

[54] **AUTOMATIC MONEY DISPENSING MACHINE**

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[51] **Int. Cl.**..... **G06m 3/02, G06m 3/10**

[58] **Field of Search**..... 340/146.2; 235/177, 61.7 B,
235/92 CC, 92 PE, 92 SH, 92 CA, 92 SB

[56] **References Cited**

UNITED STATES PATENTS

3,513,441	5/1970	Schwend	235/61.7 B
3,273,122	9/1966	Chandler	235/177 X
3,479,644	11/1969	Spald	340/146.2
3,662,343	5/1972	Goldstein et al.	235/61.7 B X
3,648,020	3/1972	Tateisi et al.	235/61.7 B

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[57] **ABSTRACT**

An automatic money dispensing machine in which data is registered in a storage register comprising a plurality of digits, and the data to be compared with the dispensed money amount is successively divided into unit data or a unit data group by a data selective circuit, the divided unit data or data group being successively compared in a comparator with the counted content of a dispensed money counting circuit, and dispensation of the money is carried out in accordance with results of the comparison in the comparator. Furthermore, a particular automatic carry circuit is provided which shifts the digit in the storage register of the above-mentioned machine in two ways; one causing shifting of the digit when a coincidence signal is issued from the comparator, and the other causing shifting when the first effective numeral of an amount of money registered in the register is at a digit lower than a comparison reference digit designated in the register.

4 Claims, 7 Drawing Figures

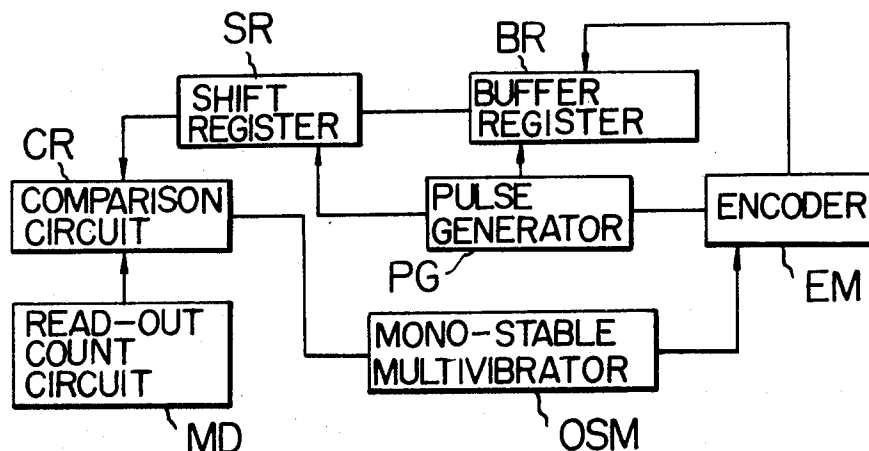


FIG. 1

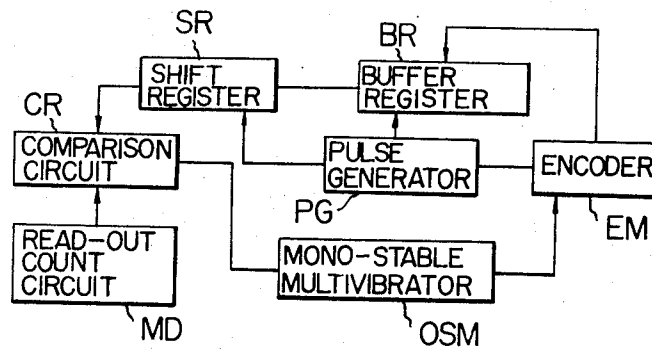


FIG. 2(A)

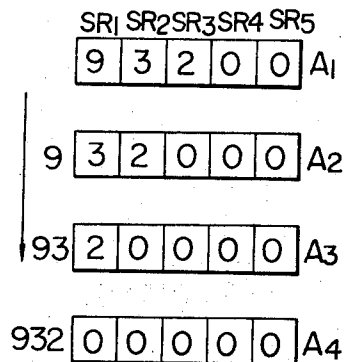


FIG. 2(B)

