US012393984B2

(12) **United States Patent**
Soejima

(10) **Patent No.: US 12,393,984 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **SETTLEMENT APPARATUS AND SETTLEMENT METHOD**

(71) Applicant: **Toshiba Tec Kabushiki Kaisha**, Tokyo (JP)

(72) Inventor: **Hidetoshi Soejima**, Fukuoka Fukuoka (JP)

(73) Assignee: **Toshiba Tec Kabushiki Kaisha**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 63 days.

(21) Appl. No.: **18/328,341**

(22) Filed: **Jun. 2, 2023**

(65) **Prior Publication Data**

US 2024/0087018 A1 Mar. 14, 2024

(30) **Foreign Application Priority Data**

Sep. 8, 2022 (JP) 2022-143184

(51) **Int. Cl.**
G06Q 40/04 (2012.01)
G06Q 20/38 (2012.01)

(52) **U.S. Cl.**
CPC ***G06Q 40/04*** (2013.01); ***G06Q 20/381*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2002/0087455 A1* 7/2002 Tsagarakis G06Q 30/06 705/64
2002/0153415 A1* 10/2002 Minami G06Q 20/1085 235/380
2002/0161707 A1* 10/2002 Cole G06Q 30/06 705/42
2006/0022032 A1* 2/2006 Fillinger G06Q 40/02 235/379
2006/0095361 A1* 5/2006 Rude G06Q 40/04 705/37
2007/0282739 A1* 12/2007 Thomsen G06Q 20/10 705/39
2008/0301047 A1* 12/2008 Fish G06Q 20/105 705/41
2009/0112757 A1* 4/2009 Hammad G06Q 30/0212 705/39
2012/0233073 A1* 9/2012 Salmon G06Q 20/384 705/44

(Continued)

FOREIGN PATENT DOCUMENTS

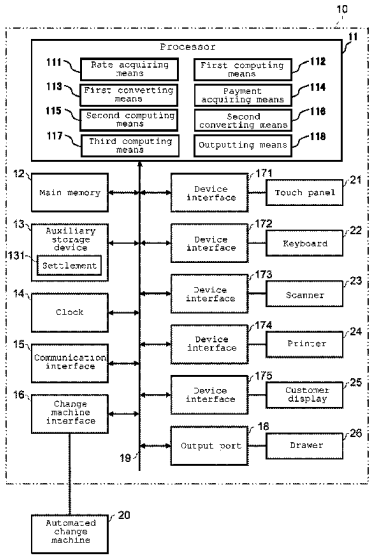
JP 4675700 B2 4/2011

Primary Examiner — William J Jacob
(74) *Attorney, Agent, or Firm* — Kim & Stewart LLP

(57) **ABSTRACT**

According to an embodiment, a settlement apparatus calculates, if a payment amount is an amount of money in a unit of a second currency, the amount of difference between a settlement amount in the unit of the second currency and the payment amount. The settlement apparatus converts the payment amount in the unit of the second currency into the payment amount in a unit of a first currency and computes the amount of difference between the converted payment amount and a settlement amount calculated in the unit of the first currency. Further, the settlement apparatus outputs the amount of difference calculated by second computing means or the amount of difference calculated by second converting means.

8 Claims, 16 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

2012/0239556	A1*	9/2012	Magruder	G06Q 30/06 705/39
2014/0358756	A1*	12/2014	Chiu	G06Q 20/10 705/37
2015/0379483	A1*	12/2015	Sharma	G06Q 20/381 705/44
2016/0267452	A1*	9/2016	Kim	G06Q 20/12
2024/0046229	A1*	2/2024	Yoon	G06Q 20/381

* cited by examiner

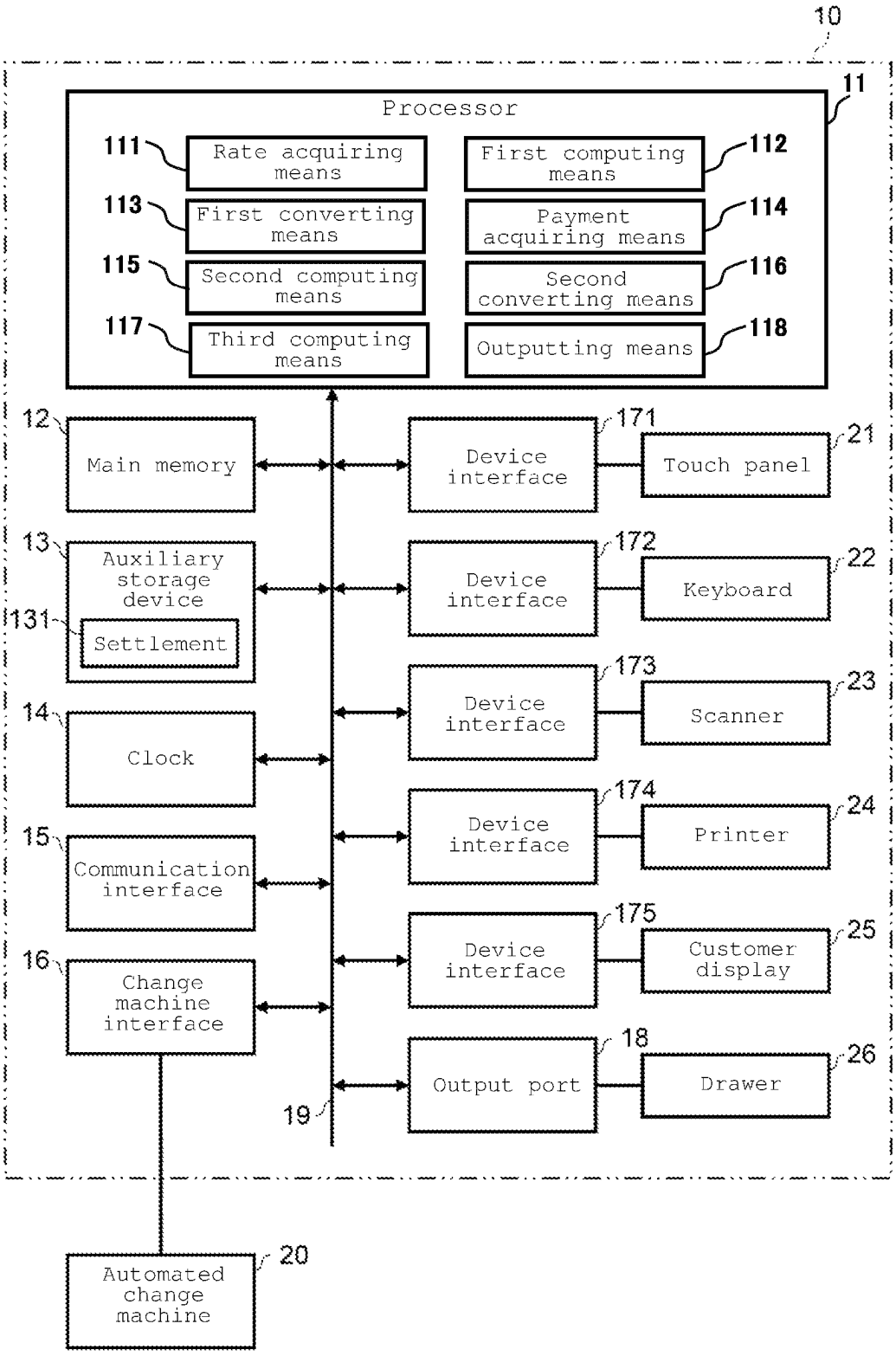

10
11
Processor
111
Rate acquiring means
112
First computing means
113
First converting means
114
Payment acquiring means
115
Second computing means
116
Second converting means
117
Third computing means
118
Outputting means
12
Main memory
13
Auxiliary storage device
131
Settlement
14
Clock
15
Communication interface
16
Change machine interface
19
171
Device interface
21
Touch panel
172
Device interface
22
Keyboard
173
Device interface
23
Scanner
174
Device interface
24
Printer
175
Device interface
25
Customer display
18
Output port
26
Drawer
20
Automated change machine

Fig.1

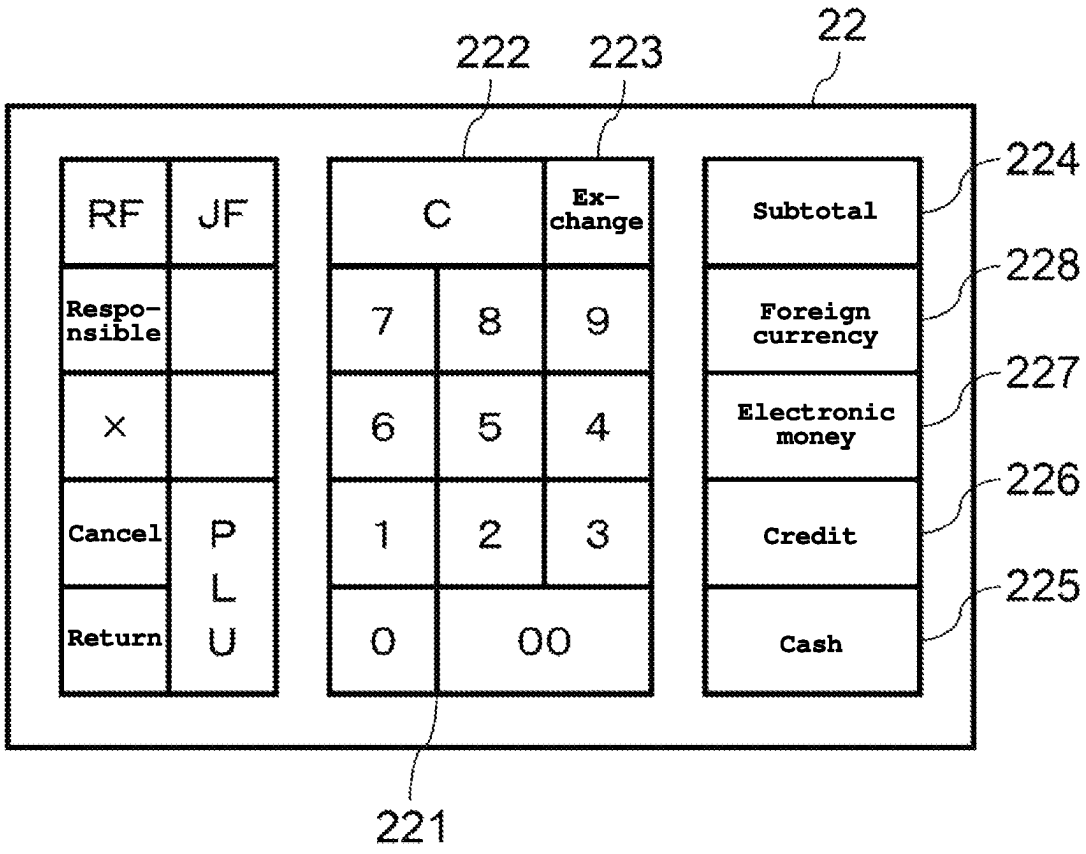

22
222
223
224
228
227
226
225
221
RF
JF
Respo-nsible
×
Cancel
Return
PLU
C
Ex-change
7
8
9
6
5
4
1
2
3
0
00
Subtotal
Foreign currency
Electronic money
Credit
Cash

Fig.2

30

Currency	Conversion rate
Dollar	136
Euro	138
Pound	162
Franc	141
⋮	⋮

Fig.3

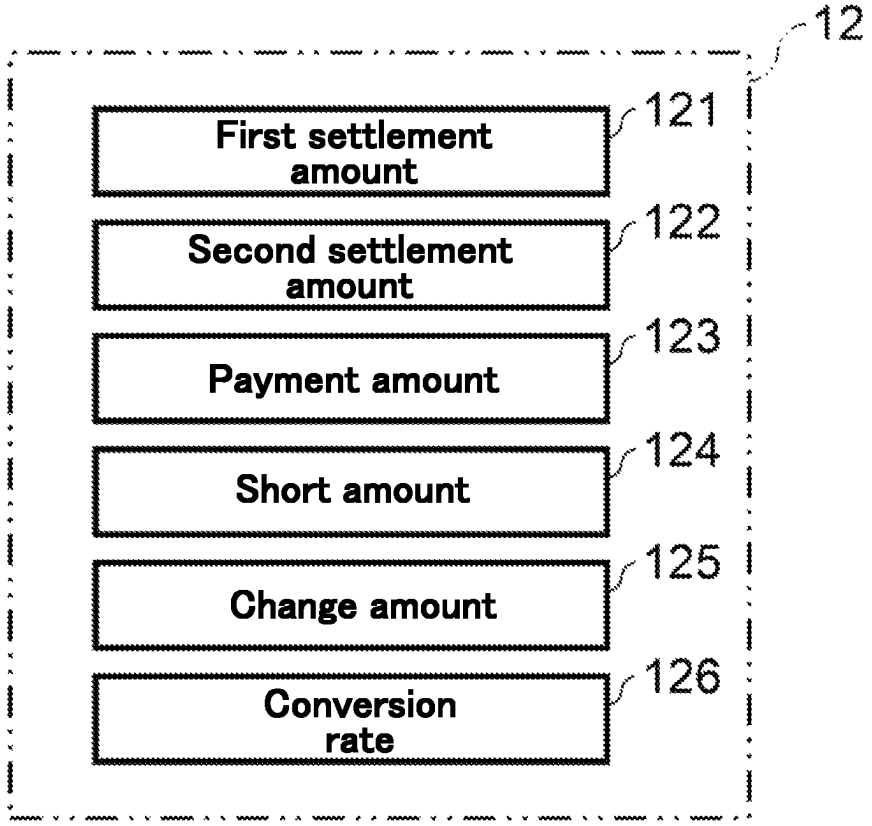

12
First settlement amount
121
Second settlement amount
122
Payment amount
123
Short amount
124
Change amount
125
Conversion rate
126

