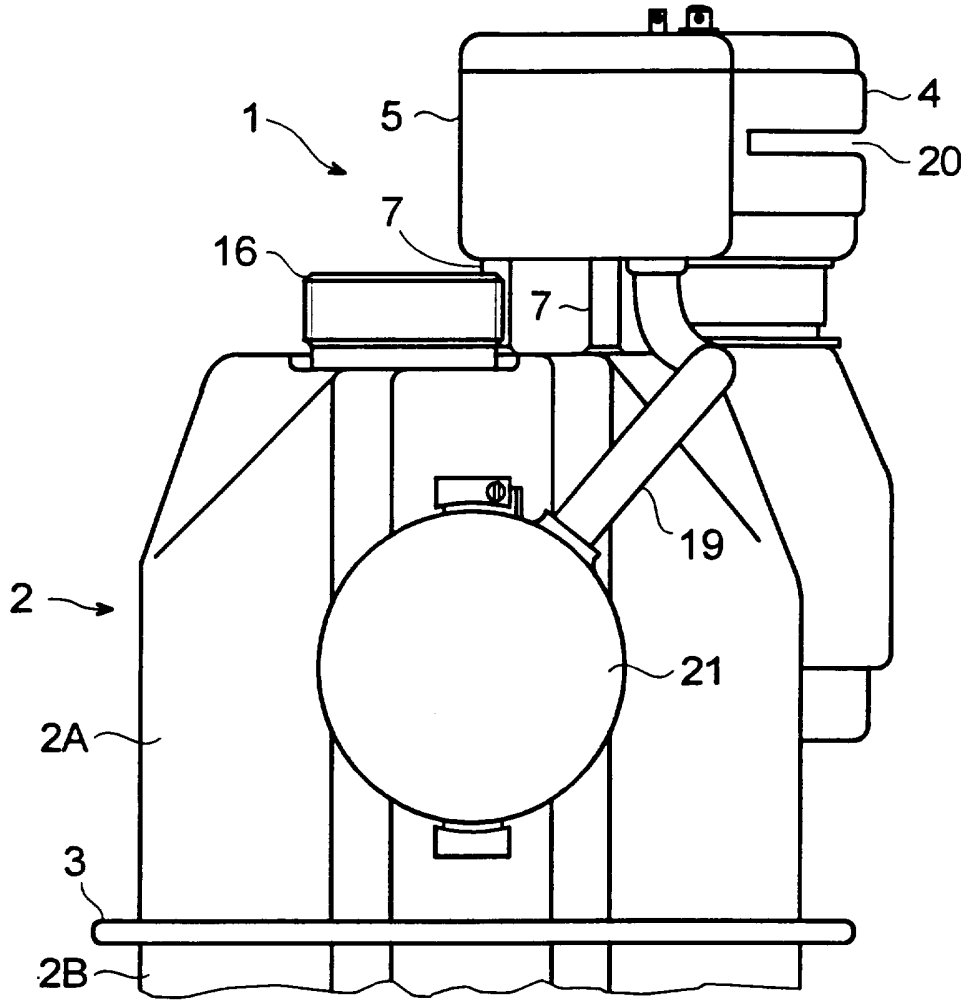

Fig. 2

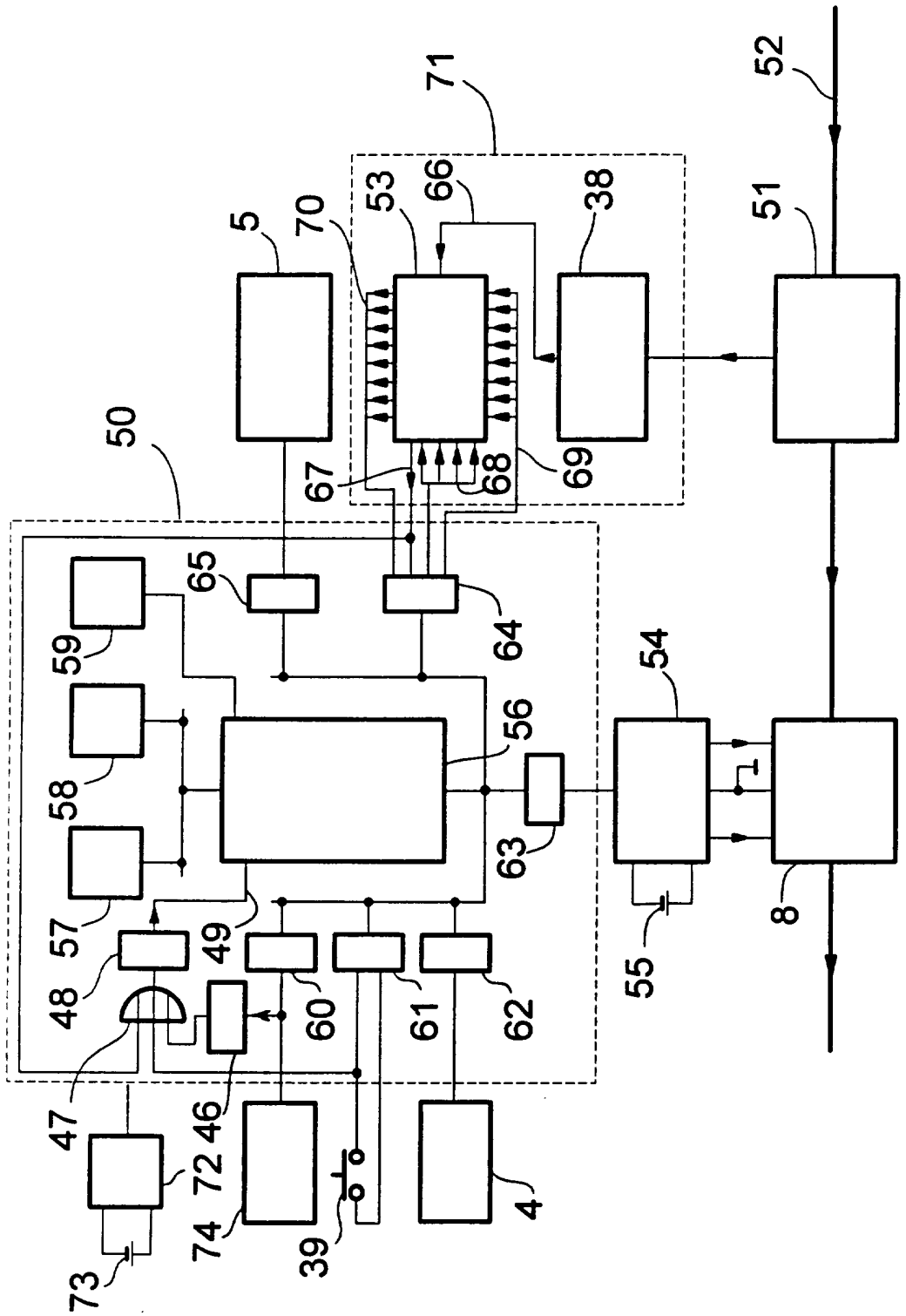
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Fig. 3

