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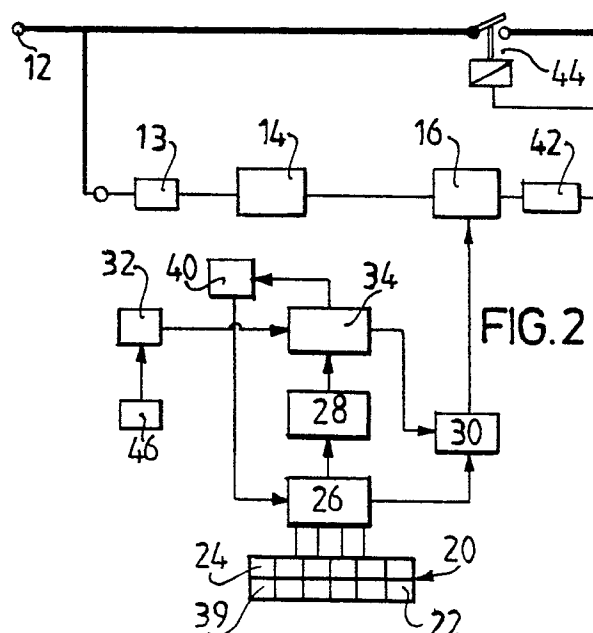
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Device for controlling delivery of a utility.

The invention concerns a device (10) for controlling the delivery of a utility e.g. electricity to a subscriber.

The device comprises a code generator (32) operating according to a certain algorithm, means (20) for loading a value code by the subscriber, means (34) for comparing the generated code and the entered value code and an element (44) for cutting off the supply of a utility. When the subscriber has paid the invoice of the utility company, the utility company supplies the subscriber with a value code which has been generated according to the same algorithm as the code generated in the device. The value code comprises a period length code which bears a relation to the period which has been paid for. The subscriber loads the value code supplied by the utility company into the device (10) where the codes are compared. If the codes coincide, supply of the utility will be continued for the next period. If the codes do not coincide, the supply of utility is cut off automatically.



DEVICE FOR CONTROLLING DELIVERY OF A UTILITY

The present invention relates to a device for controlling delivery of a metered utility such as electric energy, gas, water or an information signal.

Generally the domestic supply of energy utilities such as electricity, gas or water etc. is performed through a meter which is provided at the input of the supply installation fitted in the user's house. The meter is used for measuring the quantity of electricity, gas, water etc. which is consumed by the subscriber. This measurement is the basis for the facturation of the supply of the utility. The company which sells electricity, gas or water checks the quantity of utility displayed by the meter and an invoice based on this measured utility consumption is sent to the subscriber.

However, the meters are generally provided inside the subscriber's house, so the checking of the meters is time consuming for the company because it is not always possible to have access to the meter.

As a result, the checking of each meter is only performed once or twice per year.

The subscriber receives an invoice each month or each two months but the amount of the invoice is based on an estimated consumption and not on a checked consumption. For example, if the checking of the meters is performed only once per year, the subscriber will receive eleven invoices with an amount corresponding to 1/12th of last year's checked consumption and a twelfth invoice the amount of which is equal to the difference between the present year's consumption effectively measured and the cumulated amount of the eleven invoices already sent to the subscriber.

However, it is very difficult, and in any case expensive, for the company to check the payment of the monthly invoices and to cut off the supply of utility to the subscriber if he has not paid the invoice at the prescribed date.

In order to overcome this problem, control systems are known wherein the subscriber purchases a magnetic card which stores a quantity code specifying the subscriber's allowance, that is the quantity of utility (e.g. electricity, gas) to which the subscriber is allowed access. The utility meter is provided with a card reader. The utility is supplied to the subscriber until the subscriber's allowance is exhausted.

In the particular case of electricity or gas supply the above control system has two main drawbacks. The subscriber's consumption substantially varies from one month to another month. As a result, the renewal of the card does not take place at a regular time interval. So it is difficult for the

subscriber to estimate the date of the card's renewal.

Another drawback consists in the fact that the delivery of a new card or the reloading of the card is a time consuming and expensive process. Finally the subscriber can falsify the data stored in the magnetic tape of the card.

An object of the invention is to provide a device for controlling the supply of a metered utility which requires no memory card or the like, but which permits an automatic cut off of the utility supply if the subscriber does not pay the required amount of money at the prescribed dates.