Fig.4

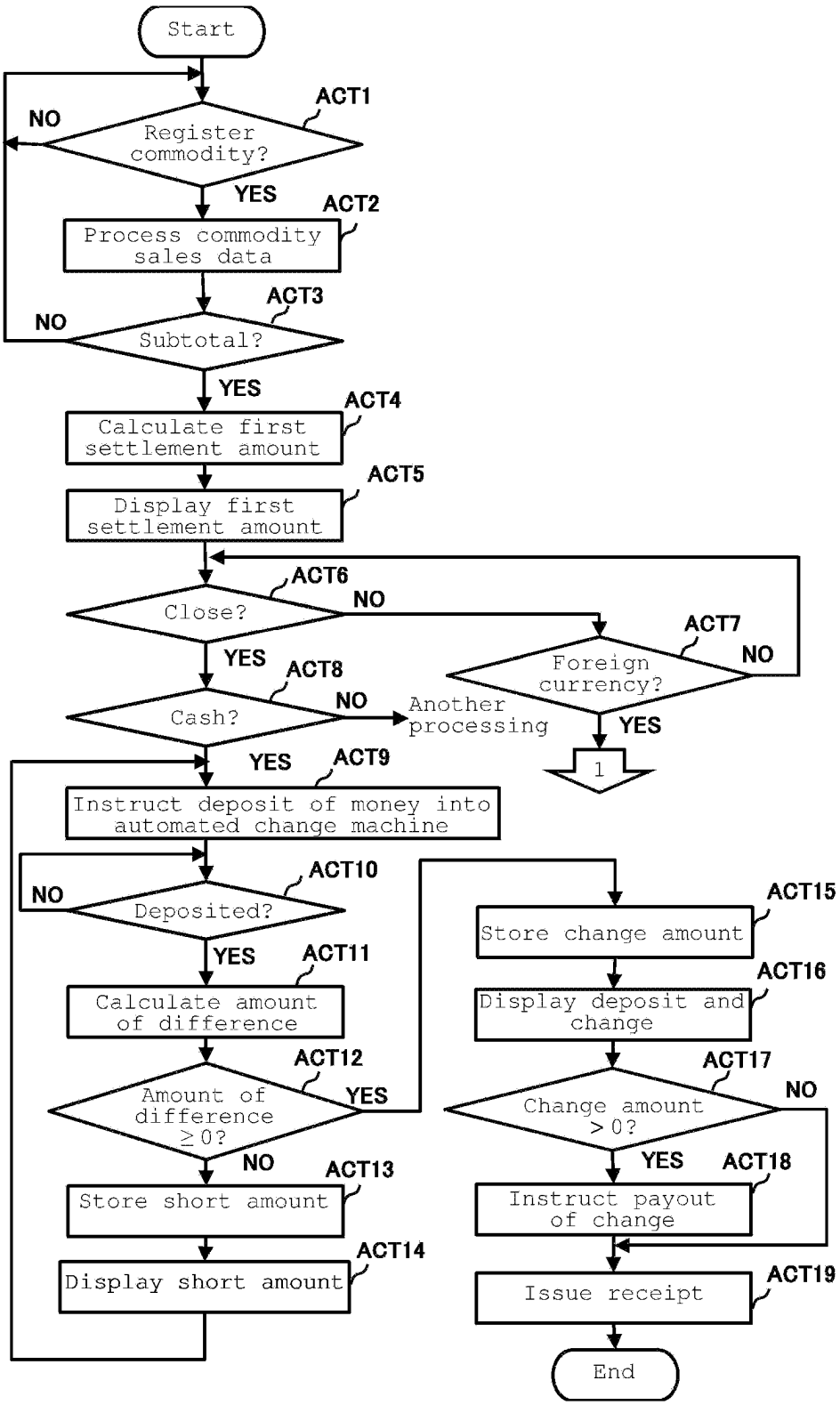

Start
ACT1
Register commodity?
NO
YES
ACT2
Process commodity sales data
ACT3
Subtotal?
NO
YES
ACT4
Calculate first settlement amount
ACT5
Display first settlement amount
ACT6
Close?
NO
YES
ACT7
Foreign currency?
NO
YES
ACT8
Cash?
NO
Another processing
YES
1
ACT9
Instruct deposit of money into automated change machine
ACT10
Deposited?
NO
YES
ACT11
Calculate amount of difference
ACT12
Amount of difference ≥ 0?
YES
NO
ACT13
Store short amount
ACT14
Display short amount
ACT15
Store change amount
ACT16
Display deposit and change
ACT17
Change amount > 0?
NO
YES
ACT18
Instruct payout of change
ACT19
Issue receipt
End

Fig.5

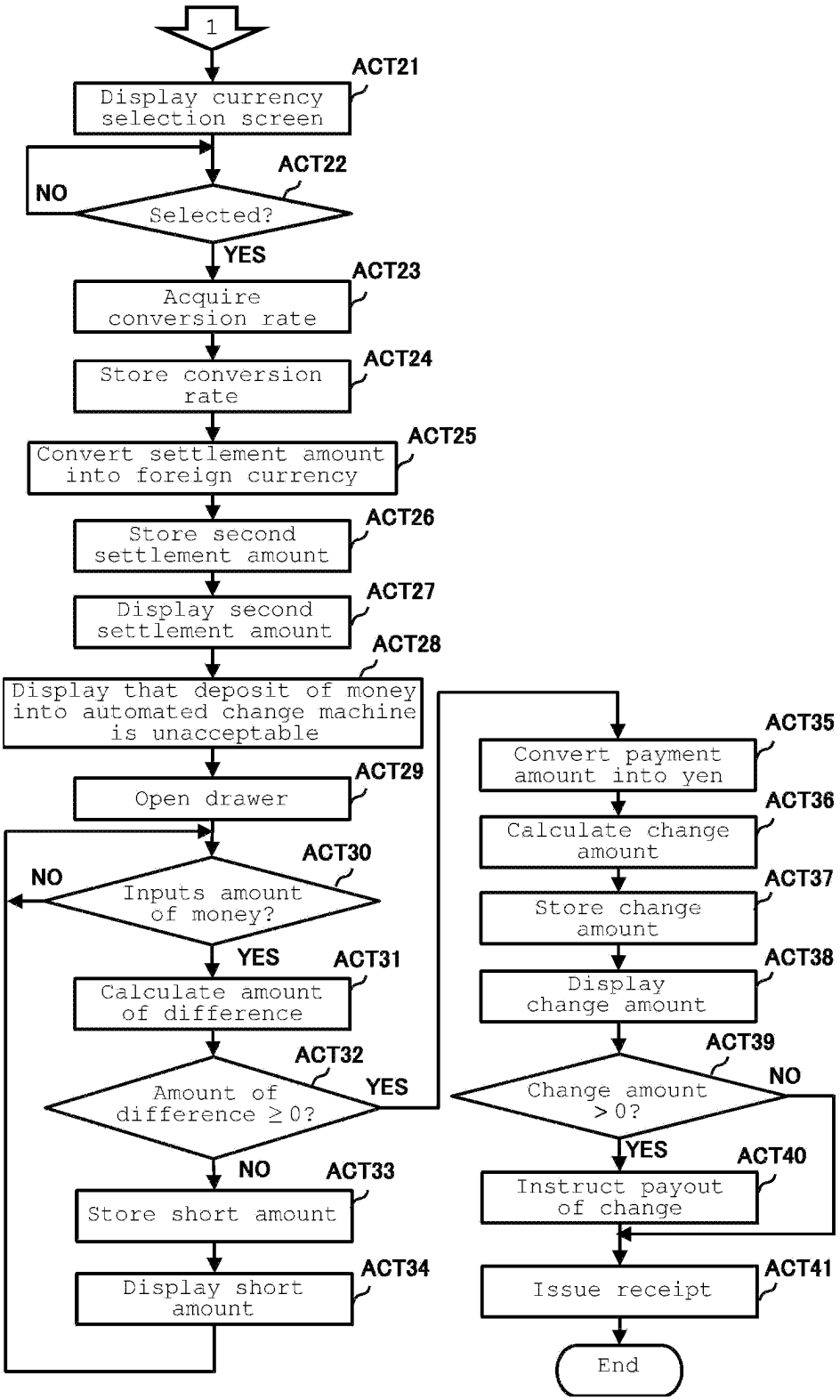

1
ACT21
Display currency selection screen
ACT22
NO
Selected?
YES
ACT23
Acquire conversion rate
ACT24
Store conversion rate
ACT25
Convert settlement amount into foreign currency
ACT26
Store second settlement amount
ACT27
Display second settlement amount
ACT28
Display that deposit of money into automated change machine is unacceptable
ACT29
Open drawer
ACT30
NO
Inputs amount of money?
YES
ACT31
Calculate amount of difference
ACT32
Amount of difference ≥ 0?
YES
NO
ACT33
Store short amount
ACT34
Display short amount
ACT35
Convert payment amount into yen
ACT36
Calculate change amount
ACT37
Store change amount
ACT38
Display change amount
ACT39
Change amount > 0?
NO
YES
ACT40
Instruct payout of change
ACT41
Issue receipt
End

Fig.6

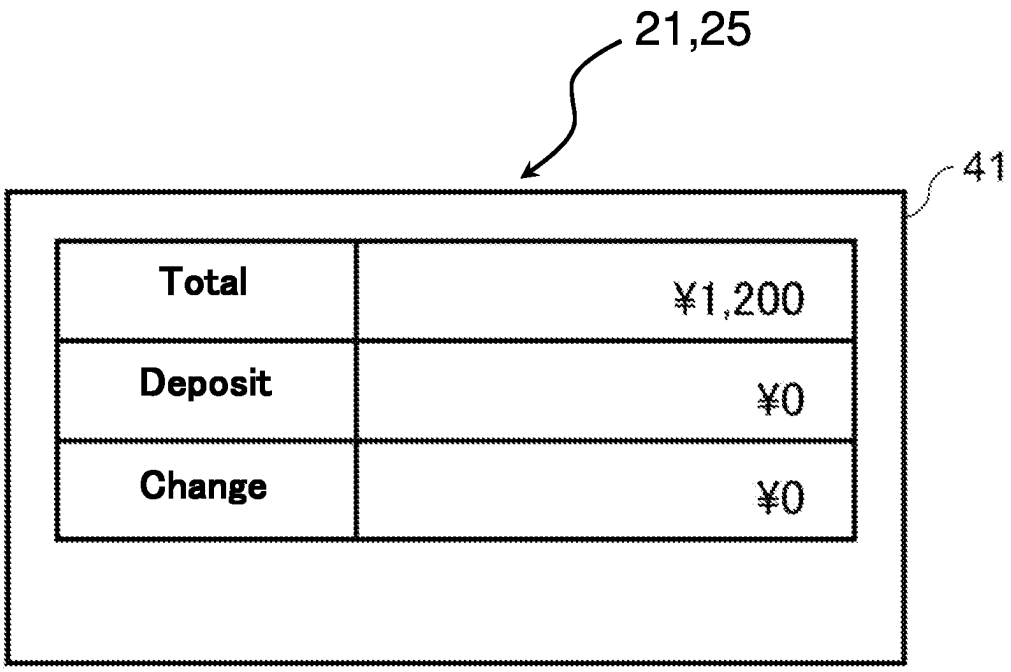


Fig.7

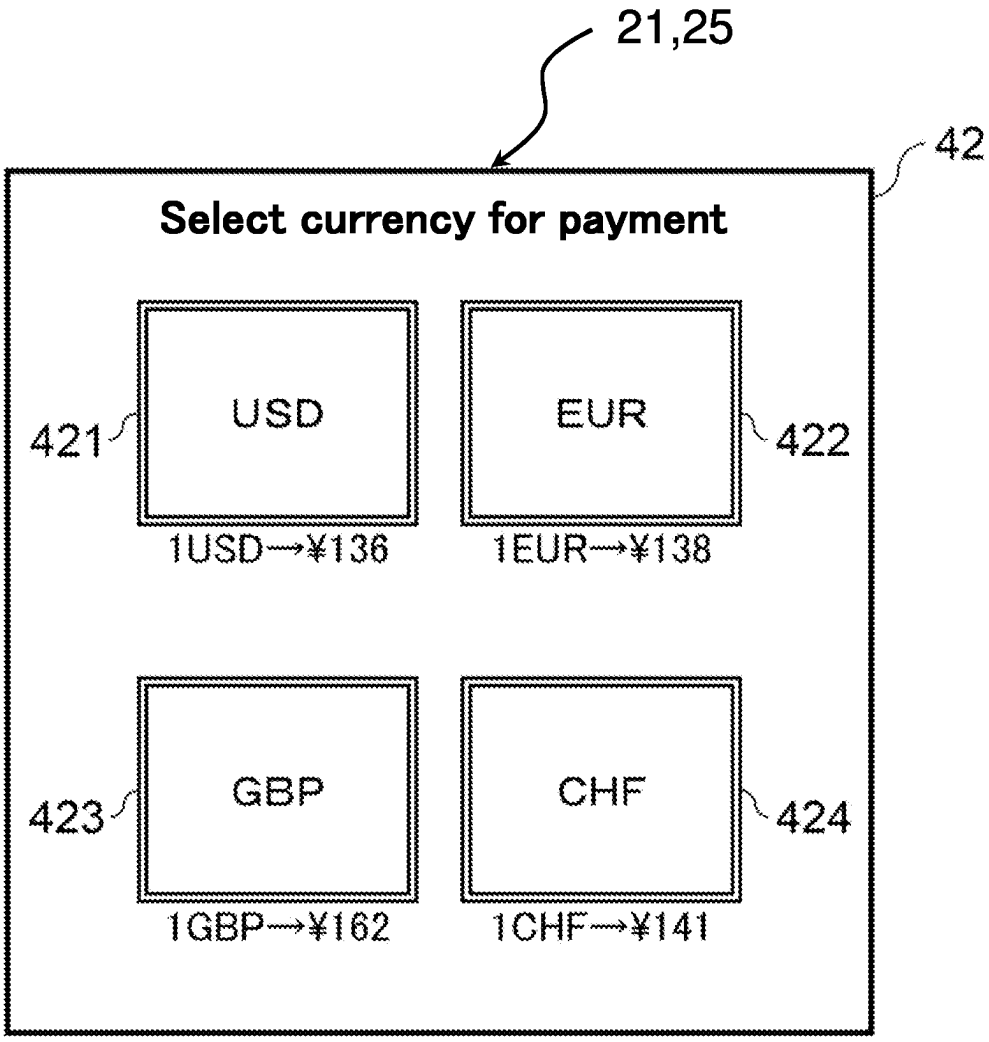

21,25
42
Select currency for payment
421
USD
1USD→¥136
EUR
422
1EUR→¥138
423
GBP
1GBP→¥162
CHF
424
1CHF→¥141

Fig.8

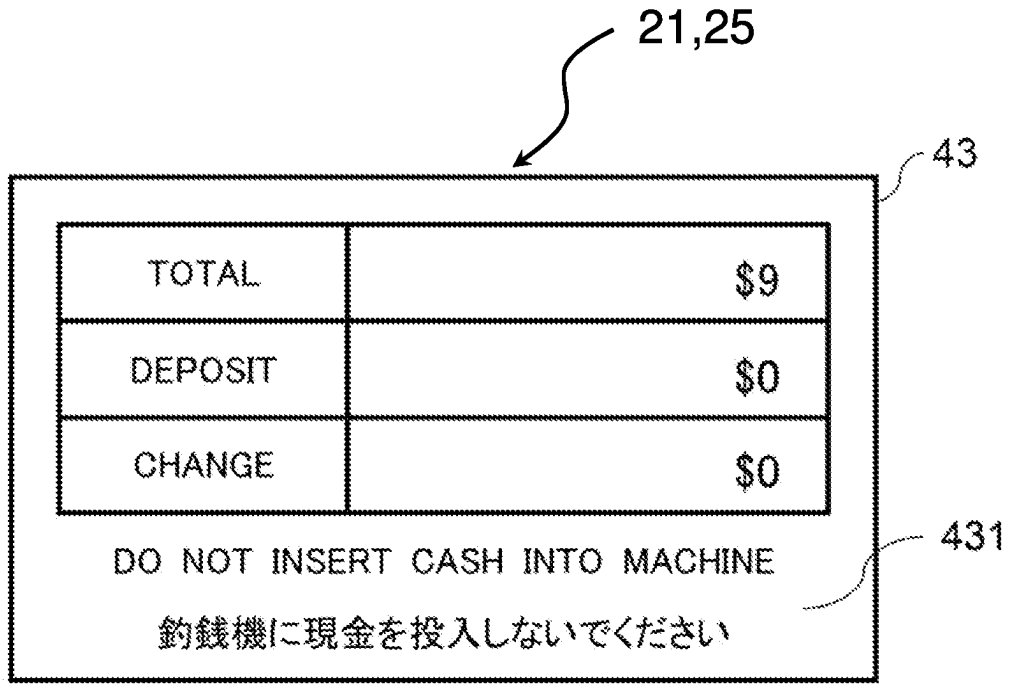

21,25
43
TOTAL
$9
DEPOSIT
$0
CHANGE
$0
431
DO NOT INSERT CASH INTO MACHINE
釣銭機に現金を投入しないでください

