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(54) Prepaid charge counting apparatus.

(57) A prepaid charge counting apparatus to be employed, for example, in a particular parking system in which the parking period of time is limited. In such a case, the driver is to purchase the apparatus in advance such that a count corresponding to the prepaid amount is assigned to the apparatus.

When parking a car in the parking place, the user first operates the ON/OFF operation unit to initiate the respective sections of the apparatus, and then the remaining amount of the count and the consumption state of the time are appropriately displayed on the display.

This apparatus is placed at a position in a car visible from the outside thereof such that the time measuring unit continuously measures the consumed period of time and that the arithmetic unit converts the measurement result of the time measuring section into a count so as to compute the remaining amountof the count. The control unit updates the display contents on the display section based on the measurement result of the time measuring section and the computation result of the arithmetic unit.

The manager of the parking place monitors the display contents to appropriately check the consumption state of the time. In consequence, in order to construct a prepayment system in the parking place, when the

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apparatus is employed, the inventment for the special facility and the management cost can be unnecessitated. Furthermore, the user is relieved from the annoying operation of the prepayment of the parking charge for each parking operation.

Fig.7a

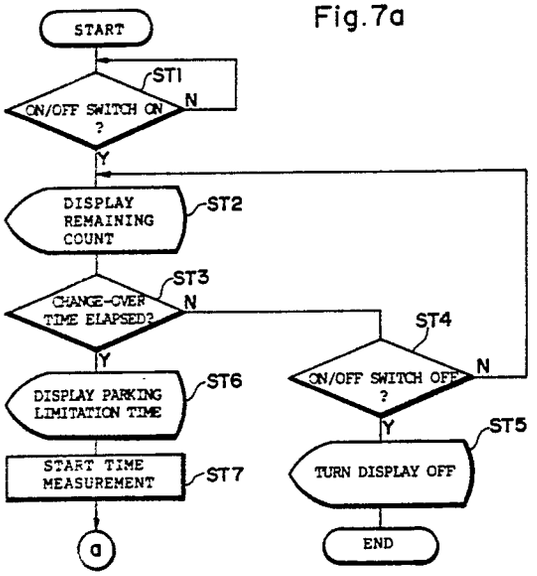
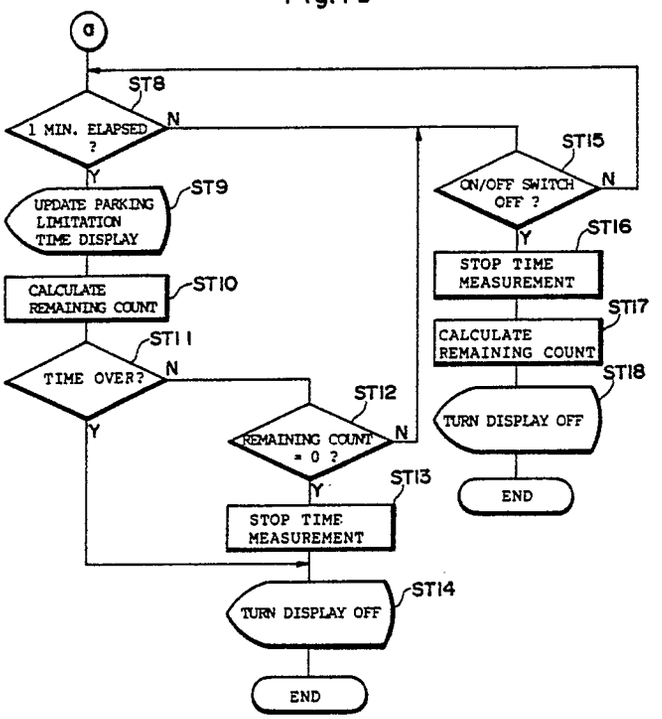


Fig.7b



PREPAID CHARGE COUNTING APPARATUS

Field of the Invention

The present invention relates to a prepaid charge counting apparatus employed in a prepayment system, for example, to pay a parking charge in advance in a parking place in which the period of parking time is limited.

Description of the Prior Art

FIGS. 19 and 20 show conventional prepayment systems in a toll parking place of this kind.

In the system of FIG. 19, a plurality of parking areas 1 are formed along a road or the like and a ticket machine 2 is installed in the proximity of the parking areas 1. In this parking place, when a driver parks a car 3 of his or her own in either one of the parking areas 1, the driver pays a parking fee into the ticket machine 2 to take a ticket accordingly issued therefrom so that the ticket is placed on a dashboard or an instrument board so as to be checked by the supervisor or manager of the parking place.

In the configuration of FIG. 20, a plurality of parking areas 4 are similarly formed and a charge counting machine 5 including a timer integrated therein is installed for each parking area 4. In this parking place, when a driver parks a car 6 of his or her own in either one of the parking areas 4, the driver pays a parking fee by use of the charge counting machine 5 so as to place the car 6 under control of the manager of the parking place.

However, in these systems, since it is necessary to resepctively install the ticket selling machine 2 and the charge counting machines 5, a great amount of expense is required for the investment of equipment on the side of the parking place owner; furthermore, for the operations of the parking place, there are required management for the collection of money and for the change and jobs associated with maintenance of the equipment, which results in a large amount of cost for the maintenance and management of the parking system. In addition, on the side of the driver, for each operation to park the car, it is necessary to go to the ticket machine 2 for a ticket or to insert bills or coins into the charge counting machine 5, namely, there have been various problems, for example, such actions are required for the payment of the parking charge and it is annoyance to prepare small coins for the payment.

Incidentally, in a toll parking place where the period of time for the parking is limited, there has been generally employed a system in which the user of the parking area is charged only in the period of time in the daytime, for example, from 8 a.m. to 5 p.m., whereas early in the morning or in the nighttime, the parking place is freed for the user. As a result, in a case of the advance payment systems of FIGS. 19 and 20, at the starting time of the parking, a portion of a length of the time for the parking limitation period of time may exceeds the toll parking time zone in some cases. For example, this is a case when the toll parking time zone ends at 5 p.m. and a driver enters the toll parking place at 4:45 p.m. where the parking period of time is limited to one hour. In such a situation, the user is required to prepay the parking fee for one hour, which leads to a problem of an unreasonable result that an excessive parking charge is to be paid.

In addition, in a toll parking place where the period of time for the parking is limited, the system does not allow a continuous parking of a car without taking a particular action. In consequently, when the manager of the parking place finds such a card exceeding the parking period limitation, an action may be taken in a specifically malicious case to forcibly remove the car.

However, in the case of the prepayment systems of FIGS. 19 and 20, for a car exceeding the parking limit, it is not easy to determine the time when the limit is exceeded and hence the degree of the excess of the parking limitation, namely, the maliciousness of the parking cannot be simply judged; in concequence, it is difficult to take an appropriate action at once.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention which has been devised by paying attention to the problems above to provide a novel prepaid charge counting apparatus dedicated to a prepayment system so as to coustruct a prepayment system at a low cost for a parking place or the like and to improve the

convenience for the system user.

Another object of the present invention is to provide a novel prepaid charge counting apparatus capable of being applied also to a plurality of parking places among which the parking limitation time zones as well as the parking charge systems vary, for example, in a toll parking system in which the parking period of time is limited.

Still another object of the present invention is to provide a novel prepaid charge counting apparatus to which an appropriate parking charge is applied depending on the parking period of time in the toll charging zone even when a portion of the charging period established in the parking time limitation exceeds the limitation, for example, in a toll parking system in which the parking period of time is limited.

Further another object of the present invention is to provide a novel prepaid charge counting apparatus, for example, in a toll parking system in which the parking period of time is limited wherein even when the remaining prepaid amount at the parking operation does not cover the parking charge for all the period of the parking time limitation, the parking is enabled within the range of the remaining prepaid amount and there is provided a function to notify the condition to the user.

Still another object of the present invention is to provide a novel prepaid charge counting apparatus, for example, in a toll parking system in which the parking period of time is limited wherein for a car exceeding the parking limitation with respect to time, the degree of maliciousness can be judged so as to take an appropriate action at once.

In addition, another object of the present invention is to provide a novel prepaid charge counting apparatus which is constituted in a disposable structue including a reuse portion and a disposale portion so as to minimize the loss due to the disposal for the financial advantaghes.

In order to solve the prblems above, according to the present invention, there is provided a prepaid charge counting apparatus in which there is given a count corresponding to a value of the amount prepaid such that the remaining amount of the count is updated depending on a consumption peiod of time for a predetermined purpose. In the prepaid charge counting apparatus, there are disposed a display unit or section for displaying thereon as visible information the remaining amount of the count and the consumption state with respect to time, a time measuring section for measuring the cosumption period of time, an arithmetic unit to convert a result of the measurement effected by the time measuring section into a value of the count so as to calculate the remaining amount of the count, a control section to update the content of the display on the display section based on the result of the measurement conducted by the time measuring section and the result of the computation achieved by the arithmetic unit, and an ON/OFF operation unit to start or to stop the operations of the respevtive section. The count here indicates a value proportinal to a value of amount associated with the charge, and a predetermine unit amount is defined as count 1.

In a case where the prepaid charge counting apparatus is adopted, for example, in a particular toll parking system in which the parking period of time is limited, the user to park a car in the parking place is to purchase through a prepayment an apparatus according to the present invention. The apparatus is assigned with a count corresponding to the prepaid amount.

When using the parking place, the user first operates the ON/OFF operation unit to activate the respective sections so as to appropriately display the remaining amount of the count and the consumption state with respect to time on the display.

This apparatus is installed at a location visible from a position outside of the car so as to measure the consumed time by use of the time measuring section and the arithmetic unit converts the result of the measurement effected by the time measuring section to compute the remaining amount of the count. The control section or controller updates the display content on the display based on the measurement result of the time measuring section and the computation result of the arithmetic unit.

The manager of the parking place monitors the display content so as to properly check the state of time consumption. In consequence, when configuring a prepayment system of a parking place, there can be unnecessitated particular cost for equipment and management associated with the parking place by employing the apparatus according to the present invention. In addition, also for the user, the annoyance prepayment of the parking charge becomes to be unnecessary for each parking operation.

Due to the constitution above according to the present invention, by utilizing the prepaid charge counting apparatus in a prepayment system, for example, of a toll parking place, the investment of equipment such as ticket machines and charge counting machines and the cost related to the maintenance and management thereof are unnecessitated, which enables the prepayment system to be constructed at a low cost; moreover, the system user is freed from the annoying operations such as the payment of parking charge.

In order to solve the problems above, there is constituted a prepaid charge counting apparatus in which

a count is assigned in association with a value of the prepaid amount such that the remaining amount of the count is updated according to the consumed amount of the limitation time controlled for a predetermined purpose. In the prepaid charge counting apparatus prepaid charge counting apparatus, there are disposed a setting unit or section in which a plurality of pairs of limitation periods of time and required counts associated therewith are set, a selection and operation unit for selecting either one of the pairs of limitation periods of time and required counts associated therewith, a display section for displaying as visible information the pair selected by the selection and operation unit, the consumption state of the limitation period of time, and the remaining amount of the count, a time measuring unit for measuring the consumed amount of the selected limitation period of time, an arithmetic unit to convert the measurement result of the time measuring section into a count so as to calculate the remaining amount of the count, a control unit to update the display content on the display unit based on the measurement result of the time measuring unit and the computation result of the arithmetic unit, and an ON/OFF operation unit to initiate or terminate the respective sections.

In a case where the prepaid charge counting apparatus according to the present invention is employed, for example, in a toll parking place in which the parking period of time is limited, the driver who desires to park a car therein is to purchase the apparatus accoding to the present invention in advance. The apparatus is assigned with a count corresponding to a value of amount prepaid.

When using the parking place, the user first operates the ON/OFF operation unit to activate the respective sections and selects a pair of the limitation period of time and a required count to be applied to the objective parking place by means of the selection and operation unit. In addition, the selected pair, the state of consumption of the limitation period of time, and the remaining amount of the count are appropriately displayed on the display unit.

This apparatus is installed at a location visible from a position outside of the car so as to measure the consumed time by use of the time measuring section and the arithmetic unit converts the result of the measurement effected by the time measuring section to compute the remaining amount of the count. The control section or controller updates the display content on the display based on the measurement result of the time measuring section and the computation result of the arithmetic unit.

The manager of the parking place monitors the display content so as to properly check the state of time consumption. In consequence, when configuring a prepayment system of a parking place, there can be unnecessitated particular cost for equipment and management associated with the parking place by employing the apparatus according to the present invention. In addition, also for the user, the annoyance prepayment of the parking fee becomes to be unnecessary for each parking operation.

In addition, since the limitation period of time and the kind of the required count are selected in this apparatus, it is possible to apply this apparatus to the toll parking places among which the parking limitation period of time and the parking charge vary.

