(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 944 739 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
16.07.2008 Bulletin 2008/29

(51) Int Cl.:
G07F 7/08 *(2006.01)* ***G06K 7/10*** *(2006.01)*

(21) Application number: **07001674.6**

(22) Date of filing: **26.01.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(30) Priority: **09.01.2007 DE 102007001428**

(71) Applicant: **International Currency Technologies Corporation**
Taipei,
Taiwan (TW)

(72) Inventor: **Chien, Tien-Yuan**
Taipei (TW)

(74) Representative: **Manasse, Uwe**
Forrester & Boehmert,
Pettenkoferstrasse 20-22
80336 München (DE)

(54) Calibration system and method thereof

(57) A calibration system and method are applied for a card reader arranged in an automatic vending machine. The card reader has a light emitting device and a light receiver. The calibration system includes a controller and calibration card which of surface has a stable reflection for a light with certain wavelength. When the automatic vending machine is set to calibration mode and the calibration card is input into the automatic vending machine, an electrical signal provided by the controller is used for adjusting the intensity of the light with certain wavelength generated by the light-emitting device. If the intensity of the light received by the light receiver matches a light intensity standard value, then a lookup table is updated based on the electrical signal and the calibration is finish, otherwise, electrical signal will be adjusted repeatedly until the intensity of the light received by the light receiver matches the light intensity standard value.

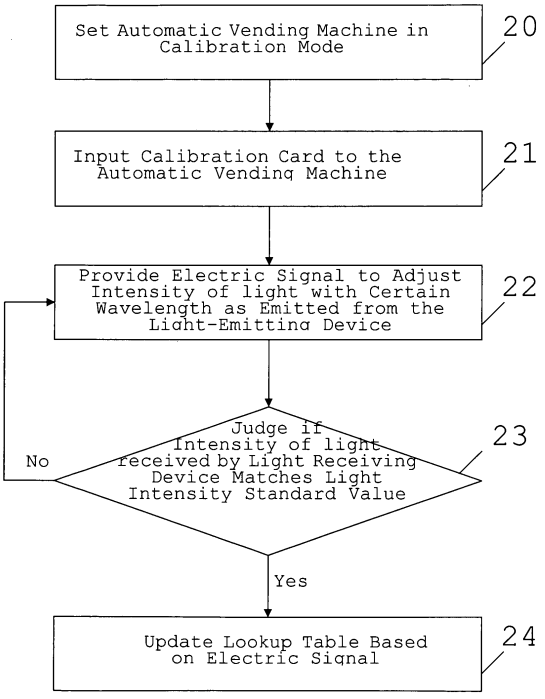

Fig. 2

EP 1 944 739 A1

Description

BACKGROUND OF THE INVENTION

(a) Field of the Invention

[0001] The present invention is related to a calibration system and method thereof, and particularly, to a calibration system and method applied for a card reader arranged in an automatic vending machine.

(b) Description of the Prior Art:

[0002] People today have accepted those conveniences brought by the popular application of induction cards. For example, with a credit card or a cash card, one does not need to carry too many cashes with him and still buy something in a store or in front of an automatic vending machine as long as where a card reader is provided by using the deposit amount or credit allowance as registered with the card. A card reader usually read out data signals on the card optically to process identification. A light-emitting device in the card reader emits beams, which in turn reflected from the card to be received by a light-receiving device in the card reader; and then the optical signals received are given data identification for the card. To achieve the optimal card identification rate, the intensity of the optical signals to be received by the light receiving device must be maintained at certain standard value to facilitate the process of the rear-end data identification procedure.

[0003] Whereas most of the automatic vending machines are provided in outdoors, severe weather conditions make it difficult for the intensity of optical signals received by the receiving device in the machine to maintain at a standard value, thus to affect accuracy of data identification. The card reader installed in the automatic vending machine is prevented from further calibration after ex-factory, or the calibration is made feasible only by removing the entire card reader causing much inconvenience.

SUMMARY OF THE INVENTION

[0004] The primary purpose of the present invention is to provide a calibration system and method to make easier in the calibration of a card reader installed in an automatic vending machine.