Fig.9

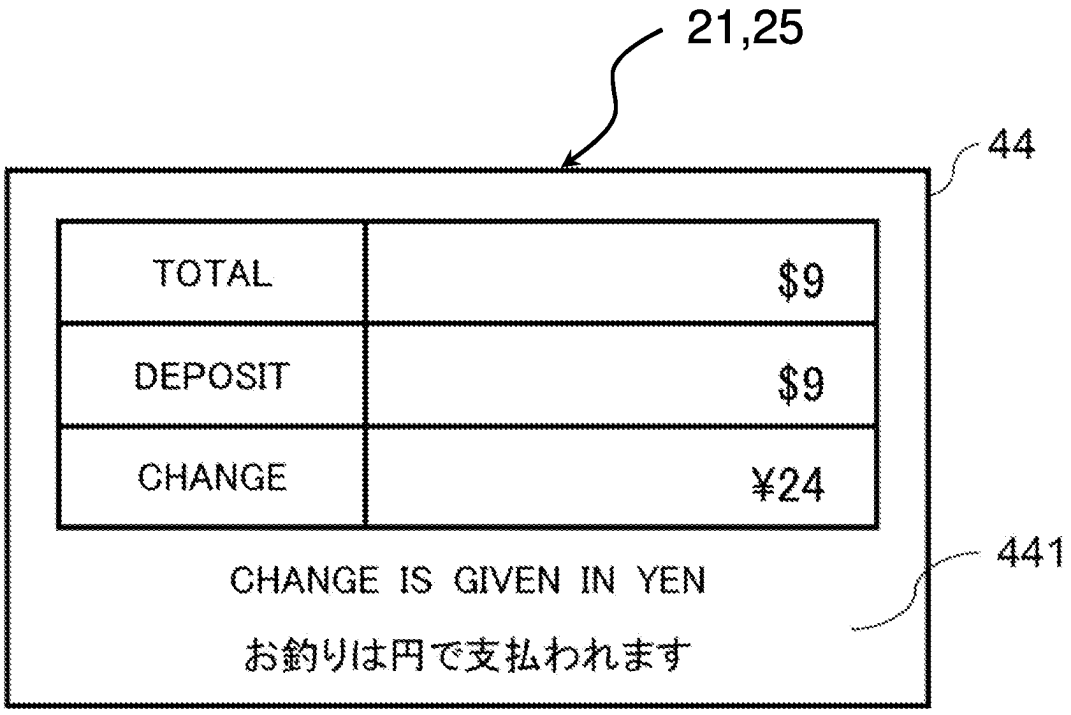

21,25
44
TOTAL
$9
DEPOSIT
$9
CHANGE
¥24
441
CHANGE IS GIVEN IN YEN
お釣りは円で支払われます

Fig.10

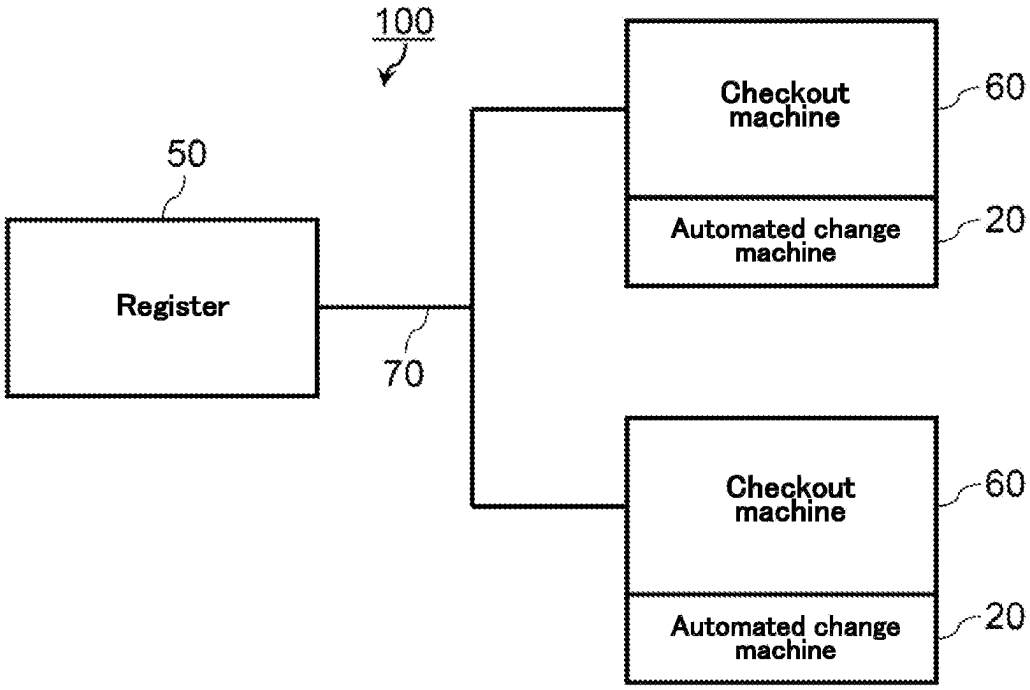

100
50
Register
70
Checkout machine
60
Automated change machine
20
Checkout machine
60
Automated change machine
20

Fig.11

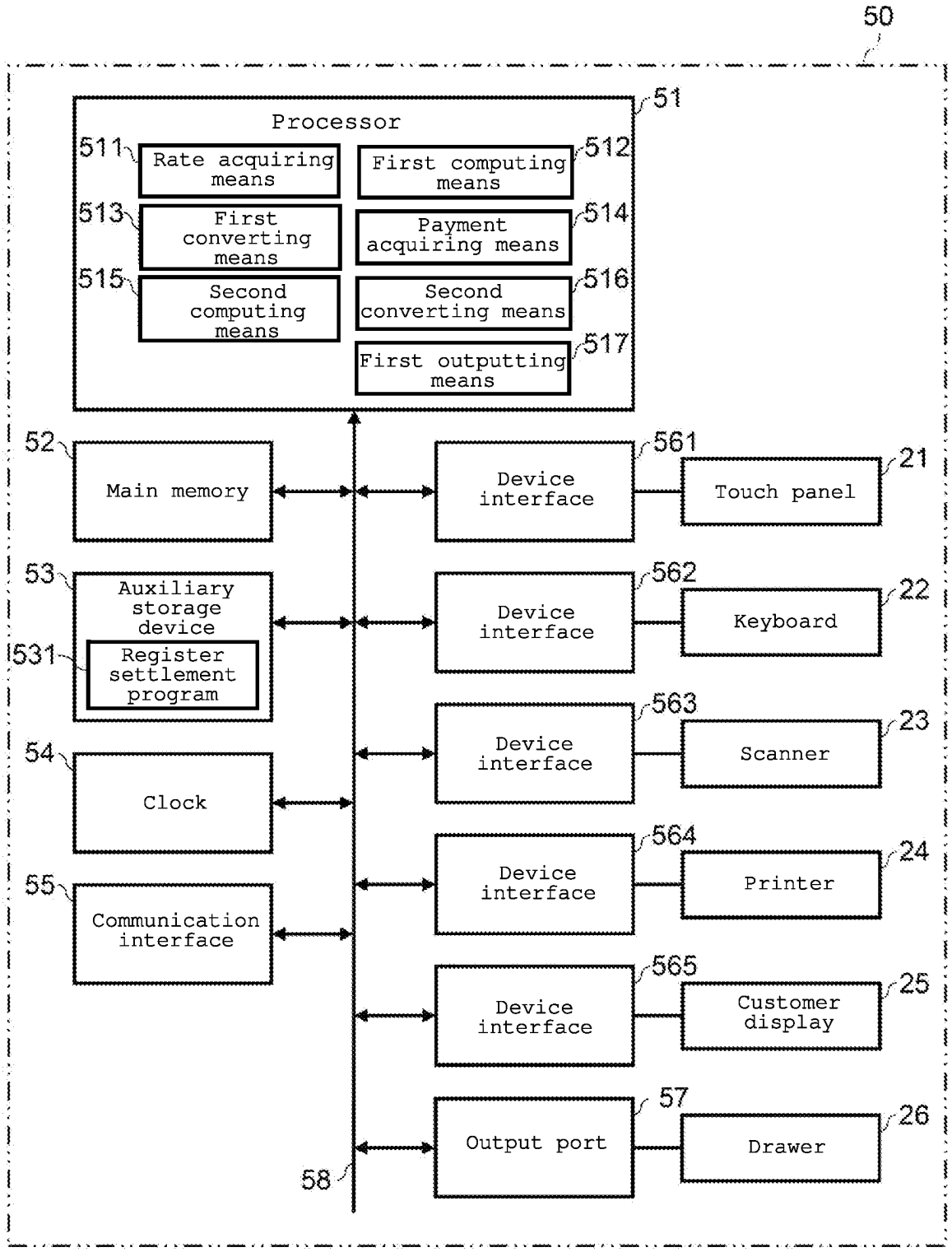

50
Processor
51
511
Rate acquiring means
512
First computing means
513
First converting means
514
Payment acquiring means
515
Second computing means
516
Second converting means
517
First outputting means
52
Main memory
53
Auxiliary storage device
531
Register settlement program
54
Clock
55
Communication interface
58
561
Device interface
21
Touch panel
562
Device interface
22
Keyboard
563
Device interface
23
Scanner
564
Device interface
24
Printer
565
Device interface
25
Customer display
57
Output port
26
Drawer

Fig.12

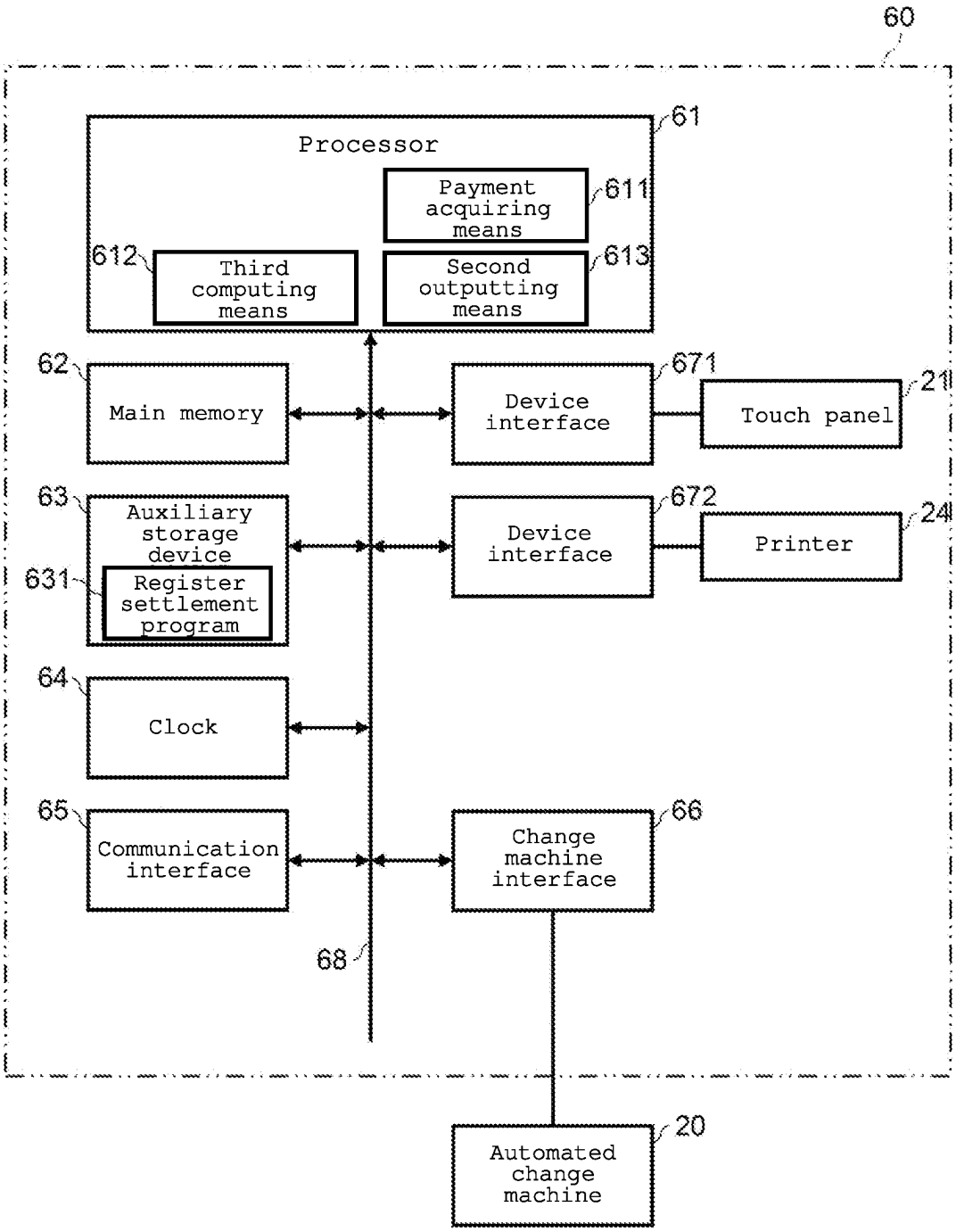

60
Processor
61
Payment acquiring means
611
612
Third computing means
Second outputting means
613
62
Main memory
671
Device interface
21
Touch panel
63
Auxiliary storage device
631
Register settlement program
672
Device interface
24
Printer
64
Clock
65
Communication interface
66
Change machine interface
68
20
Automated change machine