In order to achieve the objects above, according to the present invention, there is constituted a prepaid charge counting apparatus in which a count is assigned in association with a value of the prepaid amount such that the remaining amount of the count is updated according to the consumed amount of the limitation time controlled for a predetermined purpose. In the prepaid charge counting apparatus prepaid charge counting apparatus, there are disposed aan ON/OFF operation unit to initiate or to terminate the respective sections, a display section for displaying as a visible information the remaining amount of the count and the consumption state of the limitation period of time, a variable limitation period of time operation unit for variably setting as a value of the limitation period of time, in a case where a portion of the length of the limitation period of time relative to when an initiate operation is effected through the ON/OFF operation unit exceeds a time zone to be managed in the parking system, a value obtained by subtracting the portion of the time length from the total time length, a time measuring unit for measuring the consumed amount of the limitation period of time thus variably set, an arithmetic unit to convert the measurement result of the time measuring section into a count so as to calculate the remaining amount of the count, a control unit to update the display content on the display unit based on the measurement result of the time measuring unit and the computation result of the arithmetic unit.

In a case where the prepaid charge counting apparatus according to the present invention is employed, for example, in a toll parking place in which the parking period of time is limited, the driver who desires to park a car therein is to purchase the apparatus accoding to the present invention in advance. The apparatus is assigned with a count corresponding to a value of amount prepaid.

When using the parking place, the user first operates the ON/OFF operation unit to activate the respective sections. Furthermore, if the parking start time is near the end of the toll parking period of time, the variable limitaion period of time operation unit is operated to variably set a value of the limitation period of time corresponding to the remaining toll parking time as necessary. On the display unit, there are

appropriately displayed the remaining amount of the count and the consumption state with respect to time on the display.

This apparatus is installed at a location visible from a position outside of the car so as to measure the consumed time by use of the time measruing section and the arithmetic unit converts the result of the measurement effected by the time measuring section to compute the remaining amount of the count. The control section or controller updates the display content on the display based on the measurement result of the time measuring section and the computation result of the arithmetic unit.

The manager of the parking place monitors the display content so as to properly check the state of time consumption. In consequence, when configuring a prepayment system of a parking place, there can be unnecessitated particular cost for equipment and management associated with the parking place by employing the apparatus according to the present invention. In addition, also for the user, the annoyance prepayment of the parking fee becomes to be unnecessary for each parking operation.

In addition, since the limitation period of time is variably set in association with the length of the remaining toll parking period of time, a correct parking charge is applied. That is, since this apparatus is constructed so as to enable the limitation period of time to be variably set, even in a case where a portion of the time length of the limitation period of time enters the charge-free period of time, a correct charge is applied according to the length of the toll parking period of time.

In order to achieve the objects above, according to the present invention, there is constituted a prepaid charge counting apparatus in which a count is assigned in association with a value of the prepaid amount such that the remaining amount of the count is updated according to the consumed amount of the limitation time controlled for a predetermined purpose. In the prepaid charge counting apparatus prepaid charge counting apparatus, there are disposed an ON/OFF operation unit to initiate or to terminate the respective sections, a display section for displaying as visible information the remaining amount of the count and the consumption state of the limitation period of time, a time measuring unit for measuing the consumed amount of the selected limitation period of time, a first arithmetic unit to convert the measurement result of the time measuring section into a count so as to calculate the remaining amount of the count, a second arithmetic unit to be operative when the remaining amount of the count at the initiate operation effected through the ON/OFF operation unit is less than the count value obtained by converting the limitation period of time so as to compute a value of a limitation period of time associated with the remaining amount of the count, and a control unit to update the display content on the display unit based on the measurement result of the time measuring unit and the computation result of the arithmetic unit.

In a case where the prepaid charge counting apparatus according to the present invention is employed, for example, in a toll parking place in which the parking period of time is limited, the driver who desires to park a car therein is to purchase the apparatus accoding to the present invention in advance. The apparatus is assigned with a count corresponding to a value of amount prepaid.

When using the parking place, the user first operates the ON/OFF operation unit to activate the respective sections and then the remaining amount of the count and the state of consumption of the limitation period of time are appropriately displayed on the display unit. In this situation, if the remaining amount of the count at the initiate operation is not less than the count value attained by converting the parking limitation period of time, the parking limitation period of time is displayed as the initial vlaue on the display unit; otherwise, a value of the parking limitation period of time corresponding to the remainig amount of the count is computed by the second arithmetic unit and then the controller displays the value as the initial value on the display unit.

This apparatus is installed at a location visible from a position outside of the car so as to measure the consumed time by use of the time measuring section and the first arithmetic unit converts the result of the measurement effected by the time measuring section to compute the remaining amount of the count. The control section or controller updates the display content on the display based on the measurement result of the time measuring section and the computation result of the first arithmetic unit.

The manager of the parking place monitors the display content so as to properly check the state of time consumption. In consequence, when configuring a prepayment system of a parking place, there can be unnecessitated particular cost for equipment and management associated with the parking place by employing the apparatus according to the present invention. In addition, also for the user, the annoyance prepayment of the parking fee becomes to be unnecessary for each parking operation.

In addition, according to this apparatus, even when the remaining amount of the count at the parking time does not suffice the parking cahrge for the entire period of time in the parking limitation period of time, it is possible to park the car within the range of the amount; moreover, the condition is notfied to the user through the display; in consequence, the user need not have any fear to completely use up the prepaid amount for the parking operation by means of this apparatus. That is, according to this apparatus, even

when the remaining amount of the count at the initiate operation does not suffice the parking charge for the entire period of time in the parking limitation period of time, it is possible to park the car within the range of the amount; moreover, the condition is notfied to the user through the display; in consequence, the user need not have any fear to completely use up the prepaid amount for the parking operation by means of this apparatus.

In order to achieve the objects above, according to the present invention there is constituted a prepaid charge counting apparatus in which a count is assigned in association with a value of the prepaid amount such that the remaining amount of the count is updated according to the consumed amount of the limitation time controlled for a predetermined purpose. In the prepaid charge counting apparatus prepaid charge counting apparatus, there are disposed an ON/OFF operation unit to initiate or terminate the respective sections, a display section for displaying as a visible information the remaining amount of the count and the consumption state of the limitation period of time, a time measuring unit to measure the consumed amount of the limitation period of time, an arithmetic unit to convert the measurement result of the time measuring section into a count so as to calculate the remaining amount of the count, a control unit to update the display content on the display unit based on the measurement result of the time measuring unit and the computation result of the arithmetic unit and to be operative when the limitation period of time is used up for continuously retaining the display state of the dispaly for a preset period of time.

In a case where the prepaid charge counting apparatus according to the present invention is employed, for example, in a toll parking place in which the parking period of time is limited, the driver who desires to park a car therein is to purchase the apparatus accoding to the present invention in advance. The apparatus is assigned with a count corresponding to a value of amount prepaid.

When using the parking place, the user first operates the ON/OFF operation unit to activate the respective sections, then on the display unit, there are appropriately displayed the remaining amount of the count and the consumption state with respect to time on the display.

This apparatus is installed at a location visible from a position outside of the car so as to measure the consumed time by use of the time measuring section and the arithmetic unit converts the result of the measurement effectedby the time measuring section to comput the remaining amount of the count. The control section or controller updates the display content on the display based on the measurement result of the time measuring section and the computation result of the arithmetic unit.

The manager of the parking place monitors the display content so as to properly check the state of time consumption. In consequence, when configuring a prepayment system of a parking place, there can be unnecessitate particular cost for equipment and management associated with the parking place by employing the apparatus according to the present invention. In addition, also for the user, the annoyance prepayment of the parking fee becomes to be unnecessary for each parking operation.

In addition, according to this apparatus, even when the parking limitation period of time is elapsed, the display state is retained on the display unit, it is possible to correctly juged the degree of the incorrect parking state or the maliciousness thereof by checking whether or not the display is retained, which enables an appropriate action to be taken at once.

In order to achieve the objects above, according to the present invention there is constituted a prepaid charge counting apparatus in which a count is assigned in association with a value of the prepaid amount such that the remaining amount of the count is updated according to the consumed amount of the limitation time controlled for a predetermined purpose; moreover, in the prepaid charge counting apparatus, there are disposed, a display section for displaying as a visible information the remaining amount of the count and the consumption state of the limitation period of time, an arithmetic control unit to compute the remaining amount of the count depending on the consumed period of time so as to update the display conntent on the display unit, a power supply to supply power to the respective units, and an operation unit to initiate and to terminate the respective units.

The display and operation units are disposed on the base of the apparatus, whereas the arithmetic control unit and the power supply are located in an auxiliary housing unit such that the auxiliary housing unit is detachably connected to the apparatus base via a connector.

Since the display and operation units are disposed on the base of the apparatus and the arithmetic control unit and the power supply are located in an auxiliary housing unit so that the auxiliary housing unit is detachably connected to the apparatus base via a connector, when the count equivalent to the value of prepaid amount is consumed, it is only necessary to replace the auxiliary housing unit with a new unit, which minimizes the loss associated with the replacement or disposal of the auxiliary housing unit, thereby implementing a financially advantageous system.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be apparent from the following detailed description taken inconjunction with the accompanying drawings in which:

FIG. 1 is a perspective view showing a prepaid charge counting apparatus as an embodiment according to the present invention;

FIG. 2 is a perspective view showing a prepaid charge counting apparatus as an alternative embodiment according to the present invention;

FIG. 3 is a perspective view showing a disassembled state of the apparatus of FIG. 2;

FIG. 4 is a perspective view showing an enlarged configuration of a switch mechanism;

FIG. 5 is an electric circuit diagram showing an example of the circuit structure of the apparatus of the embodiment shown in FIG. 2;

FIG. 6 is a functional block diagram showing the function of a microcomputer;

FIGS. 7a and 7b are flowcharts showing a control procedure of the apparatus of the embodiment of FIG. 1;

FIGS. 8a to 8d are diagrams schematically showing transition of display contents in the display section of the apparatus of the embodiment shown in FIG. 1;

FIGS. 9a to 9c are flowcharts showing a control procedure of the apparatus of the embodiment shown in FIG. 2;

FIGS. 10a to 10d are diagrams showing transition of display contents in the display section of the apparatus of the embodiment shown in FIG. 2;

FIFS. 11a to 11c are diagrams showing transition of display contents in the display section in a case where the parking limitation period of time is reduced by means of a down switch in the apparatus shown in FIG. 2;

FIG. 12 is an explanatory diagram useful to explain a method of using a prepaid charge counting apparatus;

FIG. 13 is a perspective view showing a setting method of setting the prepaid charge counting apparatus in a car;

FIG. 14 is a flowchart showing a processing procedure in a variation example in which the display content on the display unit is continuously retained after the parking limitation period of time is elapsed;

FIGS. 15a to 15e are diagrams showing transition of display contents on the display unit when the operation of FIG. 14 is achieved;

FIGS. 16 to 18 show further an alternative embodiment in which;

FIG. 16 is a perspective view showing the configuration of a prepaid charge counting apparatus;

FIG. 17 is a perspective view showing a disassembled state thereof; and

FIG. 18 is an electric circuit diagram showing a cirucit constitution example of the apparatus; and

FIGS. 19 and 20 are explanatory diagrams useful to explain the prepayment systems in the conventional parking places.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Although the drawings show a prepayment system in a toll parking place in which the parking period of time is limited and a specific example of a prepaid charge counting apparaus adopted in this system, the prepaid charge counting apparatus according to the present invention is not restricted by this example and is applicable to various prepayment systems in any facilities other than the parking place.

FIG. 1 shows an apprearance of a prepaid charge counting apparatus as an embodiment according to the present invention in which there are disposed an apparatus body 10 in a shape of a thin plate or a card and a display section 11 and a switch operation unit 12 respectively located on a surface of the body 10. The display section 11 is employed to display the remaining amount of the count and the remaining period of the parking limitation period of time, whereas the switch operation unit 12 is provided with ON/OFF switch 15 for initiating or terminating the apparatus. This apparatus of the embodiment is adopted in a parking place system in which the parking limitation period of time and the parking charge are fixedly determined.

FIG. 2 shows an altetrnative embodiment in which the parking limitation period of time and the parking charge are shared ammong a plurality of different parking places. The apparatus includes a display section 11 comprising a first display section 13 and a second display section 14, which are respectively used to

display a zone number and the remaining amount of the count and the remaining period of the parking limitation period of time. In this specification, a zone indicates a type of a parking place classified according to the parking limitation priod of time and a required count (obtained by converting the parking charge) assigned to the zone. An example of the zones is as follows.

Zone number	Parking limitation period of time		Required count
0	0 hr	30 min	6
1	0	30	12
2	1	00	3
3	1	00	6
4	1	00	12
5	2	00	6
6	2	00	12
7	2	00	18
8	9	00	27
9	9	00	54

According to this table, for example, in a parking place having a zone number 0, the maximum parking limitation period of time is indicated as 30 minutes and the necessary count (parking charge) to park a card for 30 minutes is 6.

In addition, according to the embodiment of FIG. 2, the switch operation unit 12 includes, in addition to the ON/OFF switch 15, a zone switch 16 and a down switch 17. The zone switch l6 is used to select a zone, namely, for each depression thereof, the zone is sequentially changed. The down switch 17 is employed when a portion of the parking limitation period of time at the initiation of a parking operation exceeds the toll parking time zone controlled by the parking place such that a value obtained by subtracting the excessive period of time from the parking limitation period of time is variably set by use of this switch 17 as a value of the parking limitation period of time. For example, in a case where a driver enters a parking place at 4:45 p.m in which the toll parking time zone ends at 5:00 p.m. and the parking limitation period of time is one hour, a variable setting of the parking limitation period of time is effected with the remaining toll parking period of 15 minutes.