This goal is reached by a device for controlling delivery of a utility, such as gas, water, electric energy or an information signal, characterized by:

- means for generating a first code,

- means for entering a second code,

- means for comparing said first and said second code supplying an enabling signal when said first code and said second code coincide,

- switching means responsive to said enabling signal for connecting the supply of said utility,

- said generating means generating said first code according to a secret algorithm,

- said generating means generating a new value of said first code upon coinciding of the preceding value of said first code with the value of the second code.

Other features and advantages of the present invention will be better understood by reading the following description of preferred embodiments of the invention in view of the accompanying drawing wherein show:

Fig. 1: a perspective view of a first embodiment of the invention;

Fig. 2: a diagram of the first embodiment of the invention;

Fig. 3: a diagram of a second embodiment of the invention;

Fig. 4: a diagram of a third embodiment of the invention; and

Fig. 5: a flow chart showing the operation of the device of Fig. 4.

Fig. 1 shows a perspective view of a first embodiment of a device 10 for controlling the delivery of electric energy together with a kWh-meter. The control device comprises a keyboard 20 including push buttons 22 and an enter push button

24 and a display 36 showing the number of days that electricity supply is assured with the present code. The control device comprises further a green LED 37, a red LED 38 and an emergency push button 39.

In the normal situation, when the user has the disposal of electricity for at least the next five days, the green LED 37 emits light continuously and the red LED 38 is extinguished. When the period of disposal is less than five days the green LED 37 emits lights intermittently to warn the user. The user can then press the emergency button 39 which will extend the period of disposal by seven days. It is thus possible that the credit (i.e. the number of days which has been paid for) is negative in case the emergency button 39 has been pressed. To show this situation the red LED 38 emits light continuously. When the period of credit has elapsed and the support of power thus has been cut off, the green LED 37 extinguishes completely and the red LED 38 emits light intermittently. The purpose of this feature is to show whether the power has been cut off or whether there is a general power failure.

Fig. 2 shows a diagram of the first embodiment of the control device 10. According to the embodiment the control device 10 comprises discrete logic circuits for performing the various functions. The purpose of this first simplified embodiment is mainly to clarify the invention.

The control device which is numbered 10, comprises a first terminal 12 for receiving the domestic electric signal (50 Hz) for clock purposes. The terminal 12 is connected to a filter circuit 13, the output of which is connected to the input of a dividing circuit 14. The circuit 14 divides the number delivering one pulse for each period of 1/10th of day. The 1/10 day signal is applied to the down input 16a of an up-down counter 16.

The control device 10 also comprises the keyboard 20 with push buttons 22 corresponding to Figs. 0 to 9 and an "enter key" push button 24, already referred to in the description of Fig. 1. The keyboard 20 is connected to a decoder 26. The decoder 26 performs two main functions. The first one is to convert the electric signals delivered by the keyboard 20 into digital signals corresponding to the push buttons 22 which are pressed. The second function is to treat the number entered with the keyboard 20 by performing a predetermined secret algorithm. The entered number is called "value code". This number includes a period code, a period length code and a control number. By performing the algorithm it is possible to decode from the value code one period code and one period length code. The decoded period code is stored in "period code" memory 28 and the length period is stored in a "period length" memory 30.

The control device 10 further comprises a generator 32 for delivering numbers according to a predetermined secret algorithm and an initial number value. In fact these numbers correspond to the successive period code to be entered into the control device. The signal delivered by generator 32 is applied to a first group of inputs 34a of a comparator 34. A second group of inputs 34b of comparator 34 is adapted to receive the "period code" stored in memory 28. Comparator 34 compares the data applied at its inputs 34a and 34b. If these two data are identical an output 34c of comparator 34 delivers a control signal which is applied to the enabling input 30a of the memory 30. When the control signal is applied to the input 30a the length period data is applied to the up input 16b of the counter 16. That means that a number of pulses equal to the number of 1/10th of a day contained in the length period memory 30, is added to the contents of the counter 16. Considering again comparator 34, if the data applied on its two inputs 34a and 34b are different, an error pulse is emitted by the output 34d of the comparator 34. This error pulse is counted in an error counter 40. When the contents of the error counter 40 become equal to a predetermined number (i.e. 4), the counter 40 delivers a blocking signal applied to the decoding circuit 26.