[0005] To achieve the purpose, the present invention provides a calibration system adaptable to a card reader installed in an automatic vending machine. The card reader contains a light-emitting device and a light-receiving device. The calibration system includes a calibration card, a control unit, a storage unit, and a process unit. The surface of the calibration card gives a stable reflection rate to certain wavelength. The control unit provides an electric signal to control the intensity of the light with certain wavelength emitted from the light- emitting device. The storage unit stores a lookup table registered with one or a plurality of light intensity standard value and a numeric value corresponding to the electric signal of the standard value of the light intensity. Wherein, when the automatic vending machine is set in a calibration mode and the calibration card is inputted to the automatic vending machine, the control unit adjusts electric signal to change the intensity of the light with certain wavelength emitted from the light-emitting device. The light-receiving device receives the light reflected from the card while the comparison unit compares the intensity of the light received by the receiving-device; if the intensity matches the light intensity standard value, the lookup table is updated according to the electric signal.

[0006] Furthermore, the present invention discloses a calibration method adaptable to a card reader installed in an automatic vending machine. The card reader is disposed with a light-emitting device and a light-receiving device. The calibration method includes (a) Set up the automatic vending machine in a calibration status; (b) Input a calibration card to the automatic vending machine. The surface of the calibration card gives stable reflection rate to a light with certain wavelength; (c) An electric signal is provided to adjust the intensity of the light with certain wavelength emitted from the light-emitting device; (d) Estimate the intensity of the light reflected from the card as received by the light-receiving device and judge whether that intensity matches a standard value of light intensity. If yes, go to step (e); if not step (c) is executed; and (e) a lookup table registered with the corresponding relation between the light intensity standard value and the electric signal is updated based on the electric signal.

[0007] Accordingly, the calibration system and the method of the present invention provides the following advantages:

(1) The system and its method executes calibration without having to removing the card reader from the automatic vending machine thus to promote convenience of calibration; and

(2) The system and its method are not affected by the ambient light and are adaptable to automatic vending machines erected in various types of environment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is a schematic view showing a calibration system of the present invention;

Fig. 2 is a flow chart showing steps of a calibration method of the present invention; and

Fig. 3 is a flow chart showing a preferred embodiment of steps of the calibration system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] Referring to Fig. 1 for a schematic view of a calibration system of the present invention, the calibration system 1 including a calibration card 10, a control unit 11, a storage unit 12 and a process unit 16 calibrates a card reader 14 installed in an automatic vending machine 13. The card reader 14 contains a light-emitting device 141 and a light-receiving device 142. When the automatic vending machine 13 is set in its normal operation mode and a card is inputted, the light-emitting device 141 emits a light with certain wavelength to be reflected by the card to the light-receiving device 142. The card is identified based on the optical signal received by the light-receiving device 142. To achieve the optimal card identification rate, an intensity of the optical signal received by the receiving-device 142 must be maintained at certain standard value to facilitate the rear-end data identification procedure. The light-emitting device 141 surrenders to the control by the control unit 11. The control unit 11 provides an electric signal to control the intensity of a light 143 with certain wavelength emitted by the light-emitting device. The storage unit 12 stores data of a lookup table 122 registered with one or a plurality of a standard value 121 of light intensity and a numeric value 123 of the electric signal corresponding to the standard value 121 of the light intensity. Therefore, when the automatic vending machine 13 is set in its normal operation mode and a card is inputted, the control unit 11 produces an electric signal 15 to control the light-emitting device 141 for maintaining the intensity of the optical signal received by the light receiving-device at the value equal to the standard value 121 of the light intensity registered with the lookup table 122.