The apparatus body 10 includes, as shown in FIG. 3, a front plate 18, a base plate 19, a liquid crystal display plate 20, a lubber connector 21, a printed circuit board 22, a lithium battery 23, and a rear plate 24. FIG. 3 shows an assembly structure of the embodiment of FIG. 2, whereas the assembly structure of the embodiment of FIG. 1 is substantially similar to this structure and is hence not shown.

The front plate 18 includes transparent portions 25 at positions corresponding to the display section 11 and switch marks 26 to 28 printed at the respective switch positions of the switch operation unit 12. The front plate 18 has a rear surface, which is an adhesive surface so as to be fixed on a front surface of the base plate 19. The base plate 19 is formed with a synthetic resin and is provided with openings 29 at positions corresponding to the display section 11 and with switch mechanisms at the respective switch positions of the switch operation unit 12.

The switch mechanism 30 is configured as shown in FIG. 3 such that a pressing body 32 positioned at the center of the opening 31 having a circular shape and support plates 33 having a restoring force (elasticity) to support the pressing body 33 from four directions are integrally formed together with the base plate 19 and that a conductor member 34 is attached on the pressing body 31. When the operator presses a position of the switch mark 26, 27, or 28 of the front plate 18 the pressing body 32 is pushed so that the conductor member 34 is brought into contact with a predetermined switch contact pattern of the printed circuit board 22, thereby producing a switch signal.

The liquid crystal display plate 20 is disposed as a portion to digitally display a zone number, the remaining amount of the count, and the remaining period of the parking limitation period of time, whereas the lubber connector 21 is used to electrically connect the liquid crystal display plate 20 to a corresponding circuit pattern of the printed circuit board 22.

The printed circuit board 22 includes predetermined patterns constituting electric circuits such that circuit elements including a microcomputer 35 and an oscillator 36 are arranged thereon and that a lithium battery 23 is inserted into a notched portion 37. Incidentally, the rear plate 24 has an adhesive surface, which is fixed on the rear surface of the printed circuit board 22.

FIG. 5 shows a circuit configuration example of the embodiment of FIG. 2 in which centered on the

microcomputer 35, there are electrically connected a power supply circuit 38, an oscillator circuit 39, the switch operation unit 12, and the display section 11. The power supply 38 includes the lithium battery 23 and functions as a direct-current power supply for the microcomputer 35. The oscillator circuit 39 comprises the oscillator 36 to supply the microcomputer 35 with a clock signal.

The microcomputer 35 includes a central processing unit, CPU for the control and aithmetic operations, a read-only memory, ROM for storing a program, and a random access memory, RAM to be used as a work area; moreover, as shown in the functional block diagram of FIG. 6, there are provided various functions as a setting unit 40, a time measuring unit 41, an arithmetic unit 42, and a controller 43. The setting unit or section 40 is used to beforehand store therein the parking limitation period of time and the required count for each zone (the table listed above). The time measuring unit 41 measures the consumed amount of the parking limitation period of time for a selected zone. The arithmetic unit 42 converts the measurement result of the time measuring unit 41 into a count so as to compute the remaining amount of the count. In addition, when the remaining amount of the count at the initate operation is less than the value obtained by converting the parking limitation period of time, the arithmetic unit 42 computes a value of a limitation preiod of time corresponding to the remaining amount of the count. The control unit 43 updates the display content of the display unit 11 depending on the measurement resutl of the time measuring section 41 and the computation result of the arithmetic unit 42.

Incidentally, as compared with the circuit configuration of the apparatus of FIG. 1, the zone switch 16 and the down switch 17 of the switch operation unit 12 are provided in FIG. 5; moreover, the setting unit 40 is disposed in FIG. 6. The other constitutions of FIG. 1 are the same as those of FIG. 2 and hence are not shown; furthermore, description thereof will be avoided.

FIGS. 7a and 7b show a control procedure of the microcomputer in the apparatus of the embodiment of FIG. 1. Description will be given in detail of the operation of the system with reference to FIGS. 7a and 7b.

If a driver desires to use the parking place when necessary, it is required to beforehand purchase the prepaid charge counting apparatus to be kept located in the car at any time. The count corresponding to the prepaid charge is stored in the apparatus. Assume here that the user parks a car 45 in an arbitrary parking area 44 of the parking place. The driver first depresses the ON/OFF switch 15 of the switch operation unit 12 so as to initiate the prepaid charge counting apparatus. As a result, in a step 1 (denoted as "ST1" in the figure) of FIG. 7a, "YES" is resulted from the judgement of "ON/OFF switch ON?"; and then in a step 2, as shown in FIG. 8a, a count ("800" in this case) corresponding to the value of the prepaid amount is displayed on the display unit 11.

The subsequent step 3 judges to determine whether or not a predetermined change-over period of time for examaple, 5 seconds) has been elapsed after the initiation of the apparatus. Furthermore, in a step 4, a judgement is conducted to determine whether or not the ON/OFF switch of the switch operation unit 12 has been depressed during the wait time.

If the change-over period of time has been elapsed, control is passed from the step 3 to a step 6; otherwise, control is transferred from the step 4 to a step 5, which stops the operation of the apparatus and hence the display content of the display unti 11 is turned off.

In the step 8, the display content is changed over on the display unit 11 such that as shown in FIG. 8b, a parking period of time "0 hr 30 min" is displayed on the display unti 11.

At this point of time, the measuring unit 41 starts the time measuring operation (step 7). The user installs the apparatus at a position in the car 45 visible from the outside of the car 45 and then leaves the car 45.

FIG. 13 shows a specific example of the installing method of setting the prepaid charge counting apparatus in the car. In this example, a dedicated cover 47 is placed on a sun visor 46 disposed in the car and a transparent pocket 48 is provided on an outer surface of the conver 47 such that the user inserts the prepaid charge counting apparatus thus initiated into the pocket 48 and rotates the sun visor 46 toward the side of the door of the car 45 as shown in FIG. 12 so that the prepaid charge counting apparatus is confirmed from the outside.

In FIG. 7b, the step 8 checks to determine whether or not one minute has been elapsed after the start of the time measurement of the time measring section 41. If "YES" results, the processing proceeds to a step 9 so as to update the display content of the parking limitation period of time on the display unit 11, nameiy, the display is changed over to "0 hr 29 min" as shown in FIG. 8c. In the next step 10, the remaining count A at this point of time is computed by the arithmetic unit 42. Assuming the remaining count at the start of the time measurement to be B, the computation formula will be as follows.

A = B - (Required count/Parking limitation period)

X Elapsed time (1)

Incidentally, when the computation result in the term of multiplication or division includes a fractional

part in the formula above, the part is rounded off for a range from 0.0 to 0.4, is rounded off or up for a range from 0.4 to 0.6, and is rounded up for a range from 0.6 to 1.0.

In the subsequent step 11, the parking limitation period of time is checked, namely, whether or not the result of the time measuring unit 41 reaches 30 minutes is judged. In the next step 12, it is determined whether or not the remaining count computed in the step 10 is 0. If the step 12 resutls in "YES", the step 13 is effected to stop the time measuring operation and then control is passed to the step 14 to clear the display content of the display section 11. (Refer to FIG. 8d for details.) When the step 11 results in "YES", control directly proceeds to the step 14 and hence the display content is cleared on the display unit 11.

The step 15 judges to determine whether or not the ON/OFF switch 15 of the switch operation unit 12 is depressed after the initiation of the time measurement.

When the driver returns to the car within the parking limitation period of time and depresses the ON/OFF switch 15, the step 15 results in "YES" and the subsequent step 16 stops the time measurement of the time measuring unit 41, and then the next step 17 computes the remaining count at this point and clears the display on the display unit 11 (step 18).

FIGS. 9a, 9b, and 9c show a control procedure of the microcomputer in the apparatus of the embodiment of FIG. 2.

Assume here that the user parks a car in a parking place belonging to the zone 0. The user depresses the ON/OFF switch 15 of the switch operation unit 12 to initiate the prepaid charge counting apparatus. This causes the judgement of "Swithc ON?" in the step 21 as well as "ON/OFF switch?" in the step 22 of FIG. 9a to result in "YES", and hence, in the subsequent step 23, a count ("800" in this case) corresponding to the value of the prepaid amount is displayed on the second display section 14 of the display section 11 as shown in FIG. 10a.

The next step 24 determines whether or not a predetermined change-over period of time (for example, five seconds) has been elapsed after the initiation of the apparatus; moreover, steps 25 to 27 judge to determine whether or not the zone switch 16, the ON/OFF switch 15, or the down switch 17 has been depressed during the wait time.

If the change-over period of time has been elapsed or the zone switch 16 has been depressed, control is transferred from the step 24 or 25 to the step 28. If the ON/OFF switch 15 has been depressed, the processing proceeds from the step 26 to the step 30 and then the operation of the apparatus is stopped and the display contents are cleared on the display section 11.

In the step 28, a judgement is conducted to determine whether or not the remaining count is not less than the required count N_0 of the first zone (zone 0 in this example). In this case, the remaining count is "800" and the required count of the zone 0 is "6"; in consequence, the step 28 results in "YES" and then the step 31 is effected to change over the display contents of the display section 11, namely, as shown in FIG. 10b, the zone number "0" and the parking limitation period of time "0 hr 30 min" are displayed on the first and second display sections 13 and 14, respectively.

If the remaining count is less than the required count N_0 in the judgement of the step 28, control is passed from the step 28 to the step 29 so that the second arithmetic unit 50 computes the operation of the expression (2) as follows to convert the remaining count into a period of time, and then the controller 43 displays the obtained time value as the value of the parking limitation period of time on the display section 14 (step 31).

Converted time value = (Parking limitation period of time/Required count)X Remaining count (2)

Incidentally, in the expression above, if a result of the arithmetic operation includes a fractional part, the part is rounded of for a range from 0.0 to 0.4, is rounded off or is rounded up for a range from 0.4 to 0.6, and is rounded up for a range 0.6 to 1.0.

At this point of time, the time measuring section 41 starts the time measurement (step 32), and then the user installs the apparatus at a location in the car 45 visible from the outside thereof and leaves the car 45. (Refer to FIG. 12 for details.)

In FIG. 9b, the step 33 determines whether or not one minute has been elapsed after the initiation of the time measurement in the time measuring unit 41. If "YES" results, the step 34 is executed so as to update the display content of the parking limitation period of time on the second display section 14, namely, the display content is changed over, as shown in FIG. 10c, to the display of "0 hr 29 min".

In this case, if the step 29 computes a small value of the parking limitation period of time (for example, 0 hr 15 min) corresponding to the remaining count so as to use the value in the initialization, the display content is changed over from "0 hr 15 min" to "0 hr 14 min". In the next step 35, the arithmetic unit 42 computes the remaining count A at this point of time by use of the expression (1).

The next step 36 determines whether or not the parking limitation period of time, namely, 30 minutes have been measured by the time measuring unit 41, and then the succeeding step 37 judges to determine

whether or not the remaining count computed in the step 35 is 0. If the step 37 results in "YES", the step 38 is executed to stop the timer measuring operation and then the step 39 clears the display contents on the display section 11. (Refer to FIG. 10d for details.) Moreover, if the judgement of the step 36 results in "YES", control directly proceeds to the step 39 to clear the display contents on the display section 11.

Steps 40, 47, and 51 respectively determine whether or not a depression is effected in the switch operation unit 12 after the time measurement is started.

When the user parks a car in a parking place belonging to another zone, the user depresses the zone switch 16 an appropriate number of times. This causes the step 40 to result in "YES", and then in the next step 41, a judgement is conducted to determine whether or not the remaining count is not less than the required count N_i (i = 1, 2, ..., 9) for the zone. If the step 41 results in "YES", the display contents on the display section 11 are changed over in the step 43, namely, the zone number and the parking limitation period of time are displayed on the first and second display sections 13 and 14, respectively. Furthermore, in the step 41, if the remaining count is judged to be less than the required count N_i control is transferred from the step 41 to the step 42 such that the expression (2) is computed so as to convert the remaining count into a period of time and then the obtained time value is displayed as the value of the parking limitation period of time on the second display section (step 43).

In the next step 44, the arithmetic unit 42 computes the remaining count at this point of time. If the remaining count is not 0, the judgement of the step 45 results in "NO", and then the step 46 restarts the time measuring operation. If the remaining count is 0, the step 45 results in "YES" and control is passed from the step 45 to the step 38 so as to stop the time measurement.

In a case, for example, where the driver returns to the car within the parking limitation period of time, the driver depresses the ON/OFF switch 15 of the switch operation unit 12. As a result, the step 47 is executed to obtain "YES" and then the next step 48 stops the time measuring operation of the time measuring unit 41; thereafter, the step 49 computes the remaining count at this point of time and clears the display contents on the display section 11 (step 50).

In addition, when the user enters the parking place and initiates the parking operation, if a portion of the time length of the parking limitation period of time (for example 30 minutes) exceeds the toll parking time zone (for example, when the parking operation is started at 4:50 p.m. in a toll parking place of which the toll parking zone ends at 5 p.m.), the user depresses the down switch 17. This causes the step 51 to result in "YES" so as to pass control to the step 60 of FIG. 9c to compute the remaining count at this point; thereafter, the step 61 changes over the display content (the parking limitation period of time) on the second display section 14 into the content obtained by subtracting one minute from the old value.