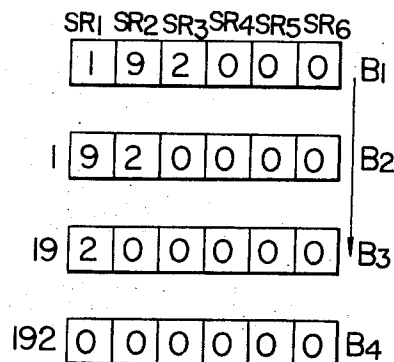


FIG. 4

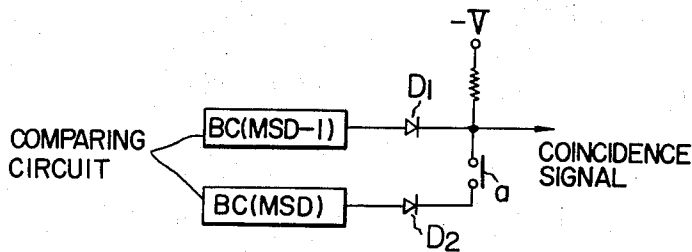


FIG. 3

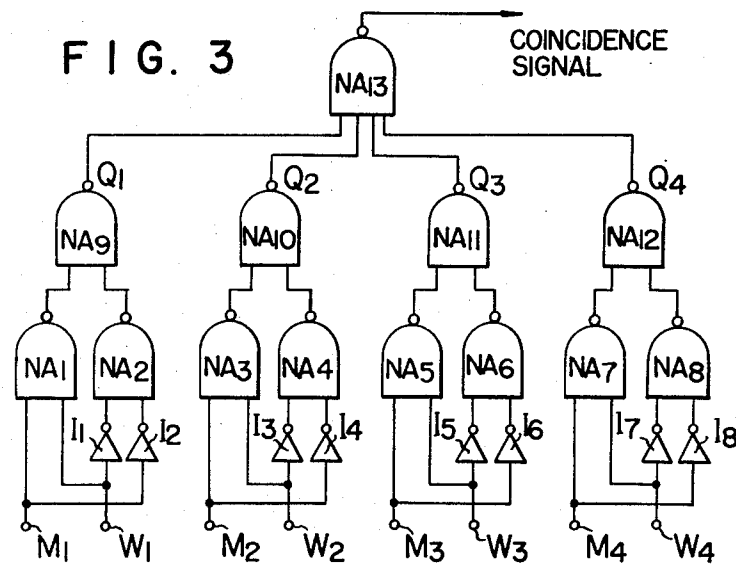


FIG. 5

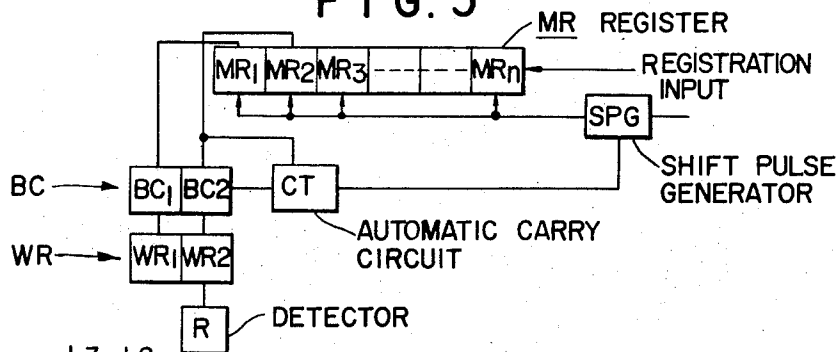
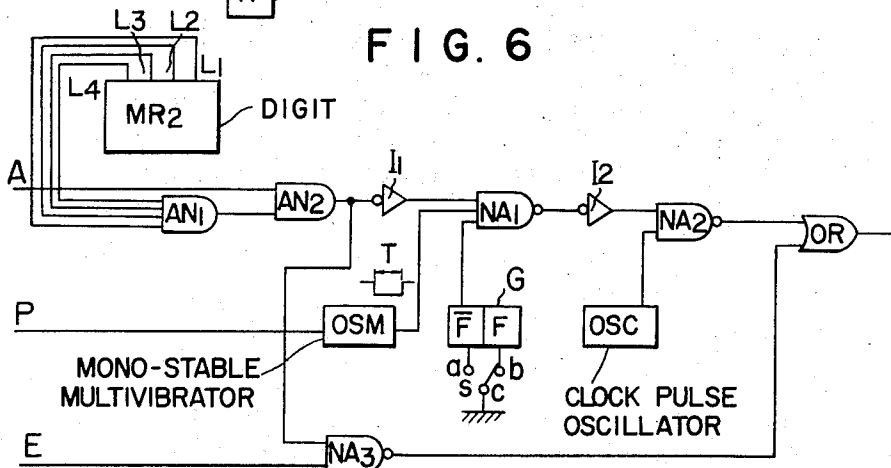


FIG. 6



AUTOMATIC MONEY DISPENSING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to an automatic money dispensing machine adapted to automatically dispense money sheets corresponding to an amount of money to be dispensed out, in which a content stored in a storage register is compared with the amount of the dispensed money, and to a particular carry circuit adapted to shift the digit of the register used in said machine in two different systems.