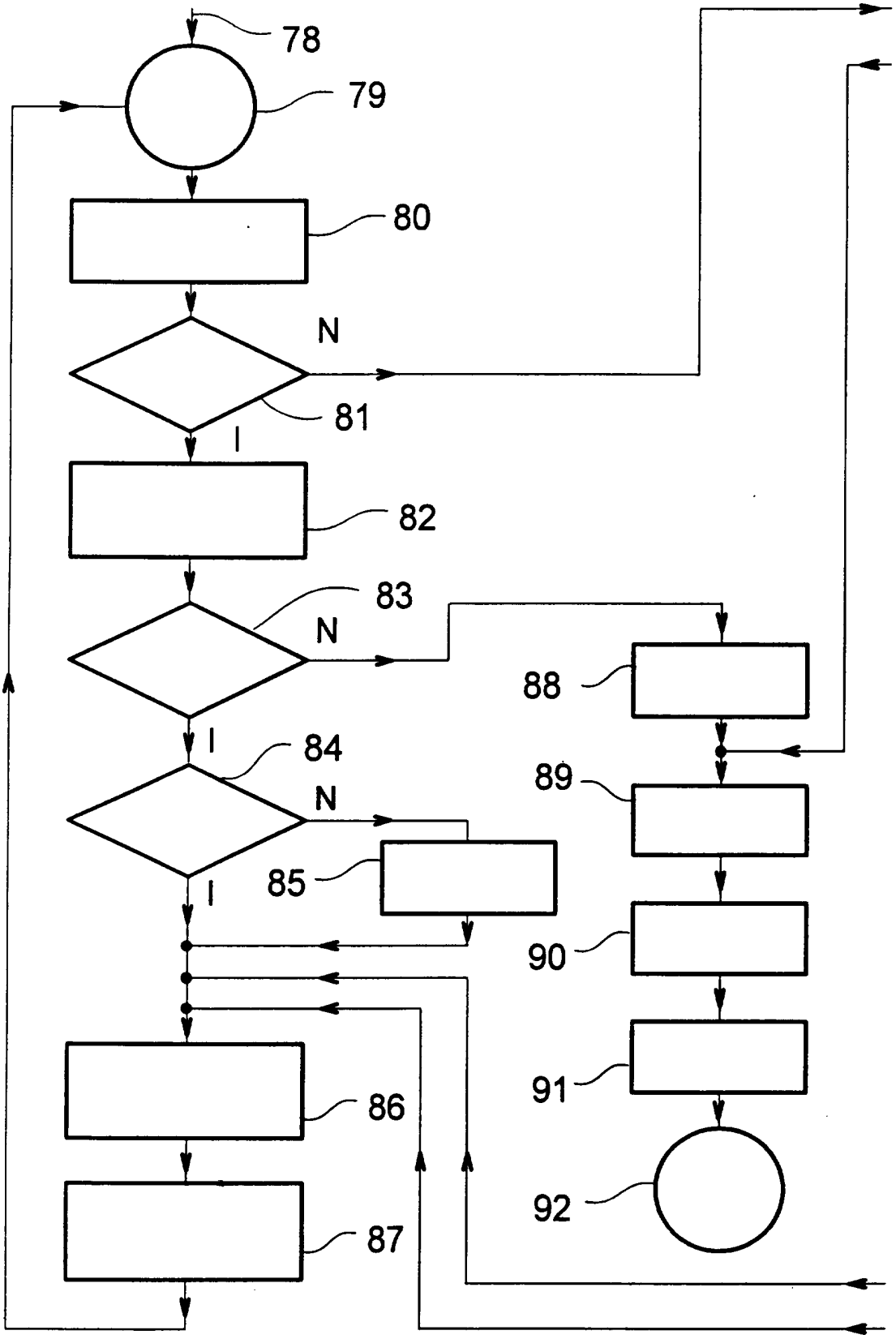

Fig. 4A

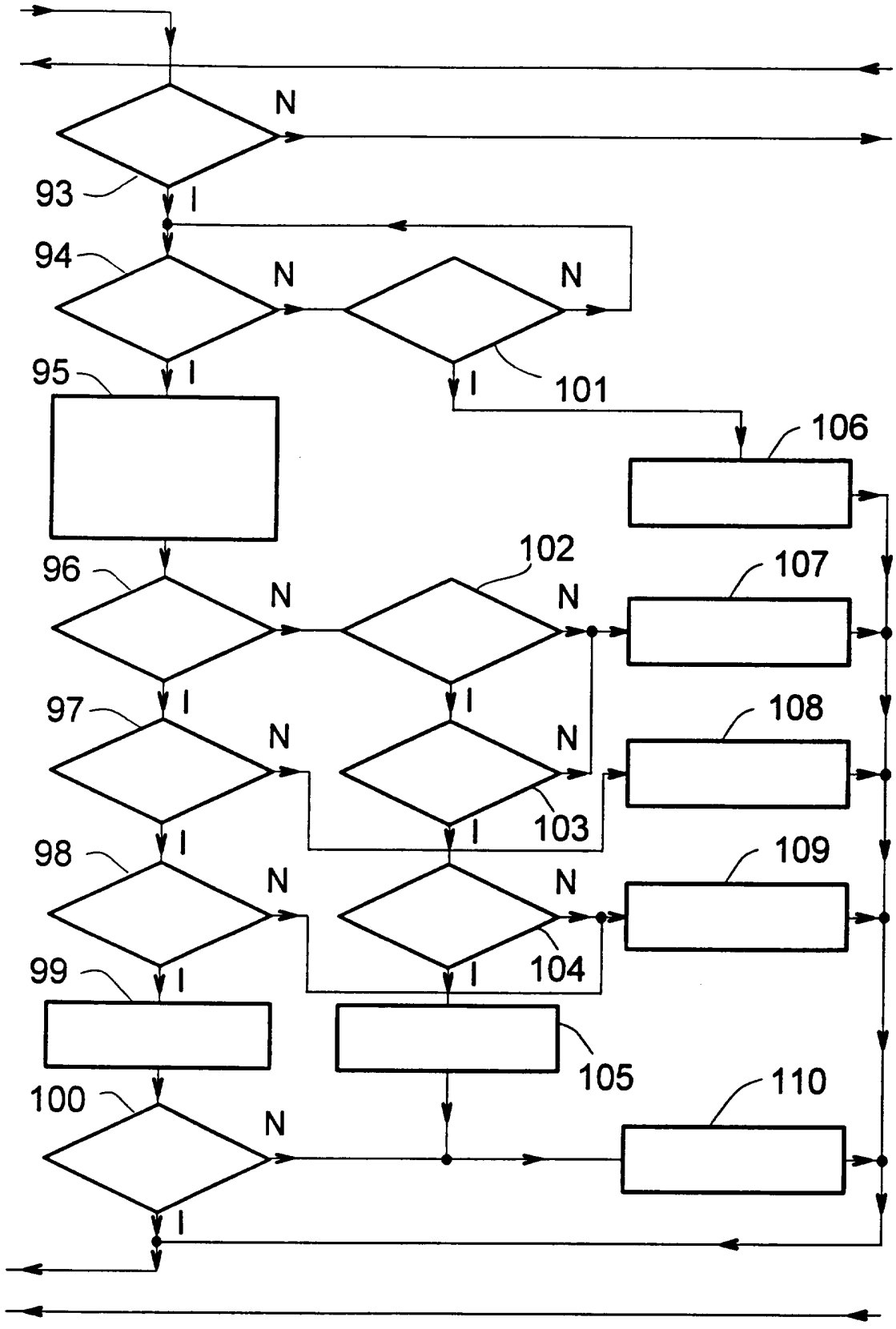
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Fig. 4B