[0010] When the light-emitting device 141 or the light-receiving device 142 suffers hardware fatigue or failure due to long-time operation or exposure to external environment and the intensity of the optical signal received by the light-receiving device 142 fails to maintain at the standard value 121, the automatic vending machine 13 must be set up in a calibration mode for the calibration system 1 to perform calibration. Whereas the surface of the calibration card 10 provides a stable reflection rate to a light with certain wavelength, the intensity of the optical signal received by the light-receiving device 142 in the course of calibration is not affected by the ambient light so to promote calibration accuracy. The control unit 11 adjusts the electric signal 15 to change the intensity of the light with certain wavelength as emitted by the light-emitting device 141. The light receiving-device 142 receives the light reflected from the calibration card 10 and the process unit 16 compares the intensity of the light received by the light-receiving device 142 with the standard value 121 of light intensity. If the intensity of light received matches the standard value 121 of light intensity, the process unit 16 updates the lookup table 121 based on the electric signal 15 by changing the numeric value 123 of the electric signal 121 corresponding to the standard value 121 of light intensity registered with the lookup table 121 to that of the current electric signal 15.

[0011] Now referring to Fig. 2 for a flow chart of steps of the calibration method of the present invention, the calibration method applicable to the calibration system 1 as illustrated in Fig. 1 includes:

Step 20: Set the automatic vending machine 13 in the calibration mode;
Step 21: Input the calibration card 10 to the automatic vending machine 13, and the surface of the calibration card gives a stable reflection rate to the light with certain wavelength;
Step 22: Provide the electric signal 15 to adjust the intensity of the light with certain wavelength as emitted from the light-emitting device 141;
Step 23: Estimate the intensity of light reflected from the calibration card 10 and received by the light-receiving device 142, and judge whether the intensity of light matches the standard value 121 of the light intensity; if yes, go to Step 24; if not, execute Step 22; and
Step 24: Based on the electric signal 15, the lookup table 122 registered with the standard value 121 of light intensity and the numeric value of the electric signal 15 corresponding to the standard value 121 of light intensity is updated.

[0012] Fig. 3 shows a flow chart of steps executed in a preferred embodiment of the calibration method of the present invention. This method is applicable to the calibration system 1 illustrated in Fig. 1 and the lookup table 122 is registered with multiple standard values 121 of light intensity and multiple numeric values 123 of electric signals corresponding to those standard values 121 of light intensity. As illustrated, the calibration method includes:

Step 30: set the automatic vending machine 13 in the calibration mode;
Step 31: Input the calibration card 10 to the automatic vending machine 13, and the surface of the calibration card gives a stable reflection rate to the light with certain wavelength;
Step 32: Select from the lookup table 122 a standard value 121 that is not yet calibrated;
Step 33: Initiate the light-emitting device to such that the intensity of the light with certain wavelength emitted from the light-emitting device 141 is at the lowest grade;
Step 34: Estimate the intensity of light reflected from the calibration card 10 and received by the light-receiving device 142, and judge whether the intensity of light matches the standard value 121 of the light intensity; if not, go to Step 35; if yes, execute Step 36;
Step 35: Adjust the electric signal 15 to promote the intensity of the light with certain wavelength as emit-

ted from the light-emitting device 141 and execute Step 34;
Step 36: Change the numeric value 123 of the selected electric signal corresponding to the standard value of light intensity registered in the lookup table 122 to the numeric value of the current electric signal 15;
Step 37: Judge if each of all the standard values 121 of light intensity registered with the lookup table 122 has been calibrated; if not, go to Step 32; if yes, this flow is ended.

[0013] It is to be noted that the preferred embodiments disclosed in the specification and the accompanying drawings are not limiting the present invention; and that any construction, installation, or characteristics that is same or similar to that of the present invention should fall within the scope of the purposes and claims of the present invention.

Claims

1. A calibration system applied to a card reader installed in an automatic vending machine; the card reader containing a light-emitting device and a light-receiving device; the calibration system including a calibration card with a surface giving stable reflection rate to a light with certain wavelength; a process unit; a control unit providing an electric signal to control the intensity of a light with certain wavelength as emitted from the light-emitting device; and a storage unit storing data of a lookup table registered with one or a plurality of standard value of light intensity and numeric value of an electric signal corresponding to the standard value of light intensity; the automatic vending machine being set in a calibration mode; the calibration card being inputted to the automatic vending machine; the control unit adjusting the electric signal to change the intensity of light with certain wavelength as emitted from the light-emitting device; the light-receiving device receiving the light reflected from the calibration card; the process unit comparing the standard value of light intensity and that of the light received by the light-receiving device; and the process unit updating the lookup table based on the electric signal if the intensity of the light received matches the standard value.