In general, when an operator depress a 10-key switch of an automatic money dispensing machine thereby to designate a desired or predetermined amount of money to be dispensed, the information representing the amount of money is registered and stored in a storage register. Then, if a start button switch is depressed, a money dispensing operation is carried out. When the amount of dispensed money coincides with the information stored in the storage register, the money dispensing operation ceases. In a money dispensing machine, of the above type a method is employed whereby comparison with respect to all the digits of a shift register is carried out, when an amount of actually dispensed money is compared with information representing the amount of money to be dispensed is stored in the shift register. However, in this method, it is necessary to provide comparator circuits, the number of which is the same as that of the digits, of the shift register and therefore the construction of the money dispensing machine is complicated. The money dispensing machine is able to perform by utilization of one and the same register, both of an operation of dispensing money with a minimum number of sheets i.e., (in which a predetermined amount of money is dispensed out by combination of a minimum number of sheets thereof, and an operation of dispensing money separately according to monetary kinds i.e., in which a predetermined amount of money is dispensed with a desired monetary kind). However, in such a money dispensing machine, the amount of dispensed money is compared with the content in the memory register, memory, however the amount of money dispensed is compared with a necessary and minimum number of digits instead of all the digits in the register thereby to dispense out the money. In other words, such a money dispensing machine carries out comparison and detection for every monetary kind corresponding to the predetermined amount of money, and when the comparison and detection of a monetary kind with a particular digit is completed, the memory is shifted thereby to conduct comparison and detection with respect to the following digit.

SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide an automatic money dispensing machine in which the amount of money to be dispensed is not compared with all the digits in a storage register, but a comparator is provided for only the digit of minimum number, whereby the content in the storage register is compared with the number of the dispensed sheets.

Another object of the present invention is to provide an automatic money dispensing machine which is simple in construction, and in which the number of com-

parison circuits employed to compare the content stored in a storage register with the number of sheets of dispensed money is much reduced.

A further object of the present invention is to provide a circuit which produces a shift instruction signal adapted to successively shift to a higher digit an amount of money to be dispensed which is registered in the register of a money dispensing machine.

A still further object of the present invention is to provide an automatic carry circuit which serves to effectively dispense money by the provision of two systems in the shift instruction issued to the shift register to an automatic money dispensing machine, one of the two systems being the case where a shifting operation is carried out by a coincidence signal furnished from a comparator, the other is the case where the shifting operation is carried out when an effective numerical figure of an amount of money registered in the shift register is at a digit lower than its comparison reference digit.

The nature, utility and principle of the present invention will be more clearly understood from the following detailed description when read with reference to the accompanying drawings:

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawings:

FIG. 1 is a block diagram of an automatic money dispensing machine according to the present invention;

FIGS. 2(A) and 2(B) are diagrams illustrating variation of the content stored in the storage register shown in FIG. 1 with lapse of time;

FIG. 3 is a schematic circuit diagram showing an example of the comparison circuit;

FIG. 4 is also a block diagram showing a comparison circuit adapted to make comparison on a plurality of digits at the same time;

FIG. 5 is a block diagram of a money dispenser used in the present invention; and

FIG. 6 is a diagram presenting an embodiment of the automatic carry circuit according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIG. 1, information fed to an encoder EM by an operator is encoded therein, and the encoded information is then led to a buffer register BR, and registered as the least significant digit of a shift register SR. The secondarily fed information is also registered in the shift register SR in the same manner as described above; however at the same time the information registered initially is shifted one digit higher and the secondary information is registered as the least significant digit of the register. Similarly, further information fed to the encoder is registered in the shift register as described. The shifting operations are accomplished with the aid of shift pulses issued from a pulse generator PG.