Fig.13

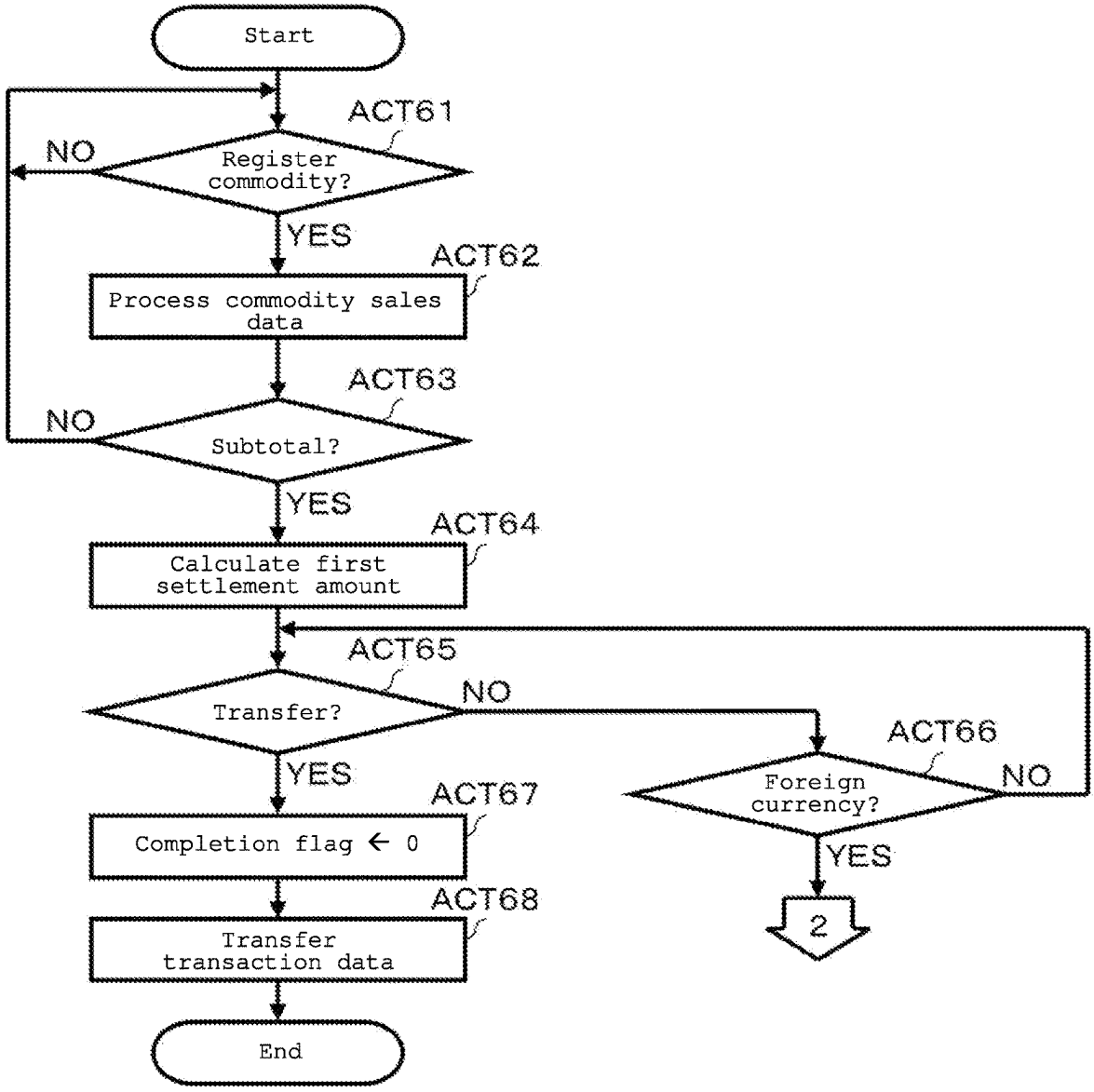

Start
ACT61
Register commodity?
NO
YES
ACT62
Process commodity sales data
ACT63
Subtotal?
NO
YES
ACT64
Calculate first settlement amount
ACT65
Transfer?
NO
YES
ACT66
Foreign currency?
NO
YES
2
ACT67
Completion flag ← 0
ACT68
Transfer transaction data
End

Fig.14

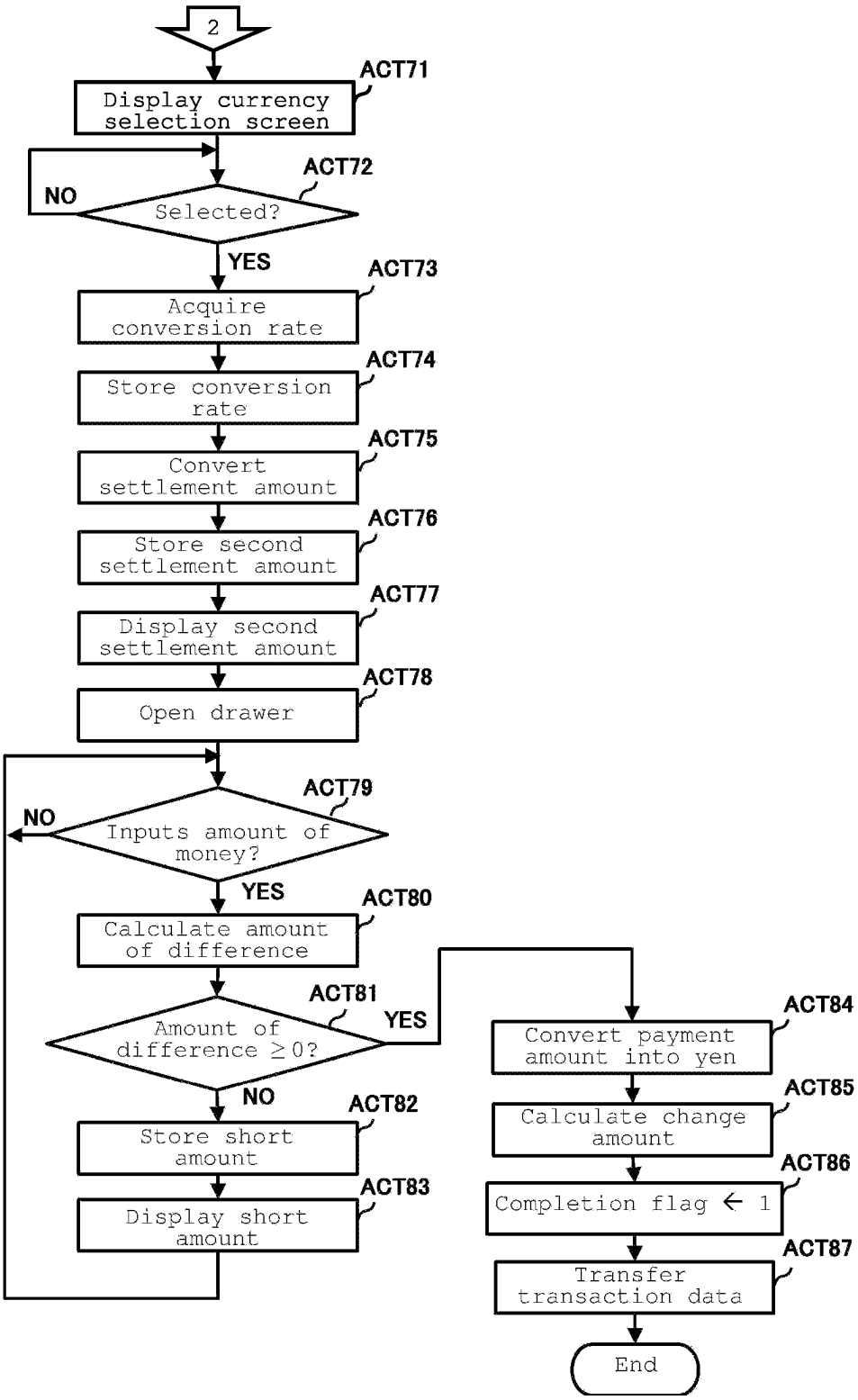

2
ACT71
Display currency selection screen
ACT72
NO
Selected?
YES
ACT73
Acquire conversion rate
ACT74
Store conversion rate
ACT75
Convert settlement amount
ACT76
Store second settlement amount
ACT77
Display second settlement amount
ACT78
Open drawer
ACT79
NO
Inputs amount of money?
YES
ACT80
Calculate amount of difference
ACT81
Amount of difference ≥ 0?
YES
NO
ACT82
Store short amount
ACT83
Display short amount
ACT84
Convert payment amount into yen
ACT85
Calculate change amount
ACT86
Completion flag ← 1
ACT87
Transfer transaction data
End

Fig.15

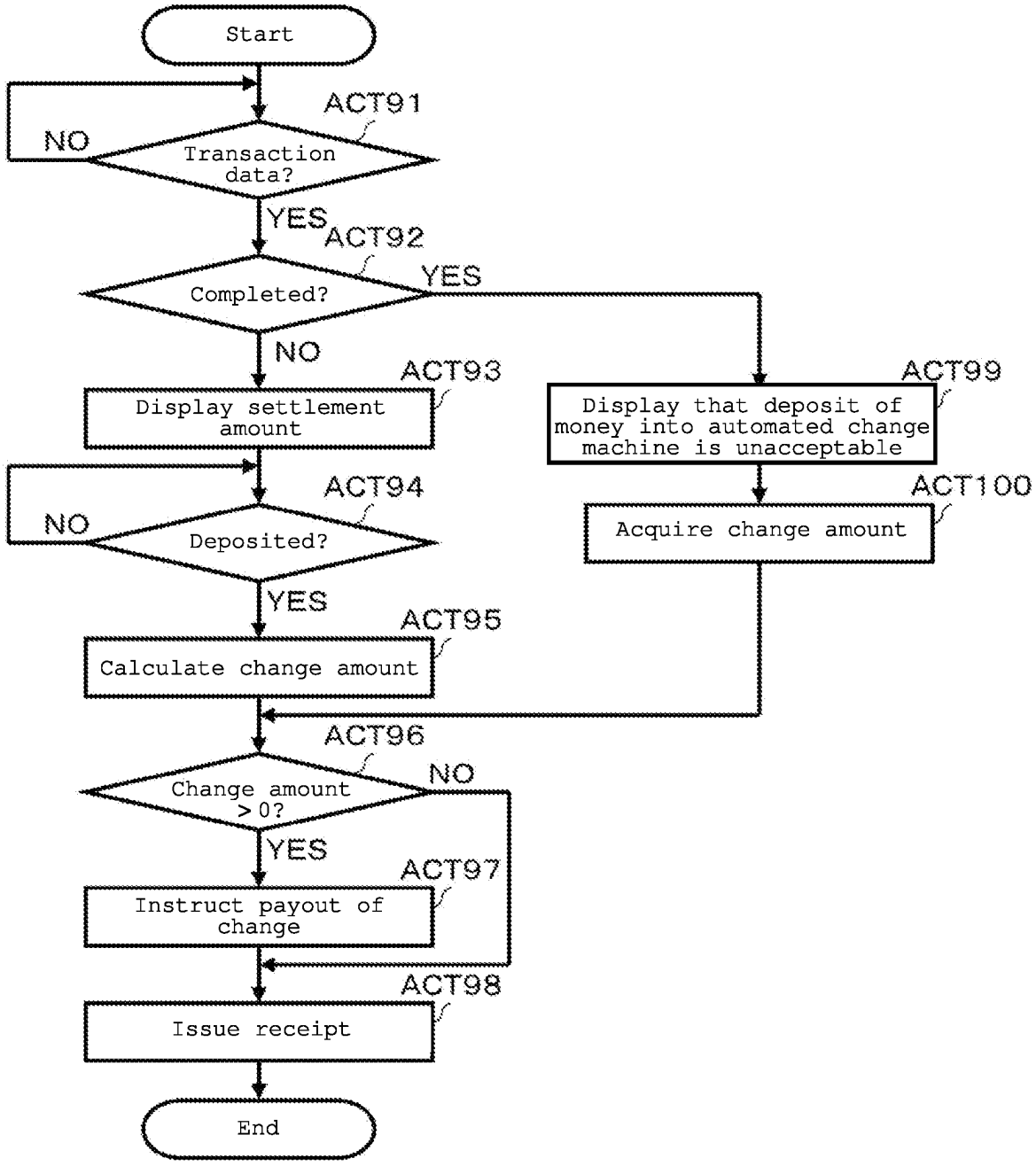

Start
ACT91
NO
Transaction data?
YES
ACT92
Completed?
YES
NO
ACT93
Display settlement amount
ACT99
Display that deposit of money into automated change machine is unacceptable
ACT94
NO
Deposited?
ACT100
Acquire change amount
YES
ACT95
Calculate change amount
ACT96
Change amount > 0?
NO
YES
ACT97
Instruct payout of change
ACT98
Issue receipt
End

Fig.16

SETTLEMENT APPARATUS AND SETTLEMENT METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2022-143184, filed on Sep. 8, 2022, the entire contents of which are incorporated herein by reference.

FIELD

Embodiments described herein generally relate to a settlement apparatus and a settlement method.

BACKGROUND

For example, stores that operate in a place where many foreigners gather, such as an airport, can be expected to attract customers by accepting payment in not only a domestic currency but also foreign currencies. In this regard, there is a demand for a settlement apparatus that handles payment in foreign currencies as well.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing a circuit configuration of a main part of a settlement apparatus according to an embodiment.

FIG. **2** is a schematic diagram showing a layout of main keys disposed in a keyboard of the settlement apparatus according to the embodiment.

FIG. **3** is a schematic diagram showing an example of a rate table referred to by the settlement apparatus according to the embodiment.

FIG. **4** is a schematic diagram showing a main work area formed in a main memory of the settlement apparatus according to the embodiment.

FIG. **5** is a flowchart showing information processing executed by a processor of the settlement apparatus according to the embodiment.

FIG. **6** is a flowchart showing information processing executed by the processor of the settlement apparatus according to the embodiment.

FIG. **7** is a diagram showing an example of a screen, on which an image is displayed, of a touch panel or a customer display of the settlement apparatus according to the embodiment.

FIG. **8** is a diagram showing an example of a screen, on which an image is displayed, of the touch panel or the customer display of the settlement apparatus according to the embodiment.

FIG. **9** is a diagram showing an example of a screen, on which an image is displayed, of the touch panel or the customer display of the settlement apparatus according to the embodiment.

FIG. **10** is a diagram showing an example of a screen, on which an image is displayed, of the touch panel or the customer display of the settlement apparatus according to the embodiment.

FIG. **11** is a schematic diagram showing the outline of a semi-self-service POS system according to an embodiment.

FIG. **12** is a block diagram showing a circuit configuration of a main part of a register in the semi-self-service POS system according to the embodiment.

FIG. **13** is a block diagram showing a circuit configuration of a main part of a checkout machine in the semi-self-service POS system according to the embodiment.

FIG. **14** is a flowchart showing information processing executed by a processor of the register according to the embodiment.

FIG. **15** is a flowchart showing information processing executed by the processor of the register according to the embodiment.

FIG. **16** is a flowchart showing information processing executed by a processor of the checkout machine according to the embodiment.

DETAILED DESCRIPTION

According to one embodiment, a settlement apparatus includes a rate table, a first settlement amount memory, a second settlement amount memory, a payment amount memory, a difference amount memory, and a processor. The rate table stores an exchange rate between a first currency and a second currency. The first settlement amount memory stores a settlement amount in a unit of the first currency. The second settlement amount memory stores a settlement amount in a unit of the second currency. The payment amount memory stores a payment amount for the settlement amount. The difference amount memory stores an amount of difference between the settlement amount and the payment amount. The processor refers to the rate table to acquire a rate for exchanging the first currency for the second currency. The processor calculates the settlement amount in the unit of the first currency to store the calculated settlement amount in the unit of the first currency in the first settlement amount memory. The processor converts the settlement amount in the unit of the first currency, which is stored in the first settlement amount memory, into the settlement amount in the unit of the second currency by using the acquired rate, to store the converted settlement amount in the unit of the second currency in the second settlement amount memory. The processor acquires the payment amount for the first settlement amount or the second settlement amount to store the payment amount in the payment amount memory. The processor calculates, if the payment amount stored in the payment amount memory is an amount of money in the unit of the second currency, an amount of difference between the settlement amount in the unit of the second currency, which is stored in the second settlement amount memory, and the payment amount stored in the payment amount memory, to store the calculated amount of difference in the unit of the second currency in the difference amount memory. The processor converts the payment amount in the unit of the second currency, which is stored in the payment amount memory, into the payment amount in the unit of the first currency by using the acquired rate, and compute an amount of difference between the converted payment amount in the unit of the first currency and the settlement amount stored in the first settlement amount memory, to store the computed amount of difference in the unit of the first currency in the difference amount memory. Further, the processor outputs the amount of difference in the unit of the second currency, which is stored in the difference amount memory, or the amount of difference in the unit of the first currency, which is stored in the difference amount memory.