2. A calibration method applied to a card reader installed in an automatic vending machine; the card reader containing a light-emitting device and a light-receiving device; the calibration method including:

(a) Set the automatic vending machine in the calibration mode
(b) Input the calibration card to the automatic vending machine, and the surface of the calibration card gives a stable reflection rate to the light with certain wavelength;
(c) Provide the electric signal to adjust the intensity of the light with certain wavelength as emitted from the light-emitting device;
(d) Estimate the intensity of light reflected from the calibration card and received by the light-receiving device, and judge whether the intensity of light matches the standard value of the light intensity; if yes, go to Step (e); if not, execute Step (c); and
(e) Based on the electric signal, the lookup table registered with the standard value of light intensity and the numeric value of the electric signal corresponding to the standard value of light intensity is updated

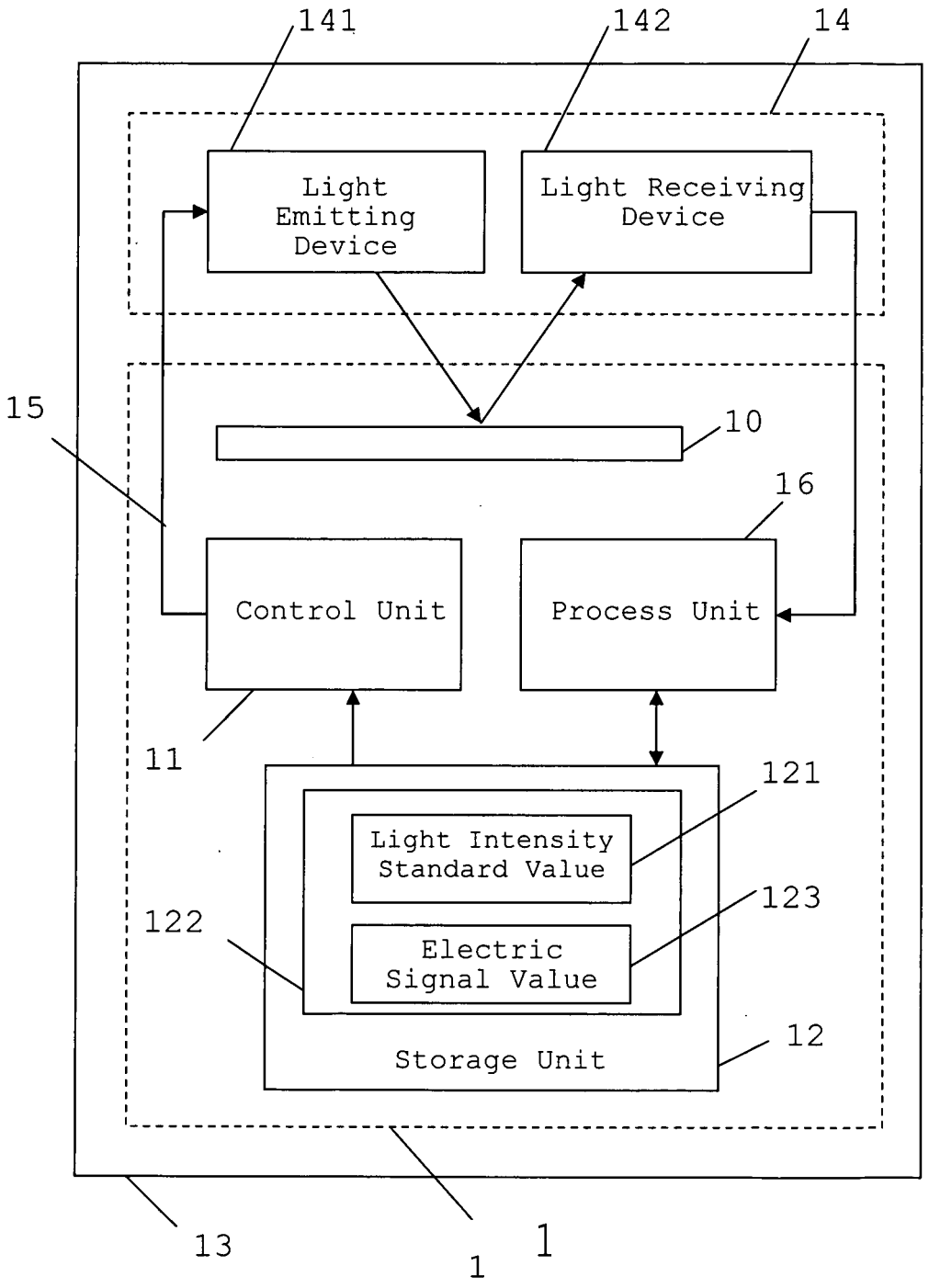
141
142
14
Light Emitting Device
Light Receiving Device
15
10
16
Control Unit
Process Unit
11
121
Light Intensity Standard Value
122
123
Electric Signal Value
12
Storage Unit
13
1
1