If the operator then depresses or closes a start switch (not shown), when the most significant digit of the storage register is not "0," money of a monetary kind with respect to the most significant digit is dispensed and the number of sheets of the money thus dispensed is read out and counted by a read-out count circuit MD. When a value thus counted coincides with the content on the most significant digit of the shift register SR, a coincidence signal is produced, whereby money of a money-

tary kind on the next digit is dispensed. At the same time, the content in the register is shifted one digit higher by the coincidence signal. Hence when the content of the most significant digit of the register is "0" at the beginning of the operation, a coincidence signal is immediately issued from the comparison circuit CR, whereby the same operation as described above is carried out.

As described above, the operations of dispensing money of predetermined monetary kinds are successively carried out from the most significant digit.

With reference now to FIG. 2, a series of operations described above are explained by presentation of the variation in the contents stored in the shift register. FIG. 2(A) is an example where 93,200 yen is registered in the shift register at the beginning of the operation, while FIG. 2(B) is another example where 192,000 yen is registered in the shift register.

Referring to FIG. 2(A), when 93,200 yen is registered first as shown in column A₁ and nine sheets of 10,000-yen paper money are then dispensed, the content in the shift register will be as shown in column A₂. Next, when three sheets of 1,000-yen paper money are dispensed, the content in the shift register is similarly shifted one digit higher, as shown in column A₃. In the same way, the content is shifted one digit higher upon dispensing two sheets of 100-yen paper money. As a result, all the digits of the shift register become "0" as shown in column A₄ and the money dispensing operation is completed. In this case, the most significant digit SR₁ of the register is regarded as a comparison reference digit throughout the money-dispensing operation.

FIG. 2(B) shows another example, where first the most significant digit SR₁ and the next digit SR₂ are used as comparison reference digits, and after that the next digit SR₂ is used as a comparison reference digit.

Registered in the register SR is 192,000 yen, and applied to the comparison circuit CR are the contents on digits SR₁ and SR₂ in the register SR. Therefore, 19 sheets of 10,000-yen paper money are dispensed, a coincidence signal is issued from the comparison circuit, and the content in the shift register SR is shifted one digit higher as shown in column B₂. In this case, the comparison circuit is provided with circuit sections adapted to compare, respectively, one of two kinds of digits as described later. The comparison circuits are constructed so that a comparison circuit section adapted to compare the two digits SR₁, SR₂ operates in the case of 10,000-yen and only a comparison circuit section corresponding to the digit SR₂ operates in the case of 1,000-yen or less. Therefore, after the above-mentioned dispensation of 19 sheets of 10,000 yen, only the digit SR₂ becomes the reference digit for comparison, and when two sheets of 1,000-yen paper money are dispensed out and a coincidence signal is issued from the comparison circuit, the content in the shift register SR is shifted as shown in column B₃. Since the reference digit SR₂ is now "0", money is no longer dispensed.

Since binary coded decimal information is stored on each digit in the shift register SR, the system of four bits per digit is employed therein. Also, the four bits per digit is employed for the read-out count circuit.

Shown in FIG. 3 is one example of the comparison circuit, in which outputs of all the bits corresponding

to the comparison reference digits in the shift register SR are applied to input terminals M₁ to M₄, while outputs of all the bits in the read-out count circuit MD are applied to terminals W₁ to W₄. The comparison circuit comprises NAND circuits NA₁ to NA₁₃ and inverters I₁ to I₈. Therefore, when all the bits coincide with one another, the output of the NAND circuit NA₁₃ becomes low in level and this low level output becomes a coincidence signal for a single digit.

It is necessary to provide a switching means in order that digits SR₁ and SR₂ are first used as the comparison reference digits thereby to compare the two high adjacent digits one of which is the most significant digit and then the digit SR₂ is used as the comparison reference digit. A circuit composition for this purpose is shown in FIG. 4, which comprises diodes D₁ and D₂ which form an AND circuit, comparison circuit sections BC(MSD-1) and BC(MSD) corresponding respectively to the digits SR₂ and SR₁, and a contact means *a* which is a make-contact of a relay provided for a money dispensing drive circuit (not shown). This relay is energized only when money of, for instance, a 10,000-yen monetary unit is dispensed, and at only this time the contact *a* is closed, and furthermore only when AND conditions of the comparison circuit section for two digits are established, a coincidence signal is issued. After the operation of dispensing 10,000-yen paper money has been completed with the result of the opening said contact *a*, the comparison circuit section MSD is disconnected, as a result of which only the comparison circuit section MSD-1 continues operation.

Although, in the above-mentioned embodiment, the number of digits for dispensing money is