The next step 62 conducts judgement to determine whether or not the down switch 17 has been continuously depressed for one second. If "YES" results, the subsequent step 63 checks for the depression state at an interval of 0.375 second such that each time "YES" is obtained from the step 63, the display content (the parking limitation period of time) is decremented by one minute on the second display section 14, thereby effecting a high-speed display change-over operation (step 64). The display change-over operation is successively achieved until the display content on the second display section 14 becomes to be "10 min" as shown in FIG. 11c.

In this situation, if the down switch 17 has not been depressed for one second in a continuous fashion ("NO" results from the step 62) or if the continuous depression of the down switch 17 is completed ("YES" results from the step 65), control is passed from the step 62 or 65 to the step 66 so as to determine whether or not the remaining count is 0. If "NO" is obtained, the step 67 is effected to restart the time measurement of the time measuring section 41. Furthermore, if the judgement of the step 66 results in "YES", the step 68 stops the time measurement and the succeeding step 69 clears the display contents on the display section 11.

Moreover, in the operation above, it is natural that the remaining count at the completion of the time measurement is stored in a memory having a backup power supply.

In the embodiment above, when the parking limitation period of time is judged to be elapsed in the step 36 of FIG. 9b, the display contents on the display section 11 are immediately cleared. In this case, however, the point of time when the parking limitation period of time is exceeded cannot be known. In order to solve the problem, an embodiment is shown in FIG. 14 and FIGS. 15a to 15e according to the present invention.

In FIG. 6, the controller 43 updates the display contents of the display section 11 based on the measurement result of the time measuring unit 41 and the computation result of the arithmetic unit 42; furthermore, continuously retains the display state of the first display section 13 for a preset period of time (for example, ten minutes) when the parking limitation period of time is completely elapsed. The period of time elapsed with respect to the preset period of time is measured by the time measuring unit 41.

FIG. 14 shows processing to be effected after the step 36 of FIG. 9b. Furthermore, FIGS. 15a to 15e

show display contents on the display section 11. FIGS. 15a to 15c are identical to FIGS. 10a to 10c.

If the judgement in the step 36 results in "YES", control proceeds to the step 70 in which the controller 43 clears the display content (the parking limitation period of time) on the second display section 14 and keeps the display content (the zone number) to be remained on the first display section 13. FIG. 15d shows the display state, which is kept retained for a preset period of time (ten minutes in this example). In consequence, when this display state is confirmed, the manager of the parking place can recognize that the parking limitation period of time is just exceeded, namely, the degree of the overdue parking is not great.

Incidentally, in this embodiment, although only the display content on the first display section 13 is kept retained, the operation is not restricted by this example. That is, various display methods are possible, for example, also the display content (for example, 0 hr 00 min) on the second display section 14 may be kept displayed; alternatively, the display content on the first display section 13 is cleared and the the display content on the second display section 14 is kept retained; furthermore, there may be displayed the period of time elapsed after the parking limitation period of time is exceeded.

The step 71 determines whether or not the ON/OFF switch 15 has been depressed in the display state above, and the next step 72 judges to determine whether or not the preset period of time, namely, ten minutes have been elapsed. If either one of these steps results in "YES", control proceeds to the step 73 to entirely clear the display contents on the display section 11. (Refer to FIG. 15e for details.) In consequence, by confirming an event that the display contents are completely cleared, the manager can determine that a considerablly long period of time is elapsed after the parking limitation period of time is exceeded, namely, that the degree of the overdue parking is great or is not negligible.

FIGS. 16 to 18 show further an alternative embodiment according to the presert invention.

This configuration includes an apparatus body 10, which is constituted as shown in FIG. 16 with a reusable base member 10A and an auxiliary member 10B to be detachably connected to the base member 10A in the mechanical and electrical sense.

The base member 10A includes, as shown in FIG. 17, a front plate 18, a base plaate 19, a liquid crystal display plate 20, a lubber connector 21, a printed circuit board 22A, and a rear plate 24. These component are identical to those shown in FIG. 3 excepting the printed circuit board 22A.

The printed circuit board 22A includes a surface on which predetermined wiring patterns are printed to constitute electric circuits such that circuit elements such as an oscillator 36 are arranged on the wiring patterns; furthermore, there is disposed an open notched portion 37A having a rectangular shape so that a terminal receiving member 50A of a connector 50 is attached on an edge of the notched portion 37A. The rear plate 24 includes a front surface, which is an adhesive surface so as to be fixed on a rear surface of the printed circuit board 22.

The auxiliary member 10B is of a shape and a size corresponding to the notched portion 37A and comprises a front plate 51, a printed circuit board 52, and a rear base plate 53.

The printed circuit board 52 includes a surface on which predetermined wiring patterns are printed to constitute electric circuits such that circuit elements such as a microcomputer 35 and a lithium battery 23 are arranged on the wiring patterns; furthermore, there is disposed on an edge thereof a connecting terminal section 50B of the connector 50. When the printed circuit board 52 is integrally sandwiched between the front plate 51 and the rear base plate 53, the connecting terminal section 50B projects toward the front side, which enables the base member 10A to be inserted into the terminal receiving section 50A. This linkage causes the base member 10A and the auxiliary member 10B to be integrally connected to each other; furthermore, the wiring patterns on the printed circuit boards 22 and 52 are electrically connected to each other.

FIG. 18 shows a circuit configuration example of this embodiment in which centered on the microcomputer 35, there are electrically connected the lithium battery 23, the oscillator circuit 39, the switch operation unit 12, and the display section 11. This circuit configuration is substntially identical to that shown in FIG. 5. Moreover, the operation of the prepaid charge counting apparatus is similar to that described in association with FIGS. 9a to 9c and FIG. 14.

As a result of the repetitious usages of the prepaid charge counting apparatus, when the count corresponding to the value of the prepaid amount is used up, the connector 50 is removed so as to detach the auxiliary member 10B from the base member 10A such that only the auxiliary member 10B is to be replaced with a new auxiliary member and the base member 10A is sustained for reuse.

The user purchases only the auxiliary member 10B in which the count corresponding to the prepaid amount is stored so as to insert the auxiliary member 10B into the apparatus body or the base member 10A for a connection therebetween, which sets the apparatus to the initial state. Thereafter, like the operation described above, the apparatus can be used until the count corresponding to the value of the prepaid amount becomes to be zero.

Claims

1. A prepaid charge counting apparatus in which a count corresponding to a value of a prepaid amount is assigned and a remaining amount of the count is updated according to a consumption period of time for a predetermined purpose comprising:
display means (11, 13, 14) for displaying as visible information the remaining amount of the count and a consumption state of the period of time;
time measure means (35, 41) for measuring the consumption period of time;
arithmetic means (35, 42) for converting a measurement result of said time measure means into a count so as to compute the remaining amount of the count;
control means (35, 43) for updating a display content on said display means based on the measurement result of said time measure means and the computation result of said arithmetic unit; and
ON/OFF operate means (12, 15) for initiating or for terminating respective sections of the apparatus.

2. A prepaid charge counting apparatus according to claim 1 further including:
setting means in which a plurality of pairs each comprising a limitation period of time and a required count are beforehand set;
selection and operation means for selecting either one of said pairs each comprising a limitation period of time and a required count
said display means for displaying as visible information the pair selected by said selection and operation means, the remaining amount of the count, and a consumption state of the period of time;
said time measure means for measuring the consumption period of time associated with the selected limitation period of time.

3. A prepaid charge counting apparatus according to claim 1 in which a count corresponding to a value of a prepaid amount is assigned and a remaining amount of the count is updated according to a consumption period of time to be controlled for a predetermined purpose comprising:
said display means for displaying as visible information the remaining amount of the count and a consumption progress of the limitation period of time;
variable limitation period of time operate means operative, when a portion of a time length of the limitation period of time relative to a point of time of an operation initiation conducted by said ON/OFF operate means exceeds a controlled time zone, for variably setting as a value of the limitation period of time a value obtained by effecting a subtraction of the portion of the time length; and
said time measure means for measuring the consumption period of time of the limitation period of time thus variably set.

4. A prepaid charge counting apparatus according to claim 1 in which a count corresponding to a value of a prepaid amount is assigned and a remaining amount of the count is updated according to a consumption period of time to be controlled for a predetermined purpose comprising:
said display means for displaying as visible information the remaining amount of the count and a consumption progress of the limitation period of time;
said time measure means for measuring a consumption amount of the limitation period of time;
first arithmetic means for converting the measurement result of said time measure means into a count so as to compute the remaining amount of the count;
second arithmetic means operative, when the remaining amount of the count at an initiate operation conducted by said ON/OFF operate means is less than the converted count value obtained by converting the limitation period of time, for computing a limitation period of time corresponding to the remaining amount of the count; and
control means for updating a display content on said display means based on the measurement result of said time measuring means and computation results respectively of said first and second arithmetic means.

5. A prepaid charge counting apparatus according to claim 1 in which a count corresponding to a value of a prepaid amount is assigned and a remaining amount of the count is updated according to a consumption period of time to be controlled for a predetermined purpose comprising:
said display means for displaying as visible information the remaining amount of the count and a consumption state of the limitation period of time;
said time measure means for measuring a consumption amount of the limitation period of time; and
said control means for updating a display content on said display means based on the measurement result of said time measuring means and computation results respectively of said first and second arithmetic means, said control means being operative, when the limitation period of time is elapsed, for continuously retaining a display state of said display means for a preset period of time.

6. An apparatus according to claim 1 further incuding:
power supply means for supplying power to said respective means;
an apparatus body including said display means and said operate means; and
auxiliary member including said time measure means, said arithmetic means, said control means, and said power supply means wherein
said auxiliary member is detachably connected to said apparatus body by means of a connector.

7. A prepaid charge counting apparatus in which a count corresponding to a value of a prepaid amount is assigned and a remaining amount of the count is updated according to a consumption period of time to be controlled for a predetermined purpose comprising:
setting means in which a plurality of pairs each comprising a limitation period of time and a required count are beforehand set;
selection and operation means for selecting either one of said pairs each comprising a limitation period of time and a required count;
display means for displaying as visible information the pair selected by said selection and operation means, a consumption state of the limitaiton period of time, and the remaining amount of the count;
time measure means for measuring the consumption period of time associated with the selected limitation period of time;
arithmetic means for converting a measurement result of said time measure means into a count so as to compute the remaining amount of the count;
control means for updating a display content on said display means based on the measurement result of said time measure means and the computation result of said arithmetic means; and
ON/OFF operate means for initiating or for terminating respective sections of the apparatus.

8. A prepaid charge counting apparatus in which a count corresponding to a value of a prepaid amount is assigned and a remaining amount of the count is updated according to a consumption period of time to be controlled for a predetermined purpose comprising:
ON/OFF operate means for initiating or for terminating respective sections of the apparatus.
display means for displaying as visible information the remaining amount of the count and a consumption progress of the limitation period of time;
variable limitation period of time operate means operative, when a portion of a time length of the limitation period of time relative to a point of time of an operation initiation conducted by said ON/OFF operate means exceeds a controlled time zone, for variably setting as a value of the limitation period of time a value obtained by effecting a subtraction of the portion of the time length;
time measure means for measuring the consumption period of time in association with the limitation period of time thus variably set;
arithmetic means for converting a measurement result of said time measure means into a count so as to compute the remaining amount of the count; and
control means for updating a display content on said display means based on the measurement result of said time measure means and the computation result of said arithmetic means.

9. A prepaid charge counting apparatus in which a count corresponding to a value of a prepaid amount is assigned and a remaining amount of the count is updated according to a consumption period of time to be controlled for a predetermined purpose comprising:
ON/OFF operate means for initiating or for terminating respective sections of the apparatus.
display means for displaying as visible information the remaining amount of the count and a consumption progress of the limitation period of time;
time measure means for measuring the consumption period of time in association with the limitation period of time;
first arithmetic means for converting the measurement result of said time measure means into a count so as to compute the remaining amount of the count;
second arithmetic means operative, when the remaining amount of the count at an initiate operation conducted by said ON/OFF operate means is less than the converted count value obtained by converting the limitation period of time, for computing a limitation period of time corresponding to the remaining amount of the count; and
control means for updating a display content on said display means based on the measurement result of said time measuring means and computation results respectively of said first and second arithmetic means.

10. A prepaid charge counting apparatus in which a count corresponding to a value of a prepaid amount is assigned and a remaining amount of the count is updated according to a consumption period of time to be controlled for a predetermined purpose comprising:
ON/OFF operate means for initiating or for terminating respective sections of the apparatus.

display means for displaying as visible information the remaining amount of the count and a consumption state of the limitation period of time;
time measure means for measuring the consumption period of time in association with the limitation period of time;
arithmetic means for converting the measurement result of said time measure means into a count so as to compute the remaining amount of the count;
control means for updating a display content on said display means based on the measurement result of said time measuring means and computation results respsptively of said first and second arithmetic means, said said control means being operative, when the limitation period of time is elapsed, for continuously retaining a display state of said display means for a preset period of time.