Fig. 1

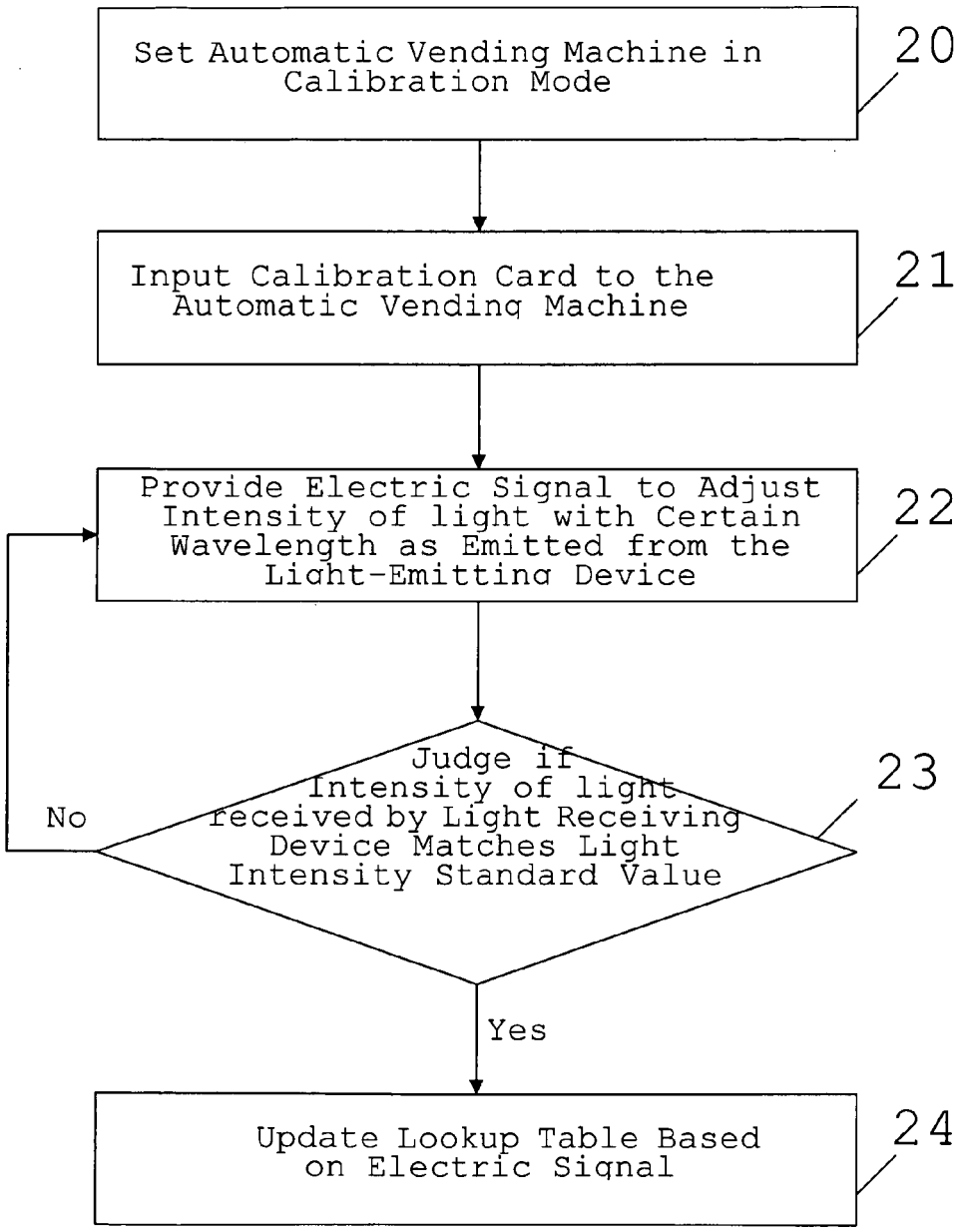
Set Automatic Vending Machine in Calibration Mode
20
Input Calibration Card to the Automatic Vending Machine
21
Provide Electric Signal to Adjust Intensity of light with Certain Wavelength as Emitted from the Light-Emitting Device
22
Judge if Intensity of light received by Light Receiving Device Matches Light Intensity Standard Value
23
No
Yes
Update Lookup Table Based on Electric Signal
24