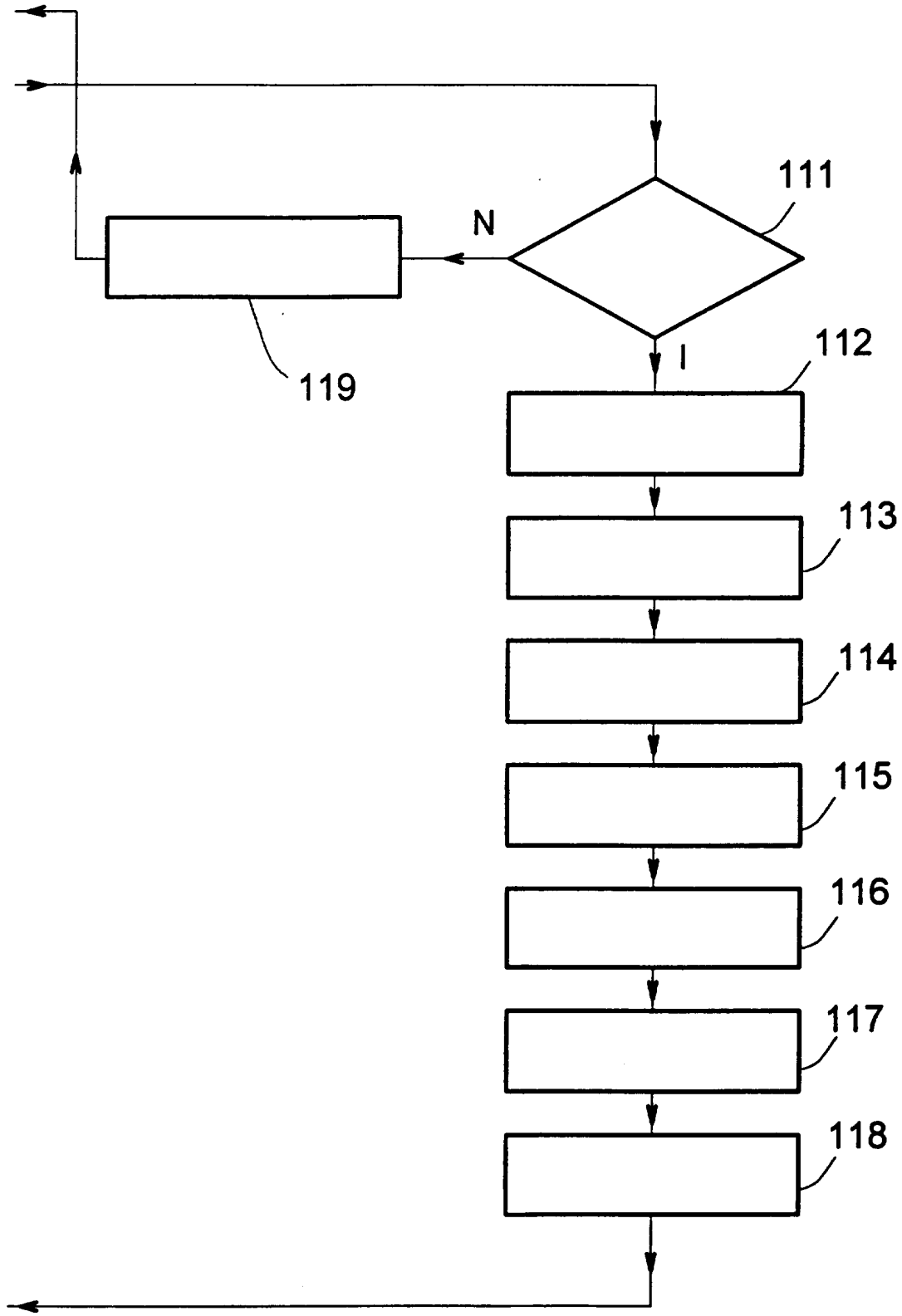

Fig. 4C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/HU 94/00031

A. CLASSIFICATION OF SUBJECT MATTER

IPC[6]: G 07 F 15/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[6]: G 07 F 9/02, 15/00, 15/02, 15/04, 15/06, 15/08, 15/10, 15/12; G 01 D 4/00-4/18; B 67 D 5/32, 3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

43 b 31, 32 (AT-classification)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 630 754 A (KOMUKAI) 23 December 1986 (23.12.86), column 7, lines 11-19; fig. 7,8(a).	1,2,3,5,7,8,9, 11,13
A	AT 386 399 B (GIRLINGER & CO) 15 January 1988 (15.01.88) page 8, last chapter; claim 9; fig.5.	6,14
A	EP 0 712 275 A2 (APPEL, CRONE, FETTER, SPIRITINO, KLOIBER) 09 February 1983 (09.02.83), claims 1,5,9; page 4, lines 16-34; page 5, lines 1-5.	4

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 April 1995 (18.04.95)	05 May 1995 (05.05.95)
Name and mailing address of the ISA/ AT AUSTRIAN PATENT OFFICE Kohlmarkt 8-10 A-1014 Vienna Facsimile No. 1/53424/535	Authorized officer Bistrich e.h. Telephone No. 1/53424/375

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/HU 94/00031

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
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		KR B1 8701723	25-09-87
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		EP A2 272245	22-06-88
		EP A3 272245	11-01-89
		EP B1 272245	09-01-91
		AT A 1310/87	15-05-89
		AT B 389504	27-12-89
EP A2 71275	09-02-83	DE A1 3130421	17-02-83
		EP A3 71275	01-06-83