Referring back to the up-down counter 16, it is shown that its output 16b is connected to a comparator 42. The comparator 42 compares to zero the contents of counter 16. If the contents of the counter 16 become equal to zero or negative the comparator delivers a control signal for opening a relay 44 so that the supply of electricity to the subscriber is interrupted.

By pressing the emergency push button 39 the contents of the counter 16 are being compared with minus seven instead of with zero so that in this situation the period of credit is extended by seven days. When a further payment is made and the next value code is inserted, the contents of the counter 16 are increased by the number corresponding to the relative period code. At the same instant the emergency state is erased so that the contents of the counter 16 are again compared with zero as was the case before pressing the emergency push button 39.

Finally the control device includes an initialization circuit 46 for supplying the generator 32 with an initial period code.

The operation of the control device of Figs. 1 and 2 is as follows:

When the subscriber has paid for the next month or next period, he receives a new value code. He enters this value code by means of the keyboard 20 and he presses the enter key push button 24. The decoder 26 processes this number

on the basis of the algorithm and elaborates a length period code which is stored in memory 30 and a period code date which is stored in the memory 28. The data stored in the memory 28 is compared with the date delivered by the generator 32. If these two data are identical, the comparator 34 delivers an enabling signal so that the period length data is transferred into the counter 16. As a result the counter 16 is increased with a number corresponding with the period which has been paid for. The memory 28 and the memory 30 are cleared and the generator 32 is controlled for elaborating a new period code based on said algorithm. As a result the control device 10 is ready for receiving a new value code for the next supply period.

If the data applied to the inputs 34a and 34b of the comparator 34 are not identical, the error counter 40 is incremented by one. Then the subscriber enters again a number which is deemed to be the correct value code. The same steps are performed again until either the result of the comparison is correct or the number of erroneous attempts counted by the error counter 40 equals four. This means that the subscriber does not have the disposition over the correct value code, so that either the subscriber has been supplied with a wrong value code or the subscriber has not paid and has entered numbers by hazard. It is of course also possible that the subscriber makes subsequent mistakes. To avoid further attempts the entry of further numbers is blocked for one hour.

Fig. 3 shows another embodiment of the invention, which differs from the embodiment shown in Fig. 2 in that the contents of the memory 30 relate to a certain amount of electric energy, and not to a certain length of time. Consequently the consumed energy has to be measured by an electricity meter device 15. Said electricity meter device 15 supplies pulses to the counter 16, the frequency of said pulses being proportional to the amount of electric energy being consumed. In this second embodiment the value code comprises an energy value instead of a period value. This energy value is - after decoding by decoder 26 - stored in memory 30, from where it will be transferred to the counter 16 when the relative period codes coincide. The other elements of this embodiment are identical to those belonging to the embodiment shown in Fig. 2.

Referring now to Figs. 4 and 5 another embodiment of the invention will be described in more detail. As the main part of this embodiment is a microprocessor, the following description will mainly refer to the flow chart of Fig. 5.

According to this second embodiment the control device 100 comprises a keyboard 102 including push buttons 104a to 104j corresponding to

Fig. 0 to 9 and an "enter key" push button 106. The device 100 also comprises a display panel 108 having two display cells. As will be explained hereafter the display panel 108 is used for displaying the amount of consumption days still allowed. The control device further comprises a current relay 110 for controlling the electricity supply line 112. Finally the device 100 includes an electronic circuit 114 including a microprocessor 116, a program memory 118, a system watchdog 120, a phase lock loop circuit 122, a rectifier 124, a supply watcher circuit 126 and a non-volatile memory 128.

The input 130 of the microprocessor is connected with the keyboard outputs for entering into the microprocessor the number corresponding to the pressed push buttons 104a to 104j. The output 132 of the microprocessor 116 is connected to the display panel 108 for driving the display elements. The output 134 of the microprocessor 116 is connected to the relay 110 for controlling the state of this relay. The microprocessor is fed by the network through the rectifier 124. The network supply is also applied to the phase lock loop circuit 122 for delivering a pulse signal having a substantially constant period. This signal is treated by the microprocessor 116 for generating the 1/10th of a day pulses. The non-volatile memory 128 can be activated by the supply watcher for storing the most important data in the case of failure of the electricity power supply.