Fig. 2

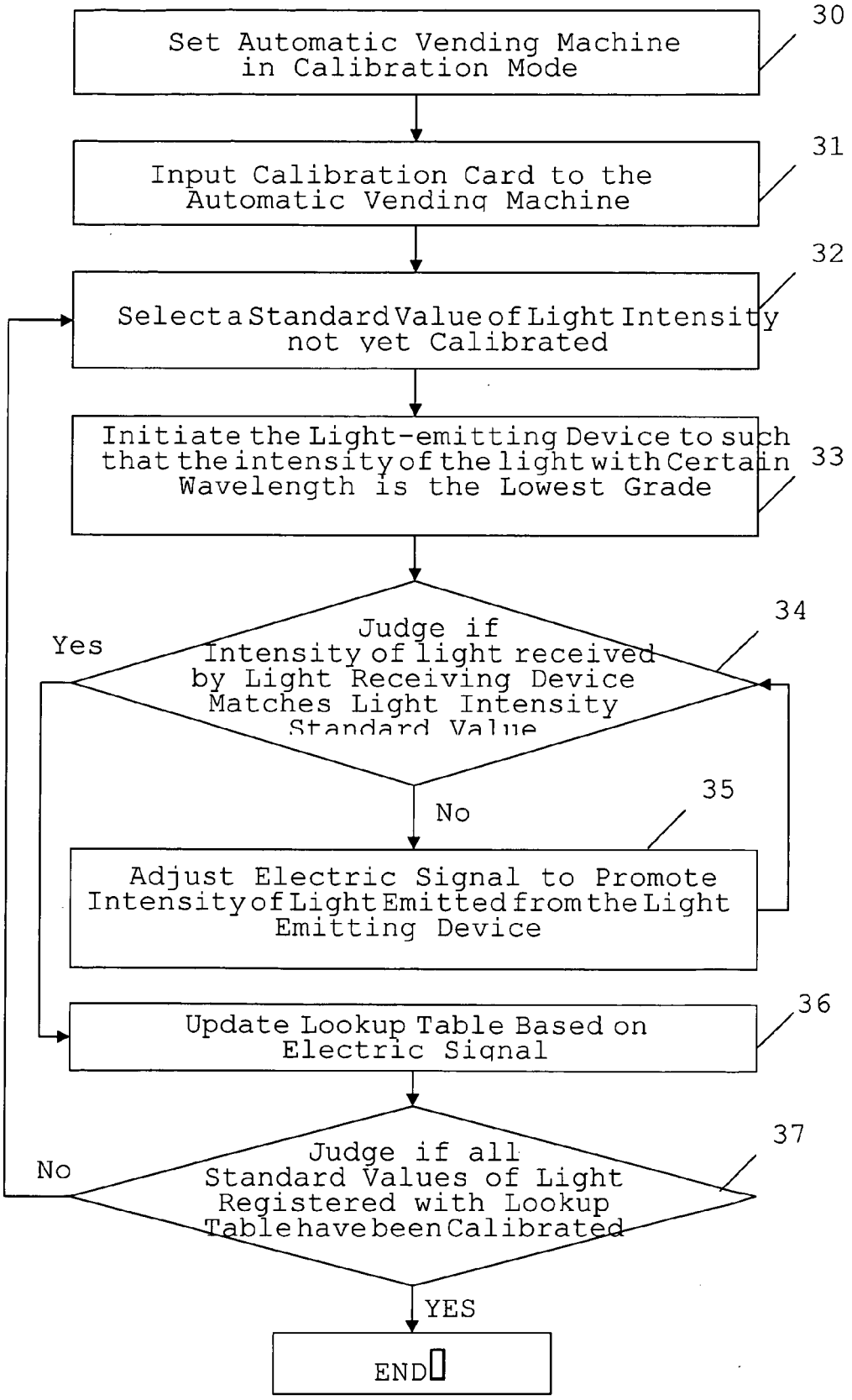
Set Automatic Vending Machine in Calibration Mode
30
Input Calibration Card to the Automatic Vending Machine
31
Select a Standard Value of Light Intensity not yet Calibrated
32
Initiate the Light-emitting Device to such that the intensity of the light with Certain Wavelength is the Lowest Grade
33
Judge if Intensity of light received by Light Receiving Device Matches Light Intensity Standard Value
34
Yes
No
Adjust Electric Signal to Promote Intensity of Light Emitted from the Light Emitting Device
35
Update Lookup Table Based on Electric Signal
36
Judge if all Standard Values of Light Registered with Lookup Table have been Calibrated
37
No
YES
END

Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 00 1674

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2003/044091 A1 (SWANSON MARK R [US] ET AL SWANSON MARK R [US] ET AL) 6 March 2003 (2003-03-06) * abstract; figures 1,2,8-10 * * paragraphs [0007] - [0019], [0033], [0034], [0040], [0044] - [0054] *	1,2	INV. G07F7/08 G06K7/10
Y	US 5 053 612 A (PIELEMEIER WILLIAM J [US] ET AL) 1 October 1991 (1991-10-01) * column 2, lines 45-65 * * column 8, lines 14-28 * * abstract *	1,2	
Y	US 6 119 940 A (KLUG PHILIP D [US]) 19 September 2000 (2000-09-19) * column 2, lines 26-53; figure 2 * * abstract; claims 1-15 *	1,2	
Y	JP 05 081305 A (FUJITSU LTD) 2 April 1993 (1993-04-02) * abstract *	1,2	
			TECHNICAL FIELDS SEARCHED (IPC)
Y	US 5 363 347 A (NGUYEN HAP [US]) 8 November 1994 (1994-11-08) * abstract *	1,2	G06K G07F
A	WO 96/23274 A (MARS INC [US]) 1 August 1996 (1996-08-01) * abstract * * page 3, line 16 - page 8, line 25 * * page 15, line 1 - line 23 *	1,2	
A	US 6 119 071 A (GORENFLO RONALD L [US] ET AL) 12 September 2000 (2000-09-12) * abstract; figures 1,5,6 * * column 3, line 48 - column 5, line 55 * * column 7, line 45 - column 8, line 37 * * claim 1 *	1,2	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 May 2007	Diaz Calvo, Sonia

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 00 1674

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-05-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003044091 A1	06-03-2003	NONE	
US 5053612 A	01-10-1991	NONE	
US 6119940 A	19-09-2000	NONE	
JP 05081305 A	02-04-1993	JP 2621697 B2	18-06-1997
US 5363347 A	08-11-1994	NONE	
WO 9623274 A	01-08-1996	AU 712532 B2	11-11-1999
		AU 4973796 A	14-08-1996
		BR 9607716 A	20-07-1996
		CA 2209191 A1	01-08-1996
		DE 69630201 D1	06-11-2003
		DE 69630201 T2	29-07-2004
		EP 0806018 A1	12-11-1997
		ES 2206563 T3	16-05-2004
		US 6819781 B1	16-11-2004
		US 5889883 A	30-03-1999
US 6119071 A	12-09-2000	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82