11. A prepaid charge counting apparatus in which a count corresponding to a value of a prepaid amount is assigned and a remaining amount of the count is updated according to a consumption period of time comprising:
display means for displaying the remaining amount of the count and a consumption state of the time;
arithmetic control means for computing a count according to the consumption period of time so as to update a display content on said display means; power supply means for supplying power to respective means of the apparatus, and
operate means for initiating or for teterminating the respective means of the apparatus wherein
an auxiliary member including said arithmetic control means and said power supply means is detachably connected to an apparatus body including said display means and said operate means by use of a connector.

Fig.1

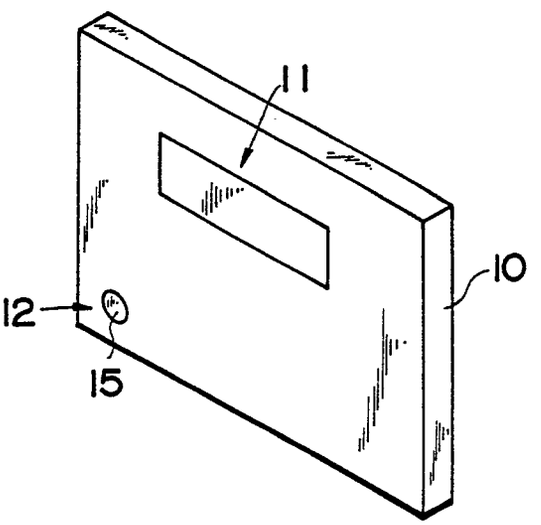


Fig.2

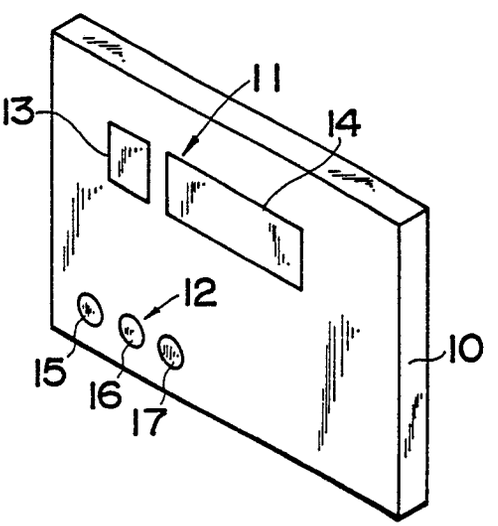


Fig.3

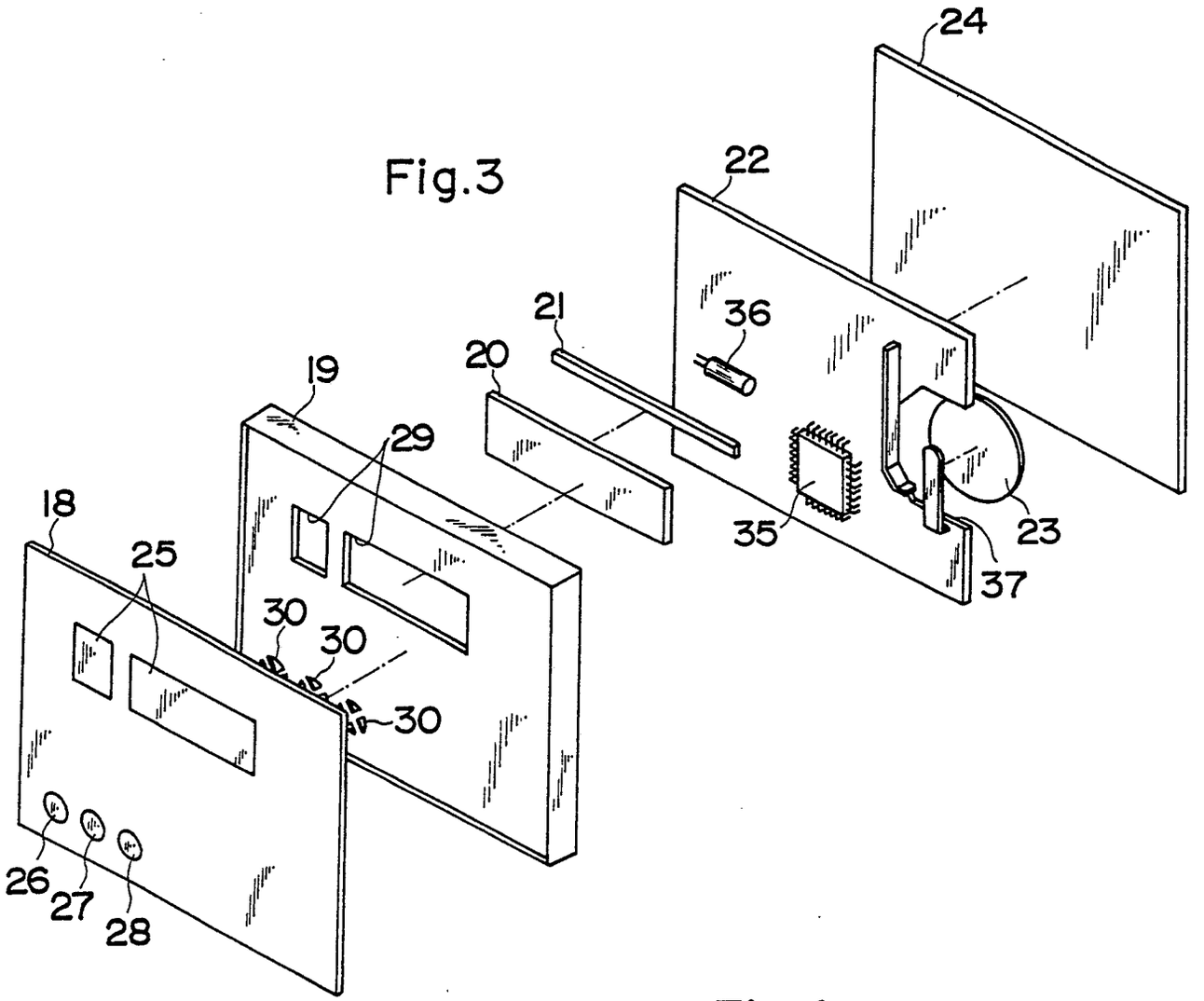

24
22
21
36
20
19
29
18
25
30
30
30
35
23
37
26
27
28

Fig.4

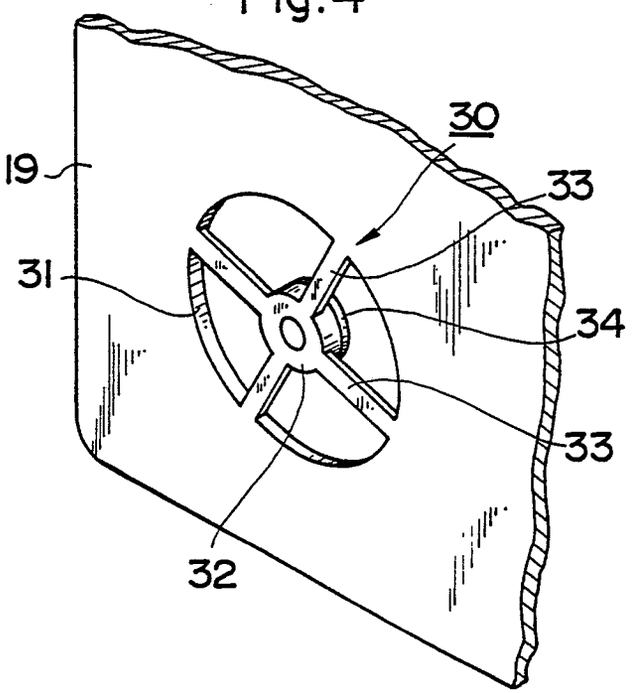

30
19
33
31
34
33
32

Fig.5

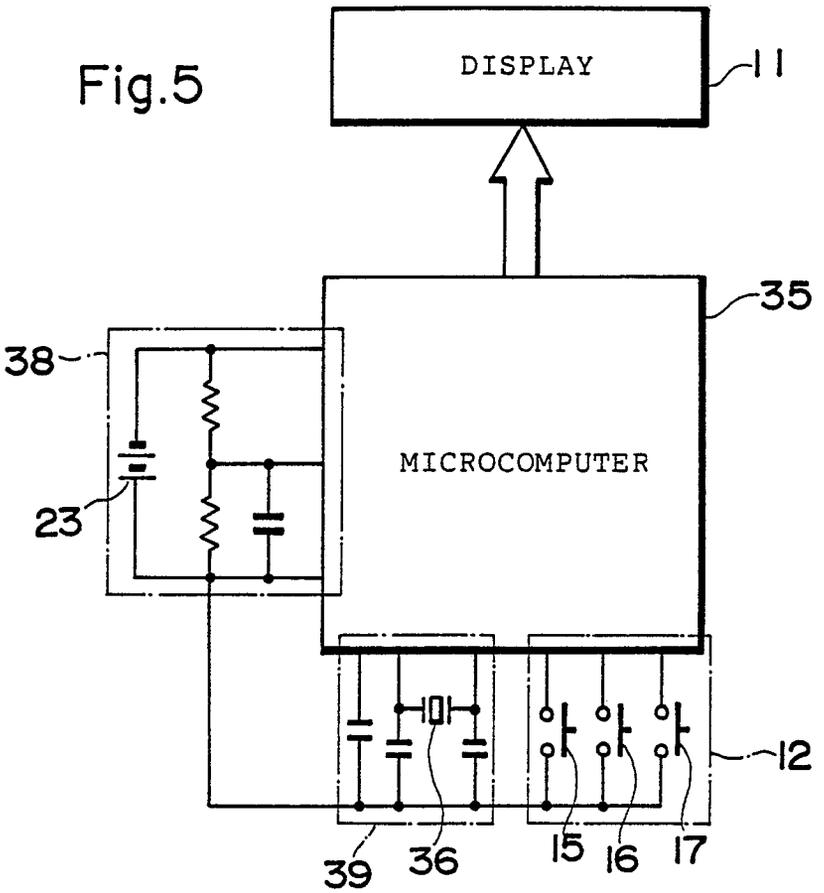

DISPLAY
11
35
38
MICROCOMPUTER
23
12
39
36
15
16
17

Fig.6

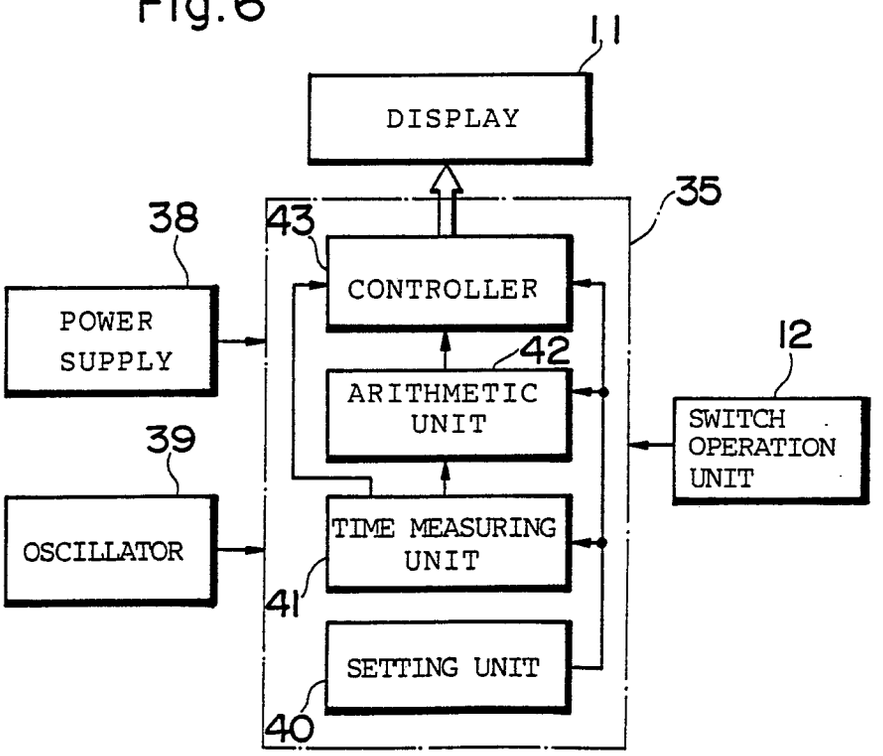

11
DISPLAY
35
38
43
CONTROLLER
POWER SUPPLY
42
12
ARITHMETIC UNIT
SWITCH OPERATION UNIT
39
OSCILLATOR
TIME MEASURING UNIT
41
SETTING UNIT
40