Hereinafter, an embodiment of a settlement apparatus capable of handling payment in foreign currencies as well

will be described with reference to the drawings. In the drawings, the same reference symbols represent the same or similar portions.

First Embodiment

FIG. **1** is a block diagram showing a circuit configuration of a main part of a settlement apparatus **10** according to a first embodiment. As shown in the figure, the settlement apparatus **10** includes a processor **11**, a main memory **12**, an auxiliary storage device **13**, a clock **14**, a communication interface **15**, a change machine interface **16**, a plurality of device interfaces **171** to **175**, an output port **18**, and a system transmission path **19**. The system transmission path **19** includes an address bus, a data bus, a control signal line, and the like. The settlement apparatus **10** connects the processor **11** with the main memory **12**, the auxiliary storage device **13**, the clock **14**, the communication interface **15**, the change machine interface **16**, the plurality of device interfaces **171** to **175**, and the output port **18** via the system transmission path **19**, thus constituting a computer. The settlement apparatus **10** then connects various devices such as a touch panel **21**, a keyboard **22**, a scanner **23**, a printer **24**, and a customer display **25** to the device interfaces **171** to **175**, respectively. Further, the settlement apparatus **10** connects a drawer **26** to the output port **18**. Note that the devices included in the settlement apparatus **10** are not limited to the devices described above. The settlement apparatus **10** may connect other devices such as a magnetic card reader, an IC card reader/writer, and a pin pad thereto via device interfaces.

The processor **11** corresponds to the central portion of the computer. The processor **11** controls the components to implement various functions as the settlement apparatus **10** according to an operating system or application program. The processor **11** is, for example, a central processing unit (CPU).

The main memory **12** corresponds to the main memory portion of the computer. The main memory **12** includes a non-volatile memory area and a volatile memory area. The main memory **12** stores the operating system or application program in the non-volatile memory area. The main memory **12** may store, in the non-volatile or volatile memory area, data necessary for the processor **11** to perform processing for controlling each component. The processor **11** uses the volatile memory area of the main memory **12** as a work area in which data is appropriately rewritten by the processor **11**. The non-volatile memory area is, for example, a read only memory (ROM). The volatile memory area is, for example, a random-access memory (RAM).

The auxiliary storage device **13** corresponds to the auxiliary storage portion of the computer. The auxiliary storage device **13** includes, for example, an electric erasable programmable read-only memory (EEPROM), a hard disk drive (HDD), or a solid-state drive (SSD). The auxiliary storage device **13** stores data used for the processor **11** to perform various kinds of processing, data created in processing performed by the processor **11**, and the like. The auxiliary storage device **13** sometimes stores the above-mentioned application program.

The clock **14** measures the date and time. The processor **11** processes the date and time obtained by the clock **14** as the current date and time.

The communication interface **15** is a circuit for performing data communication with an external computer device via a communication network. The external computer device corresponds to, for example, a server that provides services such as commodity management and summarization of sales, or a server that supports settlement by a credit card or electronic money.

The change machine interface **16** is a circuit for performing data communication with an automated change machine **20**. The automated change machine **20** has a function of counting the numbers of bills and coins inserted from an inserting port for every denomination of cash and obtaining the inserted amount to output data of the inserted amount to the settlement apparatus **10**, and a function of paying out bills and coins corresponding to change from a dispensing port on the basis of change data received from the settlement apparatus **10**. In other words, the change machine interface **16** has a function of receiving the inserted amount data from the automated change machine **20** and a function of transmitting the change data to the automated change machine **20**.

The device interface **171** is a circuit for performing data communication with the touch panel **21**. The touch panel **21** is a display device capable of displaying display elements including letters, symbols, images, and the like on the display. Further, the touch panel **21** is also an input device that detects a touch operation position on the display by a sensor and performs processing on the assumption that a display element of that position has been input.

The device interface **172** is a circuit for performing data communication with the keyboard **22**. The keyboard **22** is an input device for processing a key signal corresponding to a key operated for input. As shown in FIG. **2**, the keyboard **22** includes, in addition to a numeric key **221** for inputting numerical values such as "0" to "9" and "00", various function keys such as a C key **222**, an exchange key **223**, a subtotal key **224**, a cash key **225**, a credit key **226**, an electronic money key **227**, and a foreign currency key **228**. The C key **222** is a key for instructing clearing of the numerical values input and displayed at the last minute with the numeric key **221**. The exchange key **223** is a key for instructing exchange of money. The subtotal key **224** is a key for instructing output of a subtotal amount. The cash key **225** is a key for instructing settlement in cash. The credit key **226** is a key for instructing settlement by credit card. The electronic money key **227** is a key for instructing settlement by electronic money. The foreign currency key **228** is a key for instructing payment in a foreign currency other than a domestic currency. Incidentally, the "settlement" means that payment for a price of a commodity or compensation of a service is received and a transaction with a customer is closed. Hence, all of the cash key **225**, the credit key **226**, and the electronic money key **227** can be referred to as close keys.

Referring back to the description of FIG. **1**, the device interface **173** is a circuit for performing data communication with the scanner **23**. The scanner **23** is an optical input device that reads a machine-readable code such as a bar code or a two-dimensional code by scanning with light. The scanner **23** may be an imaging input device that reads a machine-readable code from an image captured by a camera. The scanner **23** can read not only a machine-readable code attached to a commodity or the like but also a machine-readable code displayed on a display of a terminal such as a smartphone.

The device interface **174** is a circuit for performing data communication with the printer **24**. The printer **24** is a printing device that prints data associated with settlement of a transaction on a paper medium and issues a receipt.

The device interface **175** is a circuit for performing data communication with the customer display **25**. The customer

display **25** is a display device that displays various types of information to a customer as a target person of a transaction settled by the settlement apparatus **10**.

The output port **18** is a circuit for outputting an open command signal to the drawer **26**. The drawer **26** is for housing not only domestic bills and coins but also foreign bills and coins and the like, and performs an opening operation in response to the open command signal from the output port **18**. A close operation is performed manually by an operator.

The settlement apparatus **10** having such a configuration is an electronic apparatus used to receive payment for a price of a commodity purchased in a store or for compensation of a service provided by the store from the customer and to settle the transaction with that customer. In general, the settlement apparatus **10** is referred to as a point-of-sales (POS) terminal, a money register, a checkout machine, or the like. Further, the customer may be put into a target person of a transaction, a payer, a purchaser, a store user, or the like.

The operator of the settlement apparatus **10** is typically a store clerk. There is also a self-service settlement apparatus, the operator of which may be a customer, but in this embodiment, a face-to-face settlement apparatus, the operator of which is a store clerk, will be exemplified. Thus, the touch panel **21** functions as a display for a store clerk. Further, the touch panel **21**, the keyboard **22**, and the scanner **23** are input devices operable by the store clerk. In particular, the keyboard **22** functions as an input device for inputting the amount of money.

Incidentally, the settlement apparatus **10** includes the foreign currency key **228** in the keyboard **22** so as to be capable of handling payment in not only a domestic currency but also a foreign currency. Here, in this embodiment, it is assumed that the settlement apparatus **10** is used inside Japan. In other words, the domestic currency as a first currency is "yen". The foreign currency as a second currency is, for example, "dollar", "euro", "pound", "franc", "won", or "yuan". The type and number of foreign currencies are not particularly limited.

A conversion rate is used as a rate for exchange between "yen" and a foreign currency. In this regard, the settlement apparatus **10** utilizes a data table in which conversion rates are stored for respective foreign currencies, a so-called rate table **30**, as shown in FIG. **3**. The rate table **30** is stored in the main memory **12** or the auxiliary storage device **13**. Alternatively, the rate table **30** may be managed on a server connected via the communication interface **15**, and the settlement apparatus **10** may access the server when needed. For the conversion rate, for example, a conversion rate used when yen is sold and purchased in foreign exchange markets, a so-called exchange rate (exchange quotation), only needs to be employed.

Further, as shown in FIG. **4**, the settlement apparatus **10** includes, as a part of the work area of the main memory **12**, a first settlement amount memory **121**, a second settlement amount memory **122**, a payment amount memory **123**, a short amount memory **124**, a change amount memory **125**, and a conversion rate memory **126**. The first settlement amount memory **121** is an area for storing a settlement amount in a unit of a domestic currency, that is, a first settlement amount. The second settlement amount memory **122** is an area for storing a settlement amount in a unit of a foreign currency, that is, a second settlement amount. The payment amount memory **123** is an area for storing a payment amount for the settlement amount. The short amount memory **124** is an area for storing an amount of difference as a short amount when the amount of difference obtained by subtracting the first settlement amount from the payment amount is a negative value or when the amount of difference obtained by subtracting the second settlement amount from the payment amount is a negative value. The change amount memory **125** is an area for storing an amount of difference as a change amount when the amount of difference obtained by subtracting the first settlement amount from the payment amount is zero or a positive value or when the amount of difference obtained by subtracting the second settlement amount from the payment amount is zero or a positive value. The conversion rate memory **126** is an area for storing the conversion rate acquired from the rate table **30**.

As shown in FIG. **1**, the processor **11** of the settlement apparatus **10** has functions of rate acquiring means **111**, first computing means **112**, first converting means **113**, payment acquiring means **114**, second computing means **115**, second converting means **116**, third computing means **117**, and outputting means **118**.

The rate acquiring means **111** has a function of acquiring a conversion rate, which is a rate used when exchanging a domestic currency as a first currency for a foreign currency as a second currency. The rate acquiring means **111** acquires a necessary conversion rate by referring to the rate table **30** described above.

The first computing means **112** has a function of calculating a settlement amount in a unit of the first currency. The settlement amount calculated by the first computing means **112**, that is, the first settlement amount, is stored in the first settlement amount memory **121**.

The first converting means **113** has a function of converting the first settlement amount calculated by the first computing means **112** into a settlement amount in a unit of the second currency by using the rate acquired by the rate acquiring means **111**, that is, the conversion rate. The settlement amount converted by the first converting means **113**, that is, the second settlement amount, is stored in the second settlement amount memory **122**.

The payment acquiring means **114** has a function of acquiring a payment amount for the first settlement amount or the second settlement amount. Specifically, the payment acquiring means **114** acquires an inserted amount of money, which has been inserted into the automated change machine **20**, as a payment amount for the first settlement amount. Further, the payment acquiring means **114** acquires numerical values, which have been input by the numeric key **221** of the keyboard **22**, as a payment amount for the second settlement amount. The payment amount acquired by the payment acquiring means **114** is stored in the payment amount memory **123**.

The second computing means **115** has a function of calculating, if the payment amount acquired by the payment acquiring means **114** is the amount of money in the unit of the second currency, the amount of difference between the second settlement amount and the payment amount. If the amount of difference calculated by the second computing means **115** is a negative value, the amount of difference is stored in the short amount memory **124**. If the amount of difference calculated by the second computing means **115** is zero or a positive value, the amount of difference is stored in the change amount memory **125**.

The second converting means **116** has a function of converting, if the amount of difference calculated by the second computing means **115** is zero or a positive value, the payment amount in the unit of the second currency into the payment amount in the unit of the first currency by using the rate acquired by the rate acquiring means **111**, that is, the

conversion rate, to compute the amount of difference between the converted payment amount and the first settlement amount. The amount of difference is stored in the change amount memory **125**.

The third computing means **117** has a function of calculating, if the payment amount acquired by the payment acquiring means **114** is the amount of money in the unit of the first currency, the amount of difference between the first settlement amount and the payment amount. If the amount of difference calculated by the third computing means **117** is a negative value, that amount of difference is stored in the short amount memory **124**. If the amount of difference calculated by the third computing means **117** is zero or a positive value, that amount of difference is stored in the change amount memory **125**.

The outputting means **118** has a function of outputting the amount of difference calculated by the second computing means **115** or the amount of difference calculated by the second converting means **116**. Specifically, if the payment amount in the unit of the second currency is smaller than the second settlement amount, the outputting means **118** outputs the amount of difference calculated by the second computing means **115** as a short amount. Further, if the payment amount in the unit of the second currency is equal to or larger than the second settlement amount, the outputting means **118** outputs the amount of difference calculated by the second converting means **116** as a change amount. Specifically, if the payment amount in the unit of the second currency is equal to or larger than the settlement amount in the unit of the second currency, the outputting means **118** outputs a command to pay out the amount of difference calculated by the second converting means **116**, as change, to the automated change machine **20**.

The functions of the rate acquiring means **111**, the first computing means **112**, the first converting means **113**, the payment acquiring means **114**, the second computing means **115**, the second converting means **116**, the third computing means **117**, and the outputting means **118** are implemented by information processing executed by the processor **11** according to a settlement program **131**. The settlement program **131** is installed on the auxiliary storage device **13**. The settlement program **131** may be installed on the main memory **12**. The method of installing the settlement program **131** on the main memory **12** or the auxiliary storage device **13** is not particularly limited. The settlement program **131** can be installed on the main memory **12** or the auxiliary storage device **13** by recording the settlement program **131** on a removable recording medium or distributing the settlement program **131** through communication via a network. The form of the recording medium does not matter as long as the recording medium can store programs and an apparatus can read the programs from the recording medium, like an SD memory card, a USB memory, or the like.

FIGS. **5** and **6** are flowcharts showing the information processing executed by the processor **11** according to the settlement program **131**. Further, FIGS. **7** to **10** are exemplary screens, on which images are displayed, of either the touch panel **21** or the customer display **25** or both of them according to the information processing. Hereinafter, a main operation of the settlement apparatus **10** capable of handling payment in a foreign currency as well will be descried with reference to the drawings. Note that the procedures and contents of the information processing to be described later are exemplary ones. The procedures and contents can be appropriately modified if it is possible to provide similar actions and effects. Further, the images displayed on the screens shown in FIGS. **7** to **10** are also examples. The layout, text, and the like of the display elements can be appropriately modified.

First, in ACT**1**, the processor **11** waits for an operation of registering a commodity. When a store clerk who is an operator of the settlement apparatus **10** is asked to perform checkout by a customer who is a user of the store, the store clerk uses the input device such as the touch panel **21**, the keyboard **22**, or the scanner **23** to perform an operation for registering a commodity for which the checkout is to be performed. For example, if the commodity is provided with a bar code representing a commodity code, the store clerk performs an operation for reading the bar code with the scanner **23**. If the commodity is not provided with a bar code, the store clerk performs an operation for inputting a commodity code with the touch panel **21** or the keyboard **22**. Through such operations, the processor **11** determines that the operation of registering a commodity has been performed. The processing of the processor **11** proceeds from ACT**1** to ACT**2**.