Referring now to Fig. 5, the normal operation of the control device will be described, that is, when the new period code is stored in the memory of the device, and the subscriber has to enter the new value code he received after having paid the corresponding amount of money.

The program of the microprocessor 116 is at the step 200 awaiting for the input of a value code. The subscriber enters his value code by means of the keyboard 102 (step 202). A first test is performed on the entered number for controlling the number of figures of the entered value code (step 204). If this number is equal to 8, the program goes on. If this number is different to 8, the program returns to the step 200. If the result of the test 204 is positive, an error counter program is incremented by one (step 208). Then the value code is decoded to a corresponding value code (step 210). This value code is tested in 212 to verify that the value code obeys the control number. If the result of test 212 is negative the program returns to the step 200. If the result of the test of positive the value code is decoded, according to a predetermined algorithm, to yield a period code and a period length code (step 214).

Then according to step 216, the decoded period code is compared with the period code stored in the memory of the control device. If the two

period codes are identical the program goes on. If they are different, the program returns to the initial step 200.

Then the step 218 of the program decodes the period length from the period length code elaborated at the step 214. A counting sub-program is incremented at step 220 with a number new allowed days corresponding to the number of 1/10th of days included in the period length.

A detection sub-program 222 tests permanently the number of 1/10th of days still allowed. If the number of 1/10th of days is positive the relay 110 remains closed and electricity is supplied to the subscriber. If the number of 1/10th of days is negative the relay is opened. As shown in Figs. 1 and 4 the number of supplying days still available is displayed by the display panel 108.

It is to be understood that if the results of the tests 212 or 216 are negative the program returns to the initial step 200. That means that each time the subscriber has to enter a new value code. However the number of erroneous enters of value code is counted by the error counter function 206. If the contents of this counter function become equal to 4 the next enter will be considered as a number entered by hazard, and the program is put in stand by for one hour.

As a result the subscriber who has not paid for electricity supply can enter only three hazard numbers assumed to be value code. Obviously it is very unlikely that one of these hazard numbers equals the correct value code.

Now the initialization of the control device will be explained i.e. the entering of the first period code by the employee of the utility company when the device is used for the first time.

With a personal computer or the like, the employee of the utility company will elaborate an initializing code which is to be entered in the memory of the control device and a first value code corresponding to this first period length. Preferably this period length corresponds to the number of days of the month which are left when the electricity meter is installed.

The initializing code is elaborated with three numbers, for example an "apparatus number", a "client number" and a starting number having the same number of figures as the period code. This three numbers are processed in accordance with a first predetermined algorithm for delivering the first period code. This first period code is also stored in the program memory of the control device.

With the personal computer the first value code is also elaborated. For this purpose, the number of days of the considered period is processed with a second predetermined algorithm for elaborating a period length code. This period length code and the first period code are processed in

accordance with a third predetermined algorithm for generating a code. Finally, this code is processed with a fourth predetermined algorithm including a control figure for generating the value code.

It is to be understood, that the program memory of the control device includes the predetermined algorithms so that the control device can elaborate the successive period codes starting from the preceding period code, the "client number" and the "apparatus number".

Similarly the utility company can elaborate with the personal computer the successive value codes which the subscriber receives when he pays the required amount of money.

Claims

1. Device for controlling delivery of a utility, such as gas, water, electric energy or an information signal, characterized by:

-means (32) for generating a first code,

-means (20) for entering a second code,

-means (34) for comparing said first and said second code supplying an enabling signal when said first code and said second code coincide,

-switching means (44) responsive to said enabling signal for connecting the supply of said utility,

-said generating means (32) generating said first code according to a secret algorithm,

-said generating means (32) generating a new value of said first code upon coinciding of the preceding value of said first code with the value of the second code.

2. Device according to claim 1, characterized by means (16,30,42) for inhibiting said enabling signal to the switching means (40) upon elapsing of a period after the start of the enabling signal.

3. Device according to claim 2, characterized by the means for inhibiting said enabling signal comprising:

-a counter (16) to which a clock signal from a clock circuit (14) is applied;

-a comparator (42) connected with said counter (16) and supplying said enabling signal to said switching means (40) until said counter (16) has reached a certain counting positions, and

-a memory (30), the contents whereof are trans-

ferred to said counter (16) each time said memory (30) receives an enabling signal from said comparing means (34).