Fig.7a

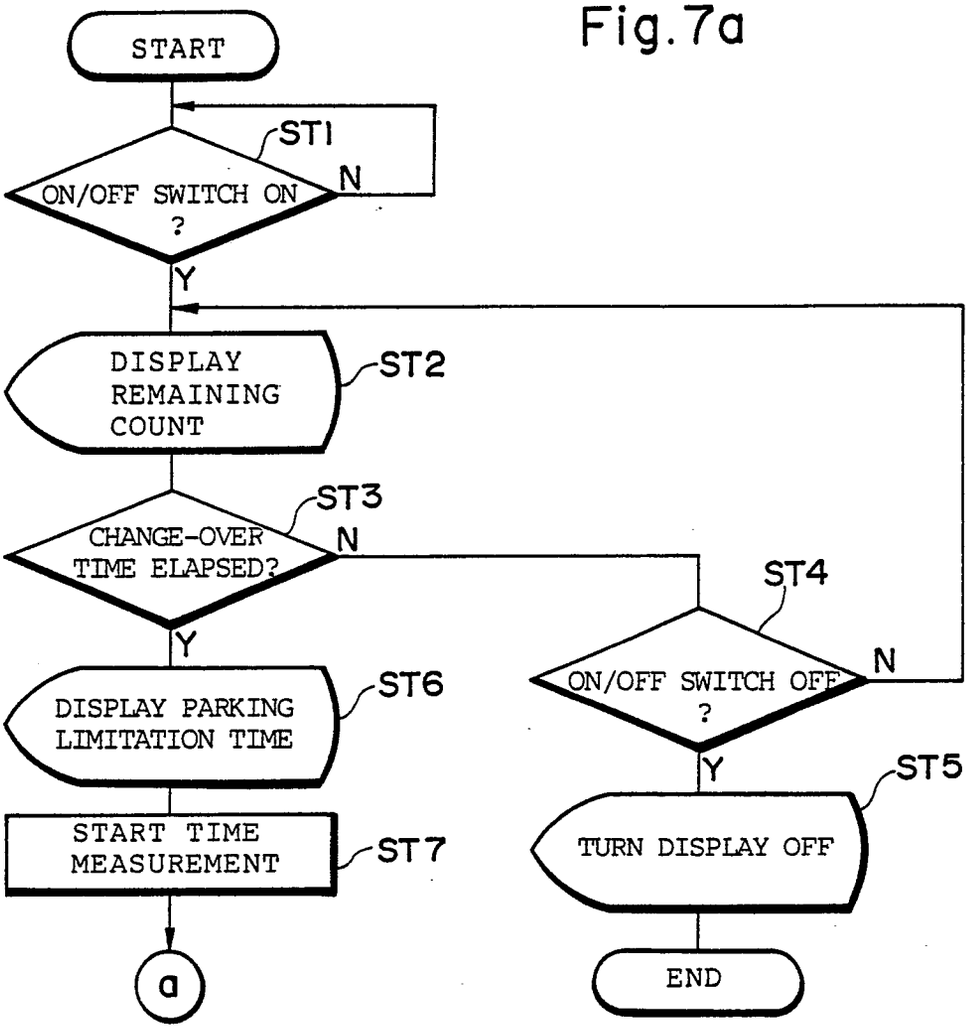

START
ST1
ON/OFF SWITCH ON ?
N
Y
DISPLAY REMAINING COUNT
ST2
ST3
CHANGE-OVER TIME ELAPSED?
N
Y
ST4
ON/OFF SWITCH OFF ?
N
Y
ST5
TURN DISPLAY OFF
END
ST6
DISPLAY PARKING LIMITATION TIME
START TIME MEASUREMENT
ST7
a

Fig.7b

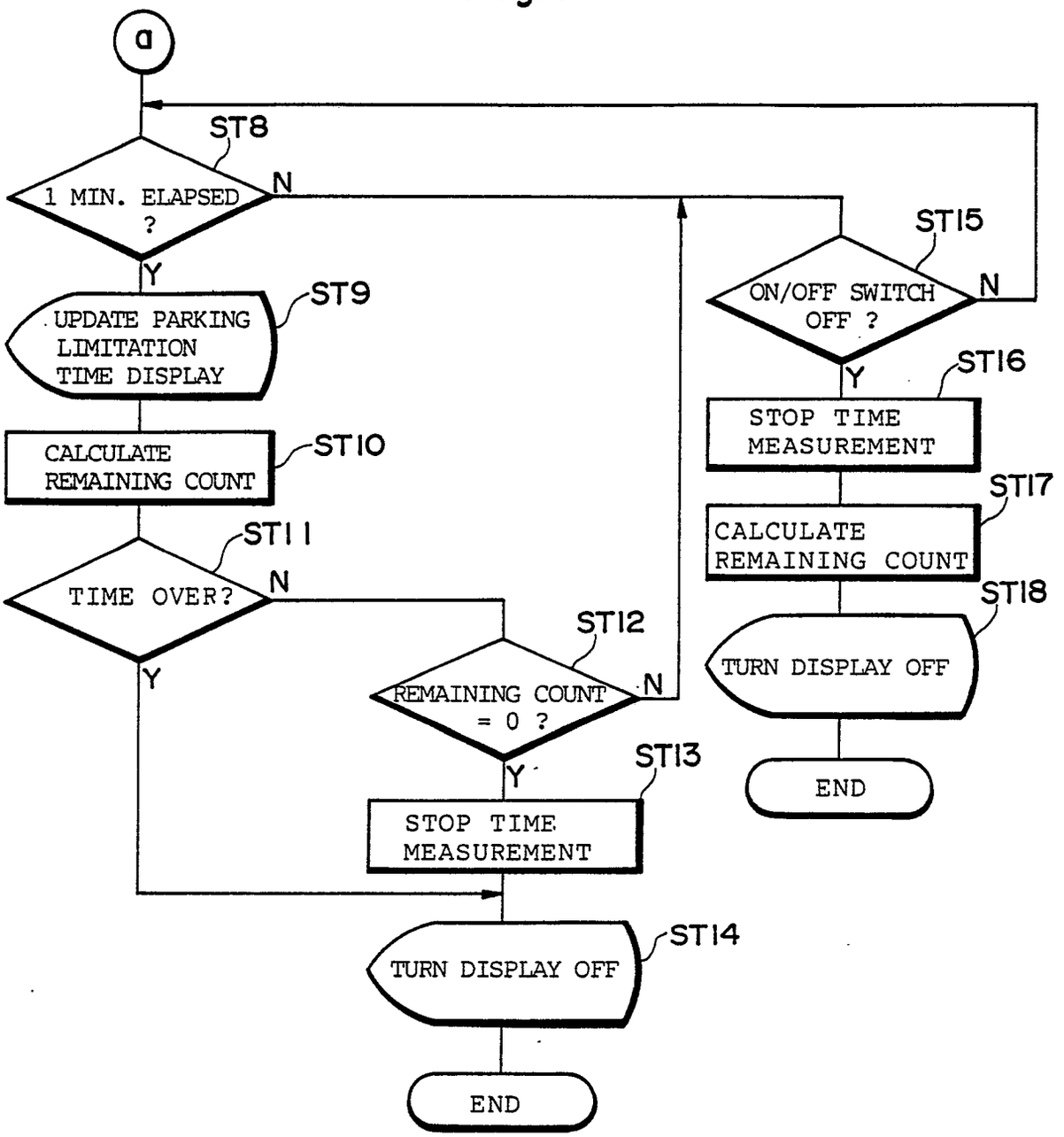

a
ST8
1 MIN. ELAPSED ?
N
Y
ST9
UPDATE PARKING LIMITATION TIME DISPLAY
CALCULATE REMAINING COUNT
ST10
ST11
TIME OVER?
N
Y
ST12
REMAINING COUNT = 0 ?
N
Y
ST13
STOP TIME MEASUREMENT
ST14
TURN DISPLAY OFF
END
ST15
ON/OFF SWITCH OFF ?
N
Y
ST16
STOP TIME MEASUREMENT
ST17
CALCULATE REMAINING COUNT
ST18
TURN DISPLAY OFF
END

Fig.8a 

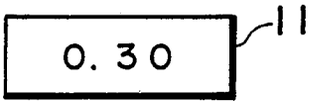
Fig.8b 

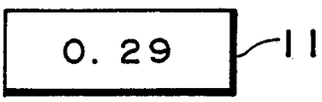
Fig.8c 

Fig.8d 

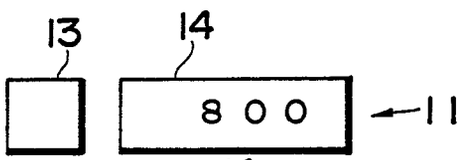
Fig.10a 

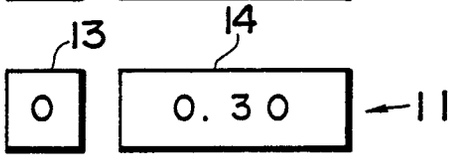
Fig.10b 

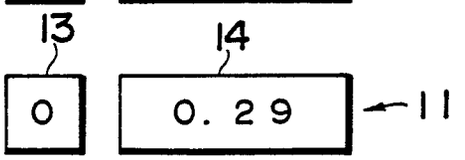
Fig.10c 

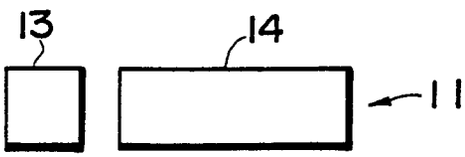
Fig.10d 

Fig.9a

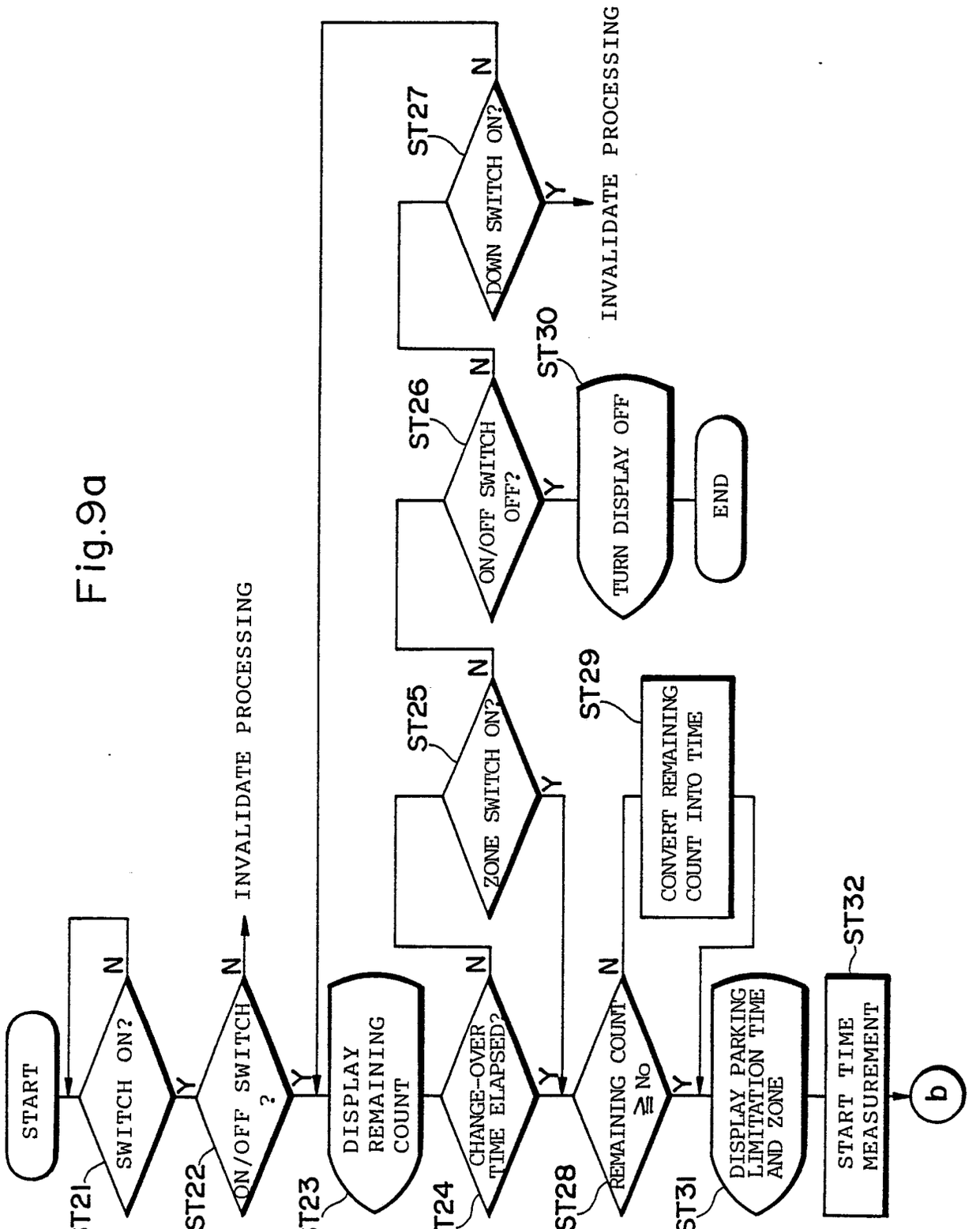

START
SWITCH ON?
ST21
N
Y
ON/OFF SWITCH ?
ST22
N
INVALIDATE PROCESSING
Y
DISPLAY REMAINING COUNT
ST23
CHANGE-OVER TIME ELAPSED?
ST24
N
Y
ZONE SWITCH ON?
ST25
N
Y
ON/OFF SWITCH OFF?
ST26
N
Y
DOWN SWITCH ON?
ST27
N
Y
INVALIDATE PROCESSING
TURN DISPLAY OFF
ST30
END
REMAINING COUNT ≧ No
ST28
N
Y
CONVERT REMAINING COUNT INTO TIME
ST29
DISPLAY PARKING LIMITATION TIME AND ZONE
ST31
START TIME MEASUREMENT
ST32
b