In ACT**2**, the processor **11** executes processing of registering commodity sales data. In other words, the processor **11** writes commodity sales data, which includes a commodity code, a commodity name, a unit price, the number of pieces to be sold, a sales amount, and the like of the commodity for which checkout is to be performed, in a transaction memory. The transaction memory is an area for saving the commodity sales data of one transaction. The transaction memory is formed in, for example, the volatile area of the main memory **12**.

When the processing of registering commodity sales data is terminated, the processing of the processor **11** proceeds to ACT**3**. In ACT**3**, the processor **11** confirms whether the subtotal key **224** has been operated or not. If the subtotal key **224** has not been operated, the processor **11** returns to ACT**1**. The processor **11** waits for the next operation of registering a commodity.

If the customer purchases two or more commodities, the store clerk also performs an operation of registering the second and other commodities sequentially. Upon receiving such a registering operation, the processor **11** repeatedly executes the processing of registering commodity sales data. When finishing all the registering operations for the commodities to be purchased by the customer, the store clerk operates the subtotal key **224**. After the subtotal key **224** is operated, the processing of the processor **11** proceeds from ACT**3** to ACT**4**. In ACT**4**, the processor **11** calculates a first settlement amount by the function of the first computing means **112**. For example, the processor **11** combines the sales amounts of the commodity sales data saved in the transaction memory to calculate a first settlement amount. The first settlement amount is a settlement amount calculated in a unit of a domestic currency. In other words, in the case of Japan, the first settlement amount is the amount of money in a unit of "yen". The first settlement amount is stored in the first settlement amount memory **121**.

After the first settlement amount is calculated, the processing of the processor **11** proceeds to ACT**5**. In ACT**5**, the processor **11** causes both the touch panel **21** and the customer display **25** to display the first settlement amount stored in the first settlement amount memory **121**.

FIG. **7** shows an example of a screen of each of the touch panel **21** and the customer display **25**, on which an image **41** including the first settlement amount is displayed. In the image **41**, the first settlement amount of "¥1,200" in the unit of "yen" is displayed in association with a text "total". For

a text "deposit" and a text "change", a deposit amount of "¥0" and a change amount of "¥0" in the unit of "yen" are respectively displayed.

The store clerk confirms the image **41** of the touch panel **21**, and then demands payment from the customer. Here, if the customer wants to pay in the domestic currency, the store clerk operates the cash key **225**. If the customer wants to pay by a credit card, the store clerk operates the credit key **226**. If the customer wants to pay by electronic money, the store clerk operates the electronic money key **227**. If the customer wants to pay in a foreign currency, the store clerk operates the foreign currency key **228**.

After the first settlement amount is displayed, in ACT**6**, the processor **11** waits until the close key, that is, the cash key **225**, the credit key **226**, or the electronic money key **227** is operated, or in ACT**7**, waits until the foreign currency key **228** is input. In this standby state, if a key other than the close key or the foreign currency key **228** is operated, the processor **11** executes processing corresponding to the operated key.

If the close key is operated in the standby state in ACT**6** and ACT**7**, the processing of the processor **11** proceeds from ACT**6** to ACT**8**. In ACT**8**, the processor **11** determines the type of the operated close key. For example, if the credit key **226** is operated, the processor **11** executes settlement processing by credit card payment. If the electronic money key **227** is operated, the processor **11** executes settlement processing by electronic money payment. The settlement processing by credit card payment or electronic money payment is known processing, and thus the description thereof will be omitted here.

If the cash key **225** is operated, the processing of the processor **11** proceeds from ACT**8** to ACT**9**. In ACT**9**, the processor **11** causes the customer display **25** to display an image for instructing a customer to deposit money into the automated change machine **20**. For example, the processor **11** causes the customer display **25** to display a message image indicating "Insert money into the automated change machine". The customer confirms the message image and then inserts the money in the domestic currency into a bill inserting port or a coin inserting port of the automated change machine **20**. After such an insertion operation, inserted amount data is transmitted from the automated change machine **20** to the settlement apparatus **10**.

After the deposit of money is instructed, the processing of the processor **11** proceeds from ACT**9** to ACT**10**. In ACT**10**, the processor **11** waits for the deposit of the payment amount by the function as the payment acquiring means **114**. Specifically, the processor **11** waits until the inserted amount data is transmitted from the automated change machine **20**. When receiving the inserted amount data, the processor **11** stores the amount of money obtained from the inserted amount data, as a payment amount in a unit of domestic currency, in the payment amount memory **123**. After that, the processing of the processor **11** proceeds to ACT**11**. In ACT**11**, the processor **11** calculates the amount of difference, which is obtained by subtracting the first settlement amount stored in the first settlement amount memory **121** from the payment amount stored in the payment amount memory **123**, by the function of the third computing means **117**. For example, assuming that the payment amount is "A" and the first settlement amount is "B", a difference "C" of "A-B" is defined as the amount of difference.

In ACT**12**, the processor **11** confirms whether the amount of difference "C" is a negative value, or "0" or a positive value. If the amount of difference "C" is a negative value, the processing of the processor **11** proceeds from ACT**12** to ACT**13**. In ACT**13**, the processor **11** stores the amount of difference "C" in the short amount memory **124**. In ACT**14**, the processor **11** then causes the touch panel **21** and the customer display **25** to display, as a short amount, the amount of difference "C" stored in the short amount memory **124**. For example, the processor **11** causes the touch panel **21** and the customer display **25** to display a message image, "The payment amount is C yen short."

Subsequently, the processing of the processor **11** returns to ACT**9**. In other words, the processor **11** causes the customer display **25** to display an image for instructing the customer to deposit money into the automated change machine **20**. For example, the processor **11** causes the customer display **25** to display a message image, "Insert the short amount of money into the automated change machine." The customer confirms the message image and then inserts the short amount of money or more in the domestic currency into the bill inserting port or the coin inserting port of the automated change machine **20**. After such an insertion operation, inserted amount data is transmitted from the automated change machine **20** to the settlement apparatus **10**.

After receiving the inserted amount data, the processor **11** adds a payment amount "D" obtained from the inserted amount data to the payment amount memory **123**. The processor **11** then calculates again an amount of difference "E", which is obtained by subtracting the first settlement amount "B" from the payment amount "A+D" stored in the payment amount memory **123**. Here, if the payment amount D is equal to or larger than the short amount C, the amount of difference "E" is "0" or a positive value, and thus the processing of the processor **11** proceeds from ACT**12** to ACT**15**. In ACT**15**, the processor **11** stores the amount of difference "E" in the change amount memory **125**. Further, in ACT**16**, the processor **11** causes the touch panel **21** and the customer display **25** to display the amount of money "A+D" of the payment amount memory **123** (that is, deposit amount) and the amount of money "E" of the change amount memory **125** (that is, change amount). For example, the processor **11** causes the touch panel **21** and the customer display **25** to display the amount of money "A+D", which is stored in the payment amount memory **123**, in association with the text "deposit" of the image **41** shown in FIG. **7**. Further, the processor **11** causes the touch panel **21** and the customer display **25** to display the amount of money "E", which is stored in the change amount memory **125**, in association with the text "change" of the image **41**.

After the deposit amount and the change amount are displayed, the processor **11** confirms whether the change amount is "0" or a positive value in ACT**17**. If the change amount is a positive value, the processing of the processor **11** proceeds from ACT**17** to ACT**18**. In ACT**18**, the processor **11** controls the change machine interface **16** to output change data for instructing the automated change machine **20** to pay out the change. By such control, the change data is transmitted from the change machine interface **16** to the automated change machine **20**, and money corresponding to the change amount is paid out from the automated change machine **20**. The money is the domestic currency. For example, if the customer inserts a bill of 1000 yen and a coin of 500 yen into the automated change machine **20** for the transaction in the total amount of 1200 yen, a change amount of 300 yen is paid out from the automated change machine **20**.

If the processor **11** terminates the processing of ACT**18** or skips the processing of ACT**18** because the change amount is "0", the processing of the processor **11** proceeds to

ACT19. In ACT19, the processor 11 controls the printer 24 to issue a receipt on the basis of the commodity sales data stored in the transaction memory. Through such operations, the processor 11 terminates the processing of one transaction according to the settlement program.

Meanwhile, if the foreign currency key 228 is operated in the standby state in ACT6 and ACT7, the processing of the processor 11 proceeds from ACT7 to ACT21 of FIG. 6. In ACT21, the processor 11 causes the touch panel 21 and the customer display 25 to display an image 42 of a currency selection screen (see FIG. 8).

FIG. 8 is a display example of an image 42 of a currency selection screen for the touch panel 21 and the customer display 25. The image 42 of the currency selection screen includes soft keys 421 to 424 for selecting a foreign currency. The soft key 421 is a key for selecting US dollar [USD]. Hereinafter, the soft key 421 will be referred to as a dollar key 421. The dollar key 421 displays the amount of money "136 yen" obtained when one dollar is converted into Japanese yen at the conversion rate of the rate table 30. The soft key 422 is a key for selecting euro [EUR]. Hereinafter, the soft key 422 will be referred to as an euro key 422. The euro key 422 displays the amount of money "138 yen" obtained when one euro is converted into Japanese yen at the conversion rate of the rate table 30. The soft key 423 is a key for selecting British pound [GBP]. Hereinafter, the soft key 423 will be referred to as a pound key 423. The pound key 423 displays the amount of money "162 yen" obtained when one pound is converted into Japanese yen at the conversion rate of the rate table 30. The soft key 424 is a key for selecting Swiss franc [CHF]. Hereinafter, the soft key 424 will be referred to as a franc key 424. The franc key 424 displays the amount of money "141 yen" obtained when one franc is converted into Japanese yen at the conversion rate of the rate table 30.

Therefore, the customer can easily understand, from the image 42 of the currency selection screen, the type of a foreign currency available for payment, and the conversion rate of that foreign currency to Japanese yen. Needless to say, the number and type of soft keys included in the image 42 of the currency selection screen are not limited to those shown in FIG. 8. For example, the image 42 may be an image of a currency selection screen further including a soft key for selecting "won" as a currency of South Korea, a soft key for selecting "yuan" as a currency of China, and the like.

After confirming the image 42 of the currency selection screen, the customer then informs the store clerk about a foreign currency to be used for payment. The store clerk touches a soft key corresponding to the foreign currency informed from the customer. For example, for a customer who makes payment in US dollar, the store clerk touches the dollar key 421. For a customer who makes payment in euro, the store clerk touches the euro key 422. The same holds true for a customer who makes payment in pound or franc.

After the image 42 of the currency selection screen is displayed, the processor 11 waits until any foreign currency is selected in ACT22. For example, when detecting that the dollar key 421 is touched, the processor 11 determines that "dollar" is selected as a foreign currency to be used for payment. For example, when detecting that the euro key 422 is touched, the processor 11 determines that "euro" is selected as a foreign currency to be used for payment. The same holds true for a case where the pound key 423 or the franc key 424 is touched.

If a foreign currency is selected, the processing of the processor 11 proceeds from ACT22 to ACT23. In ACT23, the processor 11 refers to the rate table 30 to acquire the conversion rate of the selected currency by the function of the rate acquiring means 111. In ACT24, the processor 11 then stores the acquired conversion rate in the conversion rate memory 126. For example, if the store clerk touches the dollar key 421 because the customer makes payment in US dollar, the conversion rate "136" is stored in the conversion rate memory 126. If the store clerk touches the euro key 422 because the customer makes payment in euro, the conversion rate "138" is stored in the conversion rate memory 126. The same holds true for a case where the pound key 423 or the franc key 424 is touched.

After the conversion rate is stored, in ACT25, the processor 11 converts the first settlement amount stored in the first settlement amount memory 121 at the conversion rate stored in the conversion rate memory 126 to calculate a settlement amount in the selected foreign currency, by the function of the first converting means 113. In ACT26, the processor 11 stores the converted settlement amount in the second settlement amount memory 122. In ACT27, the processor 11 causes both the touch panel 21 and the customer display 25 to display the settlement amount in the foreign currency stored in the second settlement amount memory 122, that is, the second settlement amount.

FIG. 9 is an example of a screen of the touch panel 21 and the customer display 25, on which an image 43 including the second settlement amount is displayed when the foreign currency "dollar" is selected for payment for the first settlement amount of 1200 yen. Since the conversion rate of "dollar" set in the rate table 30 is "136", the first settlement amount of 1200 yen is approximately 8.82 dollars when it is converted into "dollar", and the second settlement amount of 9 dollars is calculated by rounding up digits after a decimal point. As a result, the image 43 including the second settlement amount of "$9" in the unit of "dollar" is displayed in association with a text "TOTAL" on the screen of the touch panel 21 and the customer display 25. Further, the image 43 including a deposit amount of "$0" and a change amount of "$0" in the unit of "dollar" is displayed in association with a text "DEPOSIT" and a text "CHANGE". By such an image 43 displayed on the screen of the touch panel 21 and the customer display 25, the store clerk and the customer can easily know that 9 dollars are to be paid in the unit of the foreign currency "dollar" for the first settlement amount of 1200 yen calculated in the unit of the domestic currency "yen".

After the second settlement amount of "$9" is displayed, in ACT28, the processor 11 causes the customer display 25 to display an image 431 for notifying the customer of a message indicating that deposit of money into the automated change machine is unacceptable (see FIG. 9). As shown in FIG. 9, the image 431 is an image including a Japanese message, "Do not insert cash into the change machine." and an English message translated from the Japanese message into English.

Incidentally, if the currency in the German-speaking countries is selected as a foreign currency, the message of the image 431 is given not in English but in German. Similarly, if the currency in the French-speaking countries is selected as a foreign currency, the message of the image 431 is given in French. In such a manner, the customer display 25 is caused to display the image 431 of a message for inhibiting the money from being inserted in the official language of the countries or regions where the foreign currency is circulated, so that the customer who selects payment in the foreign currency is prevented from inserting the foreign currency into the automated change machine 20 by mistake.

After the image **431** is displayed, in ACT**29**, the processor **11** outputs an open command signal to the drawer **26**. In ACT**30**, the processor **11** then waits for the deposit of money in the selected currency by the function of the payment acquiring means **114**. When the customer makes payment in the foreign currency, the store clerk inputs the payment amount with the numeric key **221** and operates the cash key **225**. For example, if the customer pays 9 dollars in dollar bills, the store clerk inputs "9" and operates the cash key **225** for input. The store clerk houses the dollar bills received from the customer in the drawer **26**.

If the payment amount is input, the processing of the processor **11** stores the payment amount in the payment amount memory **123** and then proceeds from ACT**30** to ACT**31**. In ACT**31**, the processor **11** calculates the amount of difference, which is obtained by subtracting the second settlement amount stored in the second settlement amount memory **122** from the payment amount stored in the payment amount memory **123**, by the function of the second computing means **115**. For example, assuming that the payment amount is "F" and the second settlement amount is "G", a difference "H" of "F-G" is defined as the amount of difference.