4. Device according to claim 3, characterized by said second code comprising a period length code, and by means (26) for transferring the number corresponding with the appropriate period length to said memory (30).

5. Device according to claim 3 or 4 characterized by displaying means (36), displaying the remaining length of time until disconnecting the supply of said utility.

6. Device according to claim 1 characterized by means (16,39,42) for inhibiting said enabling signal to the switching means upon delivery of a certain amount of utility after the start of the enabling signal.

7. Device according to claim 6, characterized by the means for inhibiting said enabling signal comprising:

-a device (302) for measuring the amount of utility being consumed and for supplying a pulse signal the frequency of which is proportional to the amount of utility being consumed,

-a counter (16) to which said pulse signal is applied,

-a comparator (42) connected with said counter (16) and supplying said enabling signal to said switching means (40) until said counter has reached a certain counting position, and

-a memory (30), the contents whereof are transferred to said counter (16) each time said memory (30) receives an enabling signal from said first comparing means (34).

8. Device according to claim 7, characterized by said second code comprising a utility amount code, and by means (26) for transferring the number corresponding with the appropriate utility amount to said memory (30).

9. Device according to claim 7 or 8, characterized by displaying means (36), displaying the remaining amount of utility until disconnecting the supply of said utility.

10. Device according to one of the claims 3 -5, 7 -9, characterized by the counter (16) being a down counter and said certain counting position being zero.

11. Device according to one of the preceding claims, characterized by means (26) connected to the entering means (20) for decoding said second code according to a secret algorithm.

12. Device according to claim 11, characterized by the decoding means (26) comprising means for testing the entered second code by means of a check digit contained in said second code.

13. Device according to one of the preceding claims, characterized by means (40) for inhibiting further entry of codes after entering a number of defective codes.

14. Device according to one of the preceding claims, characterized by means for overriding the inhibiting signal supplied to the switching means for a limited period, which means can be put into use only one in every period by pushing an emergency button (39).

15. Device according to claim 14, characterized by indicating means (37, 38), showing whether or not the emergency button has been used and whether the supply of utility has been cut off.

16. Device according to one of the preceding claims, characterized by means for resetting and starting the device after a failure.

17. Device according to one of the preceding claims, characterized by means for periodically copying the contents of the memories in a non-volatile memory.

18. Device according to one of the preceding claims, characterized in that the initialization value of the first code is entered by the company supplying the utility and that the subsequent values of the first code are calculated from the preceding value of said code.

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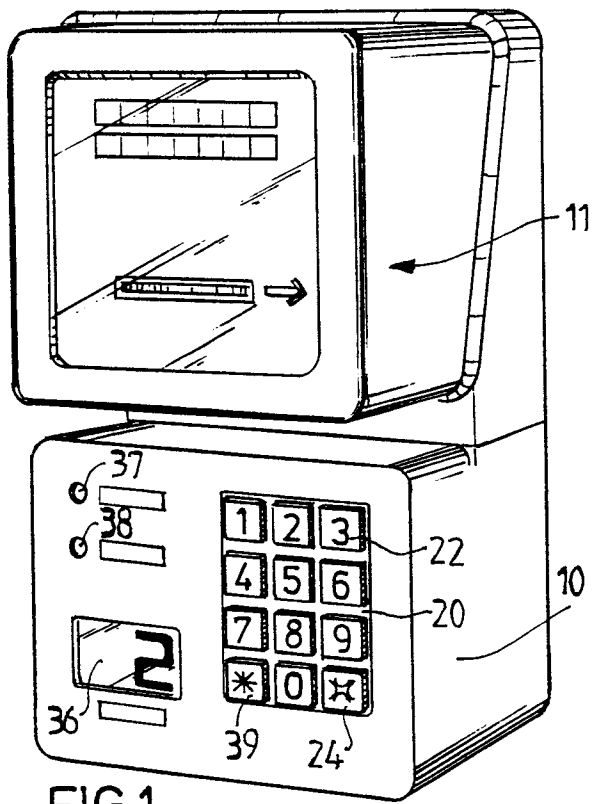