Fig.9b

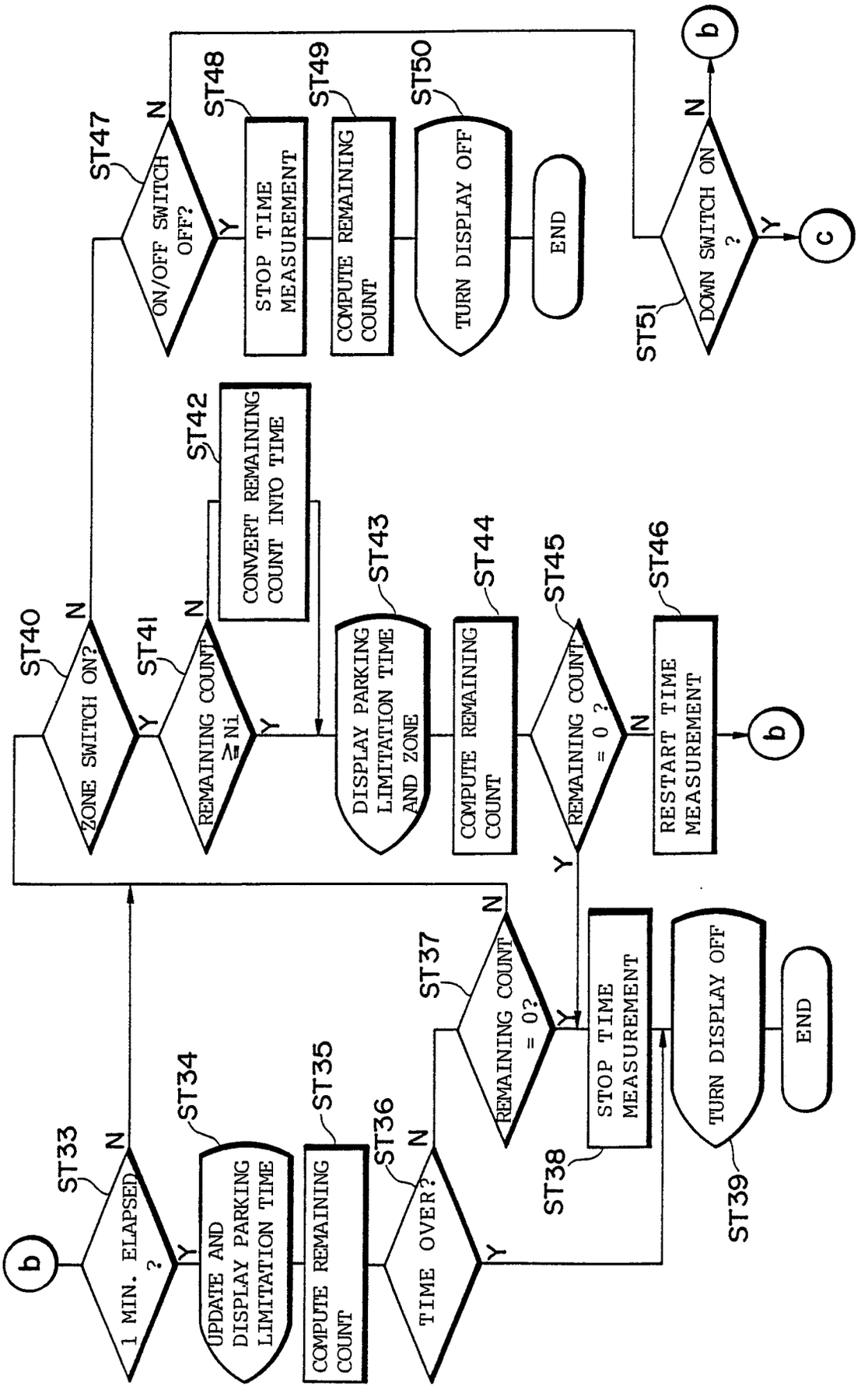
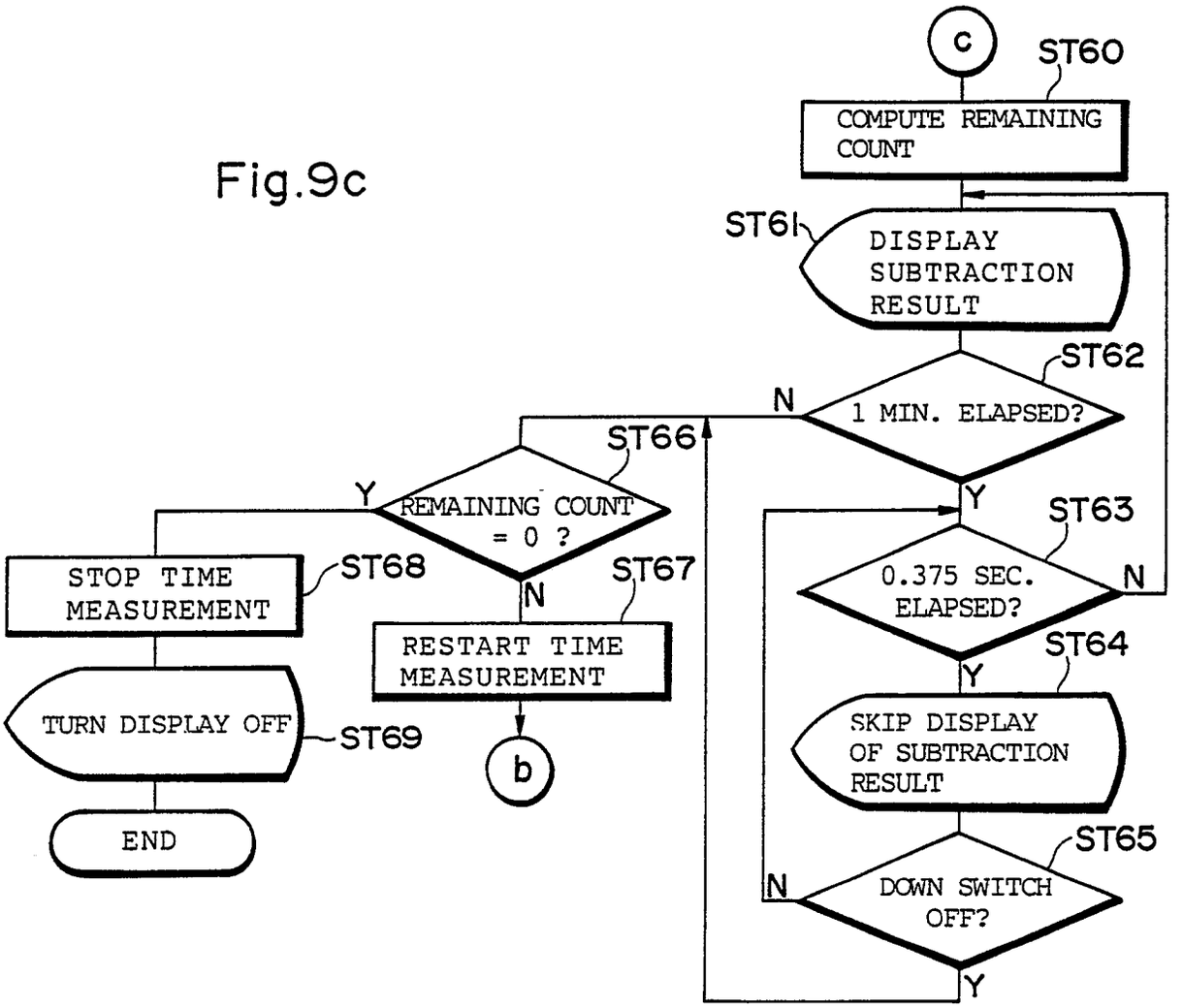

b
ST33
1 MIN. ELAPSED ?
N
Y
ST34
UPDATE AND DISPLAY PARKING LIMITATION TIME
ST35
COMPUTE REMAINING COUNT
ST36
TIME OVER?
N
Y
ST37
REMAINING COUNT = 0?
N
Y
ST38
STOP TIME MEASUREMENT
ST39
TURN DISPLAY OFF
END
ST40
ZONE SWITCH ON?
N
Y
ST41
REMAINING COUNT ≧ Ni
N
Y
ST42
CONVERT REMAINING COUNT INTO TIME
ST43
DISPLAY PARKING LIMITATION TIME AND ZONE
ST44
COMPUTE REMAINING COUNT
ST45
REMAINING COUNT = 0 ?
N
Y
ST46
RESTART TIME MEASUREMENT
b
ST47
ON/OFF SWITCH OFF?
N
Y
ST48
STOP TIME MEASUREMENT
ST49
COMPUTE REMAINING COUNT
ST50
TURN DISPLAY OFF
END
ST51
DOWN SWITCH ON ?
N
Y
b
c

Fig.9c



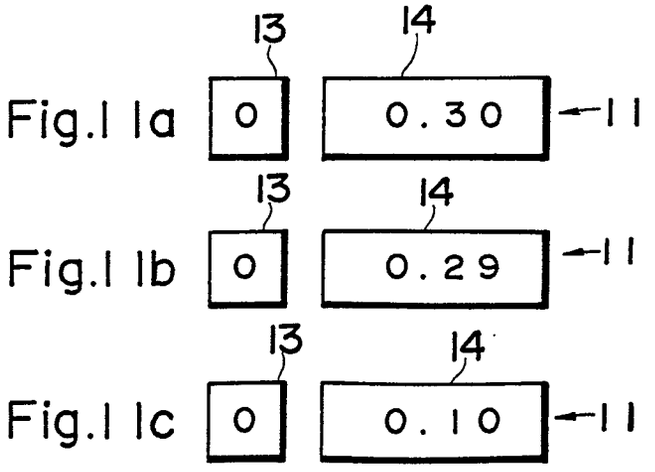


Fig.11a

Fig.11b

Fig.11c

Fig.12

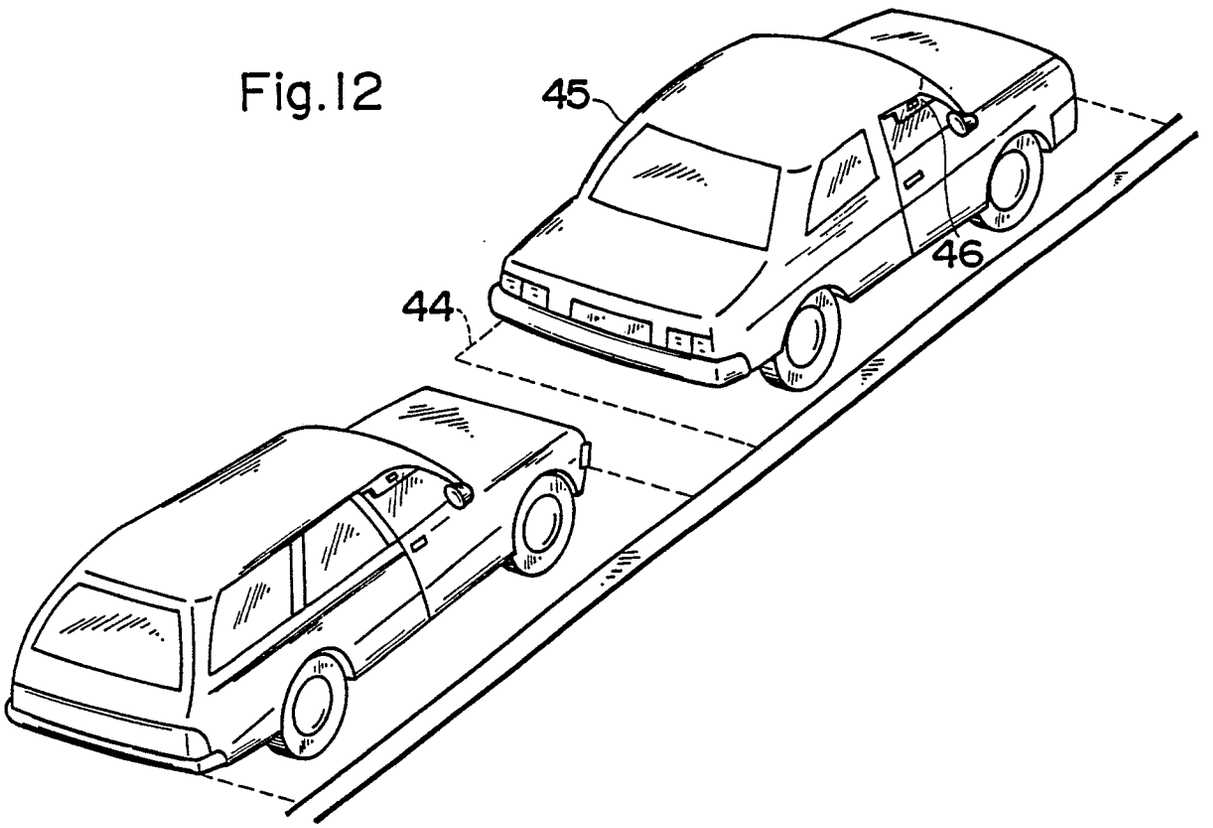
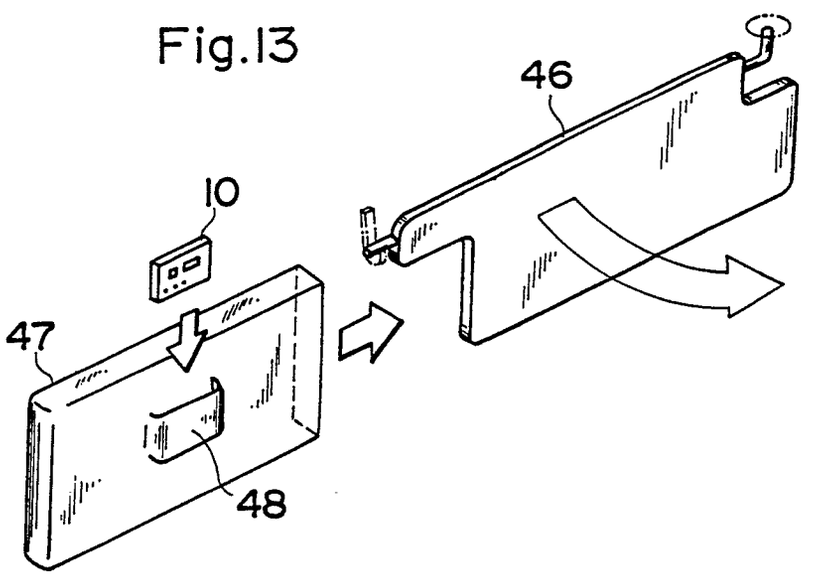


Fig.13



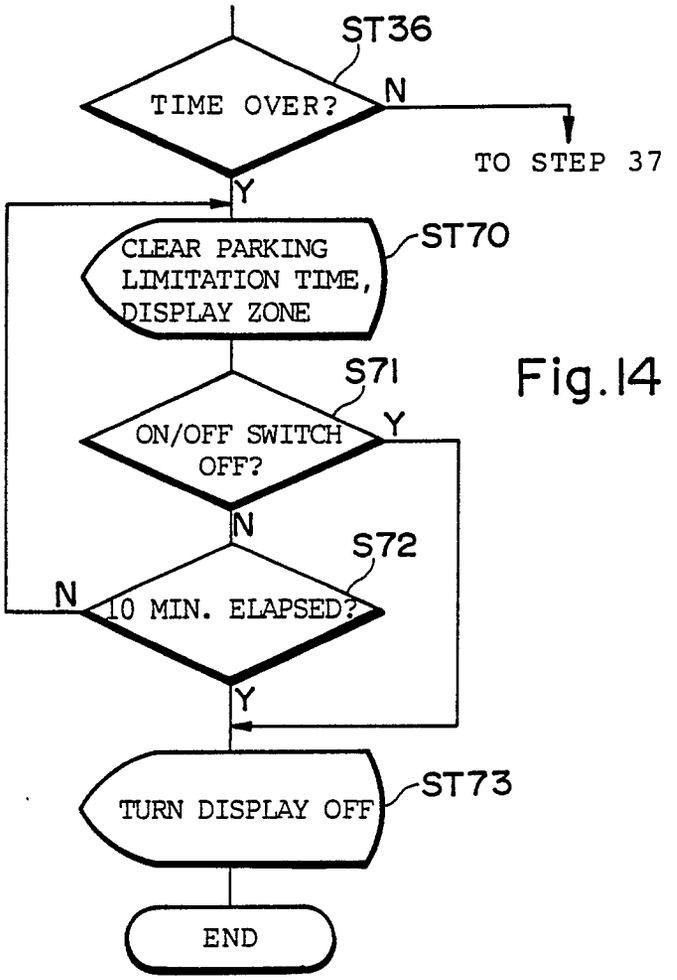


Fig.14

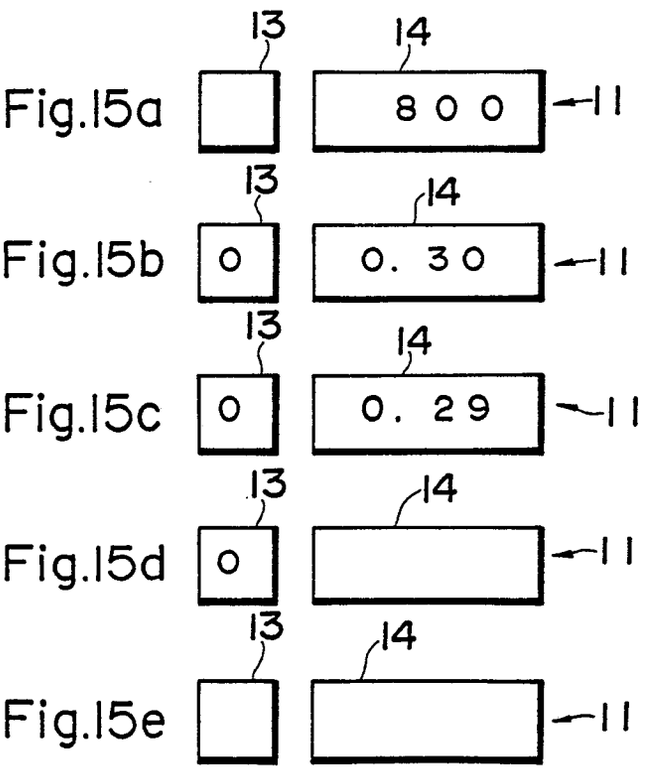


Fig.15a

Fig.15b

Fig.15c

Fig.15d

Fig.15e

Fig.16

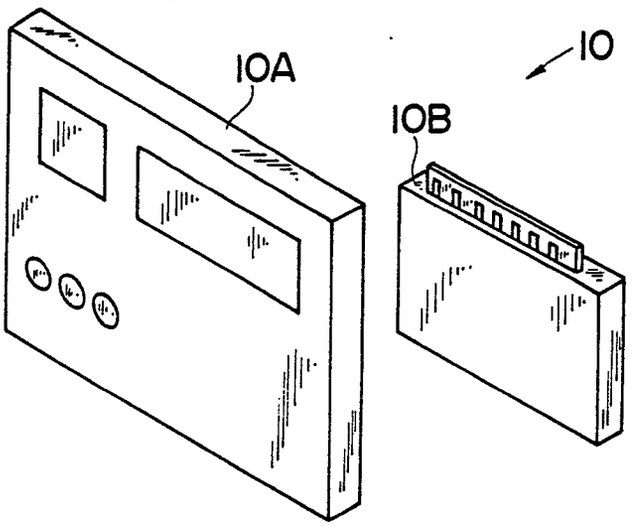

10A
10
10B

Fig.17

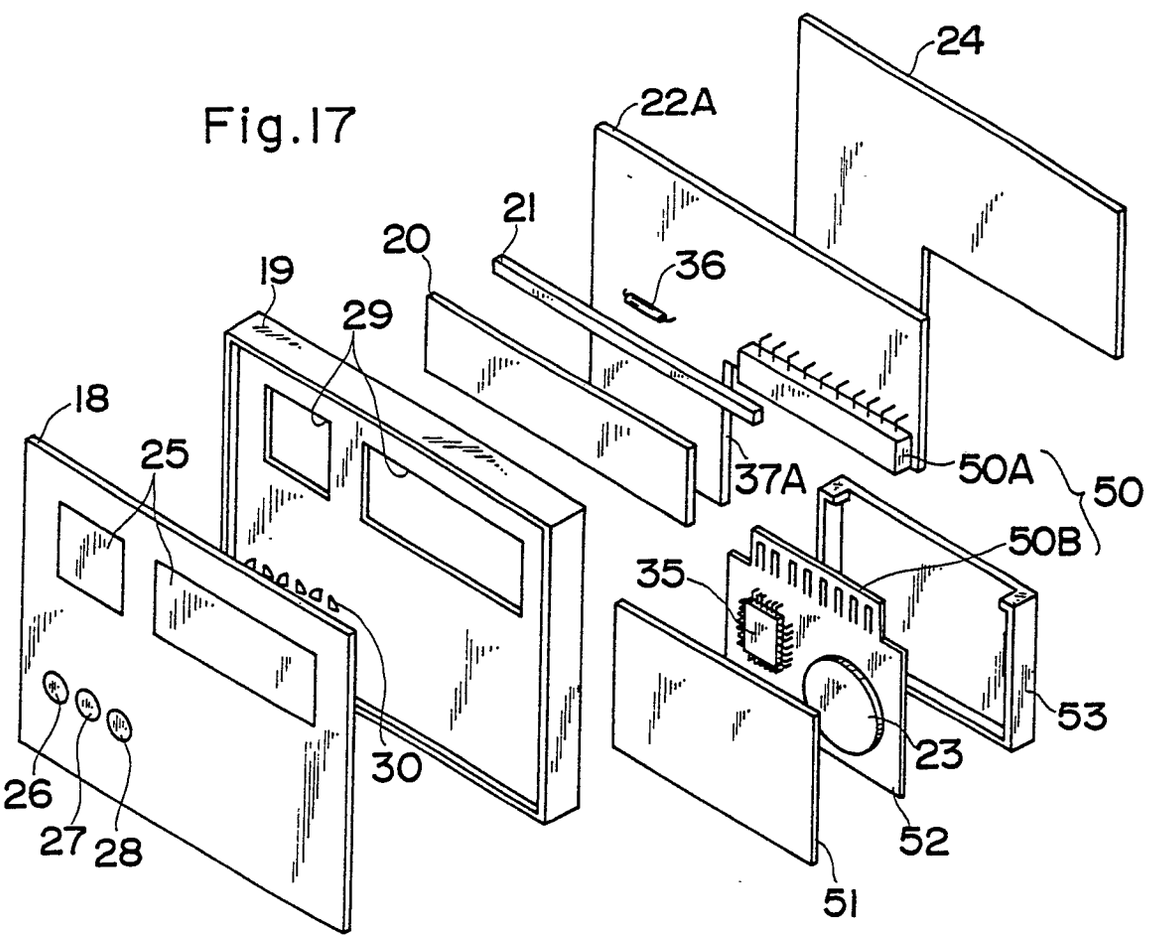

24
22A
21
20
36
19
29
18
25
37A
50A
50
50B
35
53
30
23
26
27
28
52
51

Fig.18

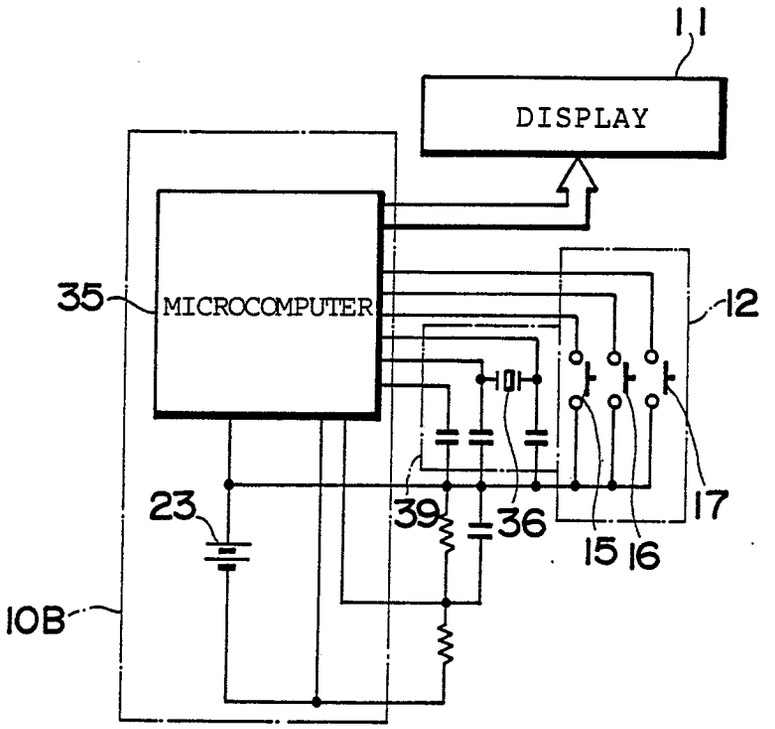


Fig.19

PRIOR ART

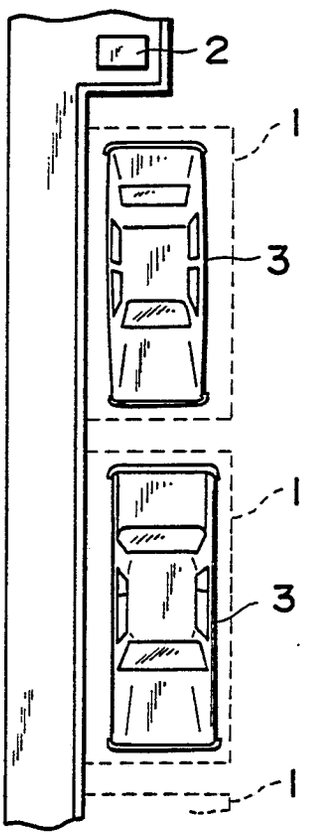


Fig.20

PRIOR ART