In ACT**32**, the processor **11** confirms whether the amount of difference "H" is a negative value, or "0" or a positive value. If the amount of difference "H" is a negative value, the processing of the processor **11** proceeds from ACT**32** to ACT**33**. In ACT**33**, the processor **11** stores the amount of difference "H" in the short amount memory **124**. In ACT**34**, the processor **11** then causes the touch panel **21** and the customer display **25** to display, as a short amount, the amount of difference "H" stored in the short amount memory **124** by the function of the outputting means **118**. For example, the processor **11** causes the touch panel **21** and the customer display **25** to display a message image, "The payment amount is H dollars short." In this case as well, the processor **11** causes the touch panel **21** and the customer display **25** to display not only the message in Japanese but alto a message in the official language of the countries or regions where the selected foreign currency is circulated.

Subsequently, the processing of the processor **11** returns to ACT**30**. In other words, the processor **11** waits for the deposit of money in the selected currency. If a payment amount J in the foreign currency is then input with the numeric key **221** and the cash key **225**, the processor **11** adds the payment amount J to the payment amount memory **123**. The processor **11** then calculates again an amount of difference "K", which is obtained by subtracting the second settlement amount "G" from the payment amount "F+J" stored in the payment amount memory **123**. Here, if the payment amount J is equal to or larger than the short amount H, the amount of difference "K" is "0" or a positive value, and thus the processing of the processor **11** proceeds from ACT**32** to ACT**35**.

In ACT**35**, the processor **11** uses the conversion rate of the conversion rate memory **126** to convert the payment amount "F+J" in the unit of the foreign currency into the amount of money in the unit of yen, by the function of the second converting means **116**. For example, if the payment amount "F+J" is 9 dollars, since the conversion rate of "dollar" set in the rate table **30** is "136", 9 dollars are converted into 1224 yen.

In ACT**36**, the processor **11** calculates the amount of difference between the converted amount of money and the first settlement amount, that is, the change amount. In ACT**37**, the processor **11** then stores the change amount in the change amount memory **125**. Further, in ACT**38**, the processor **11** causes the touch panel **21** and the customer display **25** to display the payment amount stored in the payment amount memory **123** in association with the text "DEPOSIT" of the image **43**. Further, the processor **11** causes the touch panel **21** and the customer display **25** to display the change amount stored in the change amount memory **125** in association with the text "CHANGE" of the image **43**.

FIG. **10** is an example of the screen of the touch panel **21** and the customer display **25** on which an image **44** including the payment amount and the change amount is displayed. As shown in the figure, "$9" is displayed for the text "TOTAL", "$9" is displayed for the text "DEPOSIT", and "¥24" is displayed for the text "CHANGE". The image **44** is displayed on both the touch panel **21** and the customer display **25** together with an image **441** of a message indicating that the change is to be paid in Japanese yen. The image **441** includes the message in Japanese and a message in the official language of the countries or regions where the selected foreign currency is circulated. By such an image **44** displayed on the screen of the touch panel **21**, the store clerk can know that the change of 24 yen is to be paid out for the transaction in which 9 dollars have been paid for the settlement amount of 1200 yen. Further, by the image **44** displayed on the screen of the customer display **25**, the customer can also know that the change is to be paid in Japanese yen.

After the deposit amount and the change amount are displayed, in ACT**39**, the processor **11** confirms whether the change amount is "0" or a positive value. If the change amount is a positive value, the processing of the processor **11** proceeds from ACT**39** to ACT**40**. In ACT**40**, the processor **11** controls the change machine interface **16** to output change data for instructing the automated change machine **20** to pay out the change by the function of the outputting means **118**. By such control, the change data is transmitted from the change machine interface **16** to the automated change machine **20**, and money corresponding to the change amount is paid out from the automated change machine **20**. The money is the domestic currency.

If the processor **11** terminates the processing of ACT**40** or skips the processing of ACT**40** because the change amount is "0", the processing of the processor **11** proceeds to ACT**41**. In ACT**41**, the processor **11** controls the printer **24** to issue a receipt on the basis of the commodity sales data stored in the transaction memory. Through such operations, the processor **11** terminates the processing of one transaction according to the settlement program.

As described above in detail, the settlement apparatus **10** of this embodiment can handle not only the payment in a domestic currency as a first currency but also the payment in a foreign currency as a second currency. Besides, if change is generated for the payment in the foreign currency, the change is paid out in the domestic currency from the automated change machine **20**. Therefore, it is unnecessary to pay out the change in the foreign currency, so that the current automated change machine **20** can be utilized as it is.

Second Embodiment

Next, a second embodiment in which a settlement apparatus capable of handling payment in a foreign currency as well is applied to a semi-self-service POS system will be described.

FIG. **11** is a schematic diagram showing the outline of a semi-self-service POS system **100** according to the second embodiment. The semi-self-service POS system **100**

includes one register **50** and two checkout machines **60**. The register **50** and each checkout machine **60** are connected to each other via a communication network **70** such as a local area network (LAN). Note that the number of checkout machines **60** is not limited to two. The number of checkout machines **60** may be one or three or more. Further, two or more registers **50** may be connected to one checkout machine **60**.

The register **50** is an electronic apparatus that performs processing of registering sales data of a commodity to be purchased by a customer to generate settlement data including a settlement amount for settling a transaction with the customer. The settlement data generated by the register **50** is transmitted to one of the checkout machines **60** connected thereto via the communication network **70**. The checkout machine **60** is an electronic apparatus that settles the transaction with the customer on the basis of payment data of the customer for the settlement amount of the settlement data. In the semi-self-service POS system **100** having such a configuration, the register **50** is operated by a store clerk in principle, and the checkout machine **60** is operated by a customer in principle.

FIG. **12** is a block diagram showing a circuit configuration of a main part of the register **50**. As shown in the figure, the register **50** includes a processor **51**, a main memory **52**, an auxiliary storage device **53**, a clock **54**, a communication interface **55**, a plurality of device interfaces **561** to **565**, an output port **57**, and a system transmission path **58**. The system transmission path **58** includes an address bus, a data bus, a control signal line, and the like. The register **50** connects the processor **51** with the main memory **52**, the auxiliary storage device **53**, the clock **54**, the communication interface **55**, the plurality of device interfaces **561** to **565**, and the output port **57** via the system transmission path **58**, thus constituting a computer. The register **50** then connects various devices such as a touch panel **21**, a keyboard **22**, a scanner **23**, a printer **24**, and a customer display **25** to the device interfaces **561** to **565**, respectively, similarly to the settlement apparatus **10** of the first embodiment. Further, the register **50** connects a drawer **26** to the output port **57**.

Here, the basic description on the processor **51**, the main memory **52**, the auxiliary storage device **53**, the clock **54**, the communication interface **55**, the plurality of device interfaces **561** to **565**, and the output port **57** is similar to that of the processor **11**, the main memory **12**, the auxiliary storage device **13**, the clock **14**, the communication interface **15**, the plurality of device interfaces **171** to **175**, and the output port **18** of the settlement apparatus **10**. Therefore, the description thereof will be omitted here. Note that the communication interface **55** is a circuit for performing data communication with an external computer device via the communication network **70**, and such a computer device includes the checkout machine **60**.

The register **50** having such a configuration includes, similarly to the settlement apparatus **10**, a foreign currency key **228** disposed in the keyboard **22**. Further, the register **50** includes, as a part of a work area of the main memory **52**, a first settlement amount memory **121**, a second settlement amount memory **122**, a payment amount memory **123**, a short amount memory **124**, a change amount memory **125**, and a conversion rate memory **126**.

The processor **51** of the register **50** has functions of rate acquiring means **511**, first computing means **512**, first converting means **513**, payment acquiring means **514**, second computing means **515**, second converting means **516**, and first outputting means **517**.

The rate acquiring means **511** has a function of acquiring a conversion rate, which is a rate used when exchanging a domestic currency as a first currency for a foreign currency as a second currency. The rate acquiring means **511** acquires a necessary conversion rate by referring to the rate table **30**, similarly in the first embodiment.

The first computing means **512** has a function of calculating a settlement amount in a unit of the first currency. The settlement amount calculated by the first computing means **512** is stored in the first settlement amount memory **121**. In other words, the first settlement amount memory **121** stores the first settlement amount.

The first converting means **513** has a function of converting the first settlement amount calculated by the first computing means **512** into a settlement amount in a unit of the second currency by using the rate acquired by the rate acquiring means **511**, that is, the conversion rate. The settlement amount converted by the first converting means **513** is stored in the second settlement amount memory **122**. In other words, the second settlement amount memory **122** stores the second settlement amount.

The payment acquiring means **514** has a function of acquiring a payment amount for the second settlement amount. Specifically, after the foreign currency key **228** of the keyboard **22** is operated, the payment acquiring means **514** acquires the amount of money input by the numeric key **221** as a payment amount in the unit of the second currency. The payment amount acquired by the payment acquiring means **114** is stored in the payment amount memory **123**. In other words, the payment amount memory **123** stores the payment amount for the second settlement amount.

The second computing means **515** has a function of calculating the amount of difference between the payment amount in the unit of the second currency, which has been acquired by the payment acquiring means **514**, and the second settlement amount. If the amount of difference calculated by the second computing means **515** is a negative value, the amount of difference is stored in the short amount memory **124**. If the amount of difference calculated by the second computing means **515** is zero or a positive value, the amount of difference is stored in the change amount memory **125**. In other words, the short amount memory **124** stores a short amount, and the change amount memory **125** stores a change amount. The second converting means **516** uses the conversion rate of the conversion rate memory **126** to convert the payment amount in the unit of the foreign currency into the amount of money in the unit of yen.

The first outputting means **517** has a function of outputting settlement data including the first settlement amount and the change amount to the checkout machine **60** if the payment amount in the unit of the second currency, which has been acquired by the payment acquiring means **514**, is larger than the second settlement amount.

The functions of the rate acquiring means **511**, the first computing means **512**, the first converting means **513**, the payment acquiring means **514**, the second computing means **515**, the second converting means **516**, and the first outputting means **517** are implemented by information processing executed by the processor **51** according to a register settlement program **531**. The register settlement program **531** is installed on the auxiliary storage device **53**. The register settlement program **531** may be installed on the main memory **52**. The method of installing the register settlement program **531** on the main memory **52** or the auxiliary storage device **53** is not particularly limited. The register settlement program **531** can be installed on the main memory **52** or the auxiliary storage device **53** by recording the register settle-

ment program **531** on a removable recording medium or distributing the register settlement program **531** through communication via a network. The form of the recording medium does not matter as long as the recording medium can store programs and an apparatus can read the programs from the recording medium, like an SD memory card, a USB memory, or the like.

FIG. **13** is a block diagram showing a circuit configuration of a main part of the checkout machine **60**. As shown in the figure, the checkout machine **60** includes a processor **61**, a main memory **62**, an auxiliary storage device **63**, a clock **64**, a communication interface **65**, a change machine interface **66**, a plurality of device interfaces **671** and **672**, and a system transmission path **68**. The system transmission path **68** includes an address bus, a data bus, a control signal line, and the like. The checkout machine **60** connects the processor **61** with the main memory **62**, the auxiliary storage device **63**, the clock **64**, the communication interface **65**, the change machine interface **66**, and the plurality of device interfaces **671** and **672** via the system transmission path **68**, thus constituting a computer. The checkout machine **60** then connects a touch panel **21** to the device interface **671** and connects a printer **24** to the device interface **671**.

Here, the basic description on the processor **61**, the main memory **62**, the auxiliary storage device **63**, the clock **64**, the communication interface **65**, the change machine interface **66**, and the plurality of device interfaces **671** and **672** is similar to that of the processor **11**, the main memory **12**, the auxiliary storage device **13**, the clock **14**, the communication interface **15**, the change machine interface **16**, and the plurality of device interfaces **171** to **175** of the settlement apparatus **10**. Therefore, the description thereof will be omitted here. Note that the communication interface **65** is a circuit for performing data communication with an external computer device via the communication network **70**, and such a computer device includes the register **50**.

In the checkout machine **60** having such a configuration, the processor **61** has functions of payment acquiring means **611**, third computing means **612**, and second outputting means **613**.

The payment acquiring means **611** has a function of acquiring a payment amount for the first settlement amount included in the settlement data received from the register **50**. Specifically, the payment acquiring means **611** acquires the inserted amount of money, which has been inserted into the automated change machine **20**, as a payment amount for the first settlement amount.

The third computing means **612** has a function of calculating the amount of difference between the payment amount, which has been acquired by the payment acquiring means **611**, and the first settlement amount included in the settlement data received from the register **50**.

The second outputting means **613** has a function of outputting a command to pay out the amount of difference calculated by the third computing means **612**, as change, to the automated change machine **20**. Further, the second outputting means **613** also has a function of outputting a command to pay out change corresponding to the change amount included in the settlement data received from the register **50**, to the automated change machine **20**.

The functions of the payment acquiring means **611**, the third computing means **612**, and the second outputting means **613** are implemented by information processing executed by the processor **61** according to a checkout machine settlement program **631**. The checkout machine settlement program **631** is installed on the auxiliary storage device **63**. The checkout machine settlement program **631** may be installed on the main memory **62**. The method of installing the checkout machine settlement program **631** on the main memory **62** or the auxiliary storage device **63** is not particularly limited. The checkout machine settlement program **631** can be installed on the main memory **62** or the auxiliary storage device **63** by recording the checkout machine settlement program **631** on a removable recording medium or distributing the checkout machine settlement program **631** through communication via a network. The form of the recording medium does not matter as long as the recording medium can store programs and an apparatus can read the programs from the recording medium, like an SD memory card, a USB memory, or the like.

FIGS. **14** and **15** are flowcharts showing the information processing executed by the processor **51** of the register **50** according to the register settlement program **531**. Further, FIG. **16** is a flowchart showing the information processing executed by the processor **61** of the checkout machine **60** according to the checkout machine settlement program **631**. Hereinafter, a main operation of the semi-self-service POS system **100** capable of handling payment in a foreign currency as well will be described with reference to those drawings. Note that the procedures and contents of the information processing to be described below are exemplary ones. Those procedures and contents can be appropriately modified if it is possible to provide similar actions and effects.

First, in ACT**61**, the processor **51** waits for an operation of registering a commodity. When a store clerk who is an operator of the register **50** is asked to perform checkout by a customer who is a user of the store, similarly in the first embodiment, the store clerk uses the input device such as the touch panel **21**, the keyboard **22**, or the scanner **23** to perform an operation for registering a commodity for which the checkout is to be performed. Through such an operation, the processor **51** determines that the operation of registering a commodity has been performed. The processing of the processor **51** proceeds from ACT**61** to ACT**62**.

In ACT**62**, the processor **51** executes processing of registering commodity sales data. Such registering processing is also similar to the processing executed by the processor **11** of the settlement apparatus **10** in ACT**2** in the first embodiment. When the processing of registering commodity sales data is terminated, the processing of the processor **51** proceeds to ACT**63**. In ACT**63**, the processor **51** confirms whether a subtotal key **224** has been operated or not. If the subtotal key **224** has not been operated, the processing of the processor **51** returns to ACT**61**. The processor **51** waits for the next operation of registering a commodity.