FIG. 1

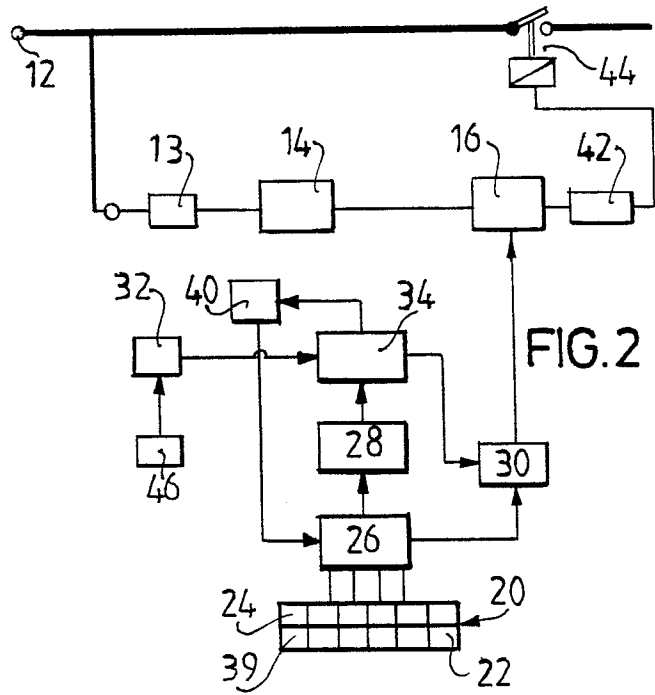


FIG. 2

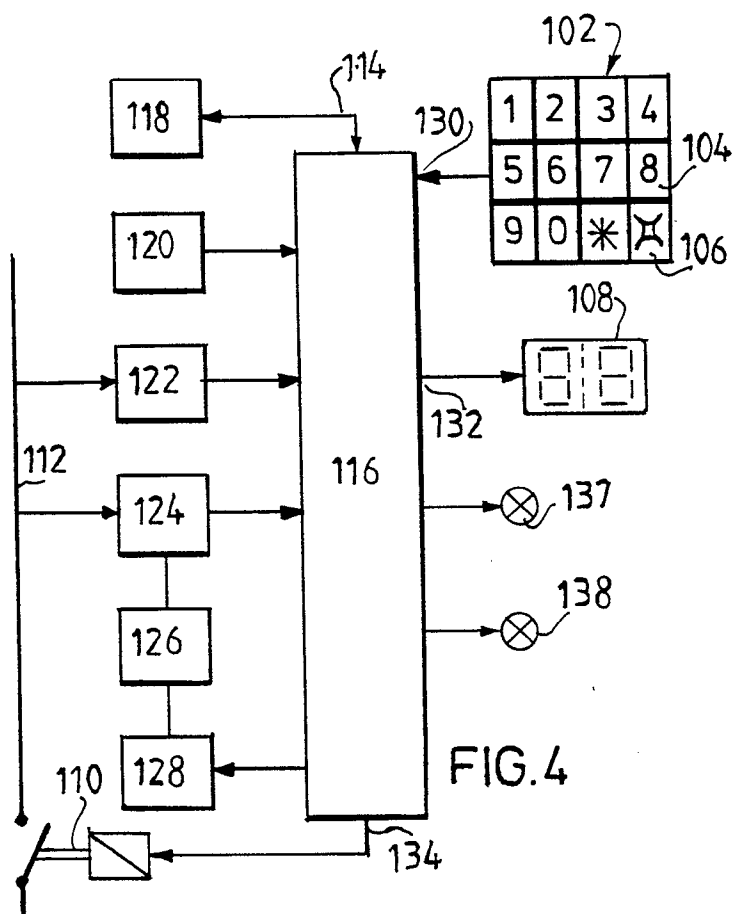


FIG. 4

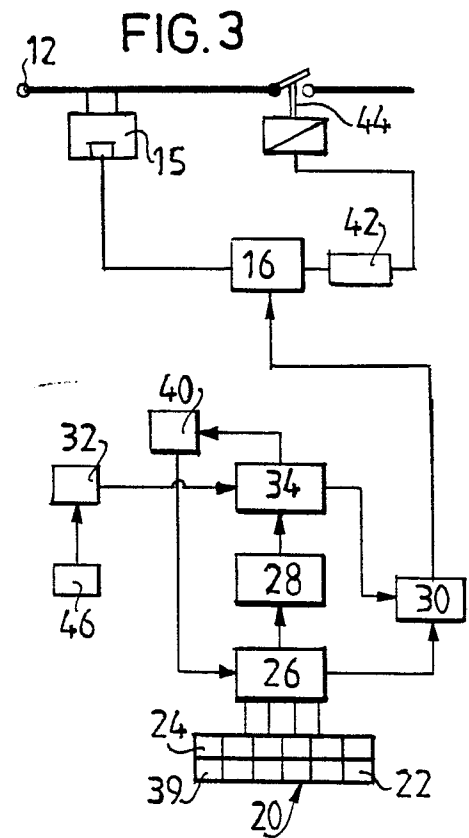
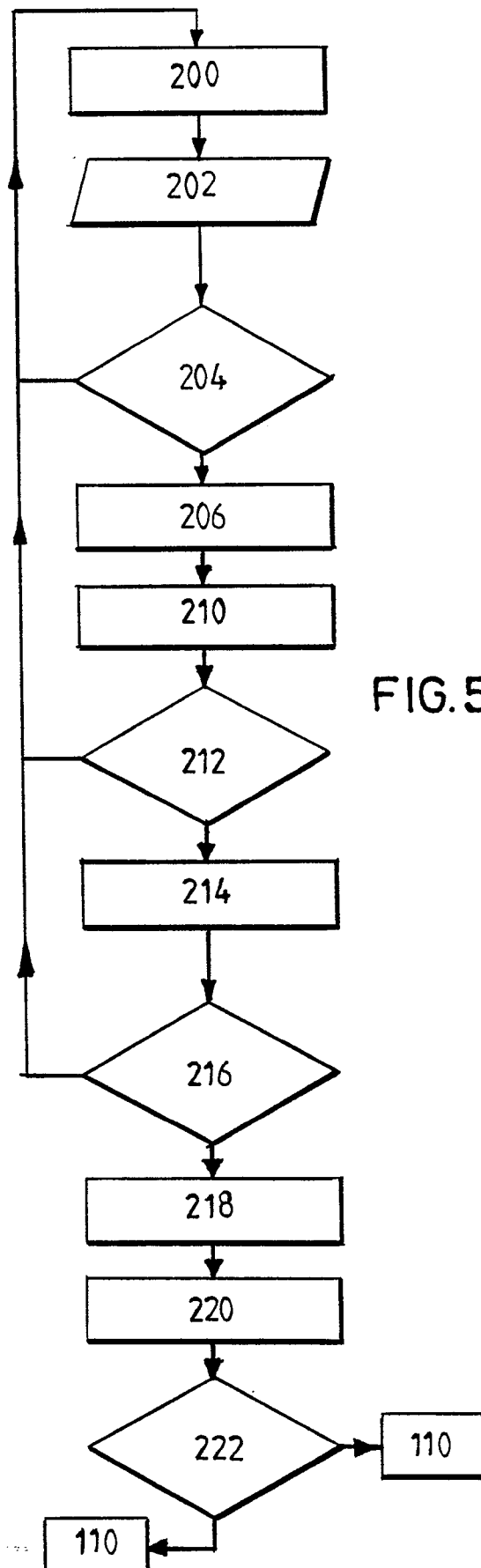


FIG. 3





EP 85 20 1738

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	GB-A-2 080 203 (PITNEY BOWES) * Abstract; figures 1,2; page 2, line 94 - page 3, line 42; claims *	1,8-11,18	G 07 F 15/00 G 07 C 9/00
A	---	3,6,7,17	
X	GB-A-1 520 530 (PITNEY BOWES) * Page 1, line 29 - page 2, line 26; figures 1,1a; page 5, line 3 - page 6, line 29; claims *	1,8-10	
A	---	3,6,7	
A	EP-A-0 151 874 (THE DE LA RUE COMPANY) * Abstract; figures; claims *	1,3,6-11,18	TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
A	EP-A-0 063 893 (MAINMET LTD.) * Abstract; figures; claims *	1-3,5-10,14	G 07 F G 07 C G 07 B
A	EP-A-0 015 120 (SOUTH EASTERN ELECTRICITY BOARD) * Whole document *	1-10	
A	EP-A-0 152 198 (SCHLUMBERGER ELECTRONICS) -----		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 08-07-1986	Examiner DAVID J.Y.H.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	