After the subtotal key **224** is operated, the processing of the processor **51** proceeds from ACT**63** to ACT**64**. In ACT**64**, the processor **51** calculates a first settlement amount by the function of the first computing means **512**. The first settlement amount is a settlement amount calculated in a unit of a domestic currency. In other words, in the case of Japan, the first settlement amount is the amount of money in a unit of "yen". The first settlement amount is stored in the first settlement amount memory **121**.

After the first settlement amount is calculated, the processing of the processor **51** proceeds to ACT**65**. In ACT**65**, the processor **51** confirms whether the transfer of the settlement data has been instructed or not. For example, the touch panel **21** includes a soft key for instructing the transfer of the settlement data, a so-called transfer key. If the customer wants to make payment in the domestic currency as a first currency, the store clerk operates the transfer key. Meanwhile, if the customer wants to make payment in a foreign

currency as a second currency, the store clerk operates a foreign currency key **228**. Note that the transfer key may be a hard key disposed in the keyboard **22**. Similarly, the foreign currency key **228** may be a soft key displayed on the touch panel **21**.

In ACT**65**, if the transfer of the settlement data has not been instructed, the processing of the processor **51** proceeds to ACT**66**. In ACT**66**, the processor **51** confirms whether the foreign currency key **228** has been operated for input. If the foreign currency key **228** has not been operated, the processing of the processor **51** returns to ACT**65**. In such a manner, in ACT**65** and ACT**66**, the processor **51** waits until the transfer key is operated or the foreign currency key **228** is operated.

If the transfer key is operated in the standby state in ACT**65** And ACT**66**, the processing of the processor **51** proceeds from ACT**65** to ACT**67**. In ACT**67**, the processor **51** sets a completion flag to "0". After that, in ACT**68**, the processor **51** transfers transaction data to the checkout machine **60**. The transaction data is data including the commodity sales data subjected to the registering processing in ACT**62**, the first settlement amount calculated in the processing of ACT**64**, and the completion flag set to "0" in the processing of ACT**67**. The transaction data is transmitted to the checkout machine **60** via the communication network **70**.

If the foreign currency key **228** is operated in the standby state in ACT**65** And ACT**66**, the processing of the processor **51** proceeds from ACT**66** to ACT**71** of FIG. **15**. In ACT**71**, the processor **51** causes the touch panel **21** to display an image **42** of a currency selection screen (see FIG. **8**). In ACT**72** to ACT**77**, the processor **51** then executes processing similar to the processing in ACT**22** to ACT**27** described in the first embodiment.

In other words, after the image **42** of the currency selection screen is displayed, the processor **51** waits until any foreign currency is selected in ACT**72**. If a foreign currency is selected by the operation of the store clerk, the processing of the processor **51** proceeds from ACT**72** to ACT**73**. In ACT**73**, the processor **11** refers to the rate table **30** to acquire a conversion rate of the selected currency by the function of the rate acquiring means **511**. In ACT**74**, the processor **51** then stores the acquired conversion rate in the conversion rate memory **126**. In ACT**75**, the processor **51** converts the first settlement amount stored in the first settlement amount memory **121** at the conversion rate stored in the conversion rate memory **126** to calculate a settlement amount in the selected foreign currency, by the function of the first converting means **513**. In ACT**76**, the processor **51** stores the converted settlement amount in the second settlement amount memory **122**. In ACT**77**, the processor **51** causes both the touch panel **21** and the customer display **25** to display the settlement amount in the unit of the foreign currency, which is stored in the second settlement amount memory **122**, that is, a second settlement amount.

After the second settlement amount is displayed, in ACT**78**, the processor **51** outputs an open command signal to the drawer **26**. In ACT**79**, the processor **51** then waits for an input of the payment amount in the selected currency by the function of the payment acquiring means **514**. If the customer makes payment in the foreign currency, the store clerk inputs the payment amount with the numeric key **221** and operates the cash key **225**.

If the payment amount is input, the processor **51** stores the payment amount in the payment amount memory **123**. After that, the processing of the processor **51** proceeds from ACT**79** to ACT**80**. In ACT**80**, the processor **51** calculates the amount of difference, which is obtained by subtracting the second settlement amount stored in the second settlement amount memory **122** from the payment amount stored in the payment amount memory **123**, by the function of the second computing means **515**.

In ACT**81**, the processor **51** confirms whether the amount of difference is a negative value, or "0" or a positive value. If the amount of difference is a negative value, the processing of the processor **51** proceeds from ACT**81** to ACT**82**. In ACT**82**, the processor **51** stores the amount of difference in the short amount memory **124**. In ACT**83**, the processor **51** then causes the touch panel **21** and the customer display **25** to display, as a short amount, the amount of difference stored in the short amount memory **124**.

Subsequently, the processing of the processor **51** returns to ACT**79**. In other words, the processor **51** waits for the deposit of money in the selected currency. If a payment amount in the foreign currency is then input with the numeric key **221** and the cash key **225**, the processor **51** adds the payment amount to the payment amount memory **123**. The processor **51** then calculates again the amount of difference, which is obtained by subtracting the second settlement amount from the payment amount stored in the payment amount memory **123**. Here, if the payment amount is equal to or larger than the second settlement amount, the amount of difference is "0" or a positive value, and thus the processing of the processor **51** proceeds from ACT**81** to ACT**84**.

In ACT**84**, the processor **51** uses the conversion rate of the conversion rate memory **126** to convert the payment amount in the unit of the foreign currency into the amount of money in the unit of yen, by the function of the second converting means **516**. Subsequently, in ACT**85**, the processor **51** calculates the amount of difference, which is obtained by subtracting the first settlement amount from the converted payment amount, as a change amount.

In ACT**86**, the processor **51** sets the completion flag to "1". After that, in ACT**87**, the processor **51** transfers transaction data to the checkout machine **60**. The transaction data is data including the commodity sales data subjected to the registering processing in ACT**62**, the second settlement amount stored in the processing of ACT**76**, the change amount calculated in the processing of ACT**85**, and the completion flag set to "1" in the processing of ACT**86**. The transaction data is transmitted to the checkout machine **60** via the communication network **70**. Through such operations, the processor **51** then terminates the processing of one transaction according to the register settlement program.

As shown in FIG. **16**, in ACT**91**, the processor **61** of the checkout machine **60** waits for the transaction data. Upon receiving the transaction data from the register **50**, the processing of the processor **61** proceeds from ACT**91** to ACT**92**. In ACT**92**, the processor **61** examines the completion flag included in the received transaction data.

If the completion flag is "0", the customer wants to make payment in the domestic currency, and thus the settlement is not completed. The processing of the processor **61** proceeds from ACT**92** to ACT**93**. In ACT**93**, the processor **61** causes the touch panel **21** to display the first settlement amount included in the transaction data. In ACT**94**, the processor **61** then waits for deposit of the payment amount by the function of the payment acquiring means **611**. Specifically, the processor **61** waits until inserted amount data is transmitted from the automated change machine **20**. If the inserted amount data equal to or larger than the first settlement amount is received, the processing of the processor **61** proceeds from ACT**94** to ACT**95**. In ACT**95**, the processor

61 calculates a change amount by subtracting the first settlement amount from the amount of money inserted into the automated change machine **20**.

In ACT**96**, the processor **61** confirms whether the change amount is "0" or a positive value. If the change amount is a positive value, the processing of the processor **61** proceeds from ACT**96** to ACT**97**. In ACT**97**, the processor **61** controls the change machine interface **66** to output change data for instructing the automated change machine **20** to pay out the change. By such control, the change data is transmitted from the change machine interface **66** to the automated change machine **20**, and money corresponding to the change amount is paid out from the automated change machine **20**. The money is the domestic currency.

If the processor **61** terminates the processing of ACT**97** or skips the processing of ACT**97** because the change amount is "0", the processing of the processor **61** proceeds to ACT**98**. In ACT**98**, the processor **61** controls the printer **24** to issue a receipt on the basis of the commodity sales data included in the transaction data. Through such operations, the processor **61** terminates the processing when the transaction data with the completion flag of "$_0$" is received.

Meanwhile, if the completion flag is "1" in ACT**92**, the customer wants to make payment in the foreign currency, and thus the settlement is completed in the register **50**. Thus, the processing of the processor **61** proceeds from ACT**92** to ACT**99**. In ACT**99**, the processor **61** causes the touch panel **21** to display an image for notifying the customer of the fact that deposit of money into the automated change machine is unacceptable, similarly to ACT**28** in the first embodiment. Further, in ACT**100**, the processor **61** acquires the change amount from the transaction data. Subsequently, the processing of the processor **61** proceeds to ACT**96**. The processor **61** then executes the processing from ACT**96** to ACT**98** in a similar manner as described above. In other words, if the change amount is a positive value, the processor **61** controls the change machine interface **66** to output change data for instructing the automated change machine **20** to pay out the change. By such control, the change data is transmitted from the change machine interface **66** to the automated change machine **20**, and money corresponding to the change amount is paid out from the automated change machine **20**. The money is the domestic currency. If the change amount is "0", the processor **61** does not perform the processing of outputting the change data to the automated change machine **20**. Subsequently, the processor **61** controls issue of a receipt. Through such operations, the processor **61** terminates the processing when the transaction data with the completion flag of "1" is received.

As described above, similarly to the settlement apparatus **10** of the first embodiment, the semi-self-service POS system **100** can handle not only the payment in the domestic currency as a first currency but also the payment in the foreign currency as a second currency. Besides, if change is generated for the payment in the foreign currency, the change is paid out in the domestic currency from the automated change machine **20**. In such a manner, it is unnecessary to pay out the change in the foreign currency, so that the current automated change machine **20** included in the checkout machine **60** can be utilized as it is.

Hereinabove, the embodiments of the settlement apparatus have been described, but embodiments thereof are not limited thereto.

For example, the rate used for converting the settlement amount calculated in the unit of the first currency into the settlement amount in the unit of the second currency by the first converting means **113** or the first converting means **513** may be different from the rate used for converting the payment amount in the unit of the second currency into the payment amount in the unit of the first currency by the second converting means **116** or the second converting means **516**.

For example, the customer display **25** may be used as a touch panel, and a customer may perform an input with a soft key of the currency selection screen.

The input device for inputting the amount of money may be the touch panel **21**.

The action for inhibiting money from being inserted into the automated change machine **20** is not limited to the action of outputting a message for inhibiting money from being inserted in an official language of the countries or regions where the foreign currency is circulated. For example, it may be possible to automatically close the bill inserting port and the coin inserting port of the automated change machine **20** and physically prevent money from being inserted.

While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

What is claimed is:

1. A settlement apparatus, comprising:

a rate table that stores an exchange rate between a first currency and a second currency;

a first settlement amount memory that stores a settlement amount in the first currency;

a second settlement amount memory that stores a settlement amount in the second currency;

a payment amount memory that stores a payment amount for the settlement amount;

a difference amount memory that stores an amount of difference between the settlement amount and the payment amount;

an automated change machine;

a display; and

a processor configured to

refer to the rate table to acquire a rate for exchanging the first currency to the second currency,

calculate the settlement amount in the first currency to store the calculated settlement amount in the first currency in the first settlement amount memory,

convert the settlement amount in the first currency, which is stored in the first settlement amount memory, into the settlement amount in the second currency by using the acquired rate, to store the converted settlement amount in the second currency in the second settlement amount memory,

acquire the payment amount in the second currency to store the payment amount in the second currency in the payment amount memory,

calculate an amount of difference between the settlement amount in the second currency, which is stored in the second settlement amount memory, and the payment amount in the second currency stored in the payment amount memory, to store the calculated amount of difference in the second currency in the difference amount memory,

convert the payment amount in the second currency, which is stored in the payment amount memory, into the payment amount in the first currency by using the acquired rate, and compute an amount of difference between the converted payment amount in the first currency and the settlement amount stored in the first settlement amount memory, to store the computed amount of difference in the first currency in the difference amount memory,

in response to determining that the payment amount in the second currency is smaller than the settlement amount in the second currency, control the display to display a message indicating the amount of the difference in the second currency, which is stored in the difference amount memory, as a short amount, and

in response to determining that the payment amount in the second currency is equal to or larger than the settlement amount in the second currency, control the automated change machine to dispense cash in the amount of difference in the first currency, which is stored in the difference amount memory, as a change amount.

2. The settlement apparatus according to claim **1**, wherein the difference amount memory includes

a short amount memory that stores, if the payment amount in the second currency is smaller than the settlement amount in the second currency, the amount of difference between the payment amount in the second currency and the settlement amount in the second currency, and

a change amount memory that stores, if the payment amount in the second currency is equal to or larger than the settlement amount in the second currency, the amount of difference between the payment amount in the first currency and the settlement amount in the first currency.

3. The settlement apparatus according to claim **2**, wherein if the payment amount in the second currency is smaller than the settlement amount in the second currency, the processor outputs the amount of difference in the second currency, which is stored in the short amount memory.

4. The settlement apparatus according to claim **2**, wherein if the payment amount in the second currency is equal to or larger than the settlement amount in the second currency, the processor outputs the amount of difference in the first currency, which is stored in the change amount memory.

5. The settlement apparatus according to claim **1**, further comprising

an input device with which an amount of money is input, wherein

the processor

acquires the amount of money, which is input via the input device, as the payment amount in the second currency,

acquires an amount of money inserted into the automated change machine as the payment amount in the first currency, and

performs, when acquiring the payment amount in the second currency, an action for inhibiting money from being inserted into the automated change machine.

6. The settlement apparatus according to claim **5**, wherein the first currency is a domestic currency,

the second currency is a foreign currency, and

the action for inhibiting money from being inserted into the automated change machine includes an action for displaying on the display a message for inhibiting money from being inserted in an official language of a country or region where the foreign currency is circulated.

7. A settlement method for a settlement apparatus, comprising:

storing an exchange rate between a first currency and a second currency in a rate table;

referring to the rate table to acquire a rate for exchanging the first currency to the second currency;

calculating a settlement amount in the first currency to store the calculated settlement amount in the first currency in a first settlement amount memory;

converting the settlement amount in the first currency, which is stored in the first settlement amount memory, into a settlement amount in the second currency by using the acquired rate, to store the converted settlement amount in the second currency in a second settlement amount memory;

acquiring a payment amount in the second currency to store the payment amount in the second currency in a payment amount memory;

calculating an amount of difference between the settlement amount in the second currency, which is stored in the second settlement amount memory, and the payment amount in the second currency stored in the payment amount memory, to store the calculated amount of difference in the second currency in the difference amount memory;

converting the payment amount in the second currency, which is stored in the payment amount memory, into the payment amount in the first currency by using the acquired rate, and computing an amount of difference between the converted payment amount in the first currency and the settlement amount stored in the first settlement amount memory, to store the computed amount of difference in the first currency in the difference amount memory;

in response to determining that the payment amount in the second currency is smaller than the settlement amount in the second currency, displaying on a display a message indicating the amount of the difference in the second currency, which is stored in the difference amount memory, as a short amount, and

in response to determining that the payment amount in the second currency is equal to or larger than the settlement amount in the second currency, dispensing from an automated change machine cash in the amount of difference in the first currency, which is stored in the difference amount memory, as a change amount.

8. The settlement apparatus according to claim **1**, further comprising:

a cash drawer, wherein

the processor is configured to cause the cash drawer to be opened when payment in the second currency is processed and not to be opened when payment in the first currency is processed.

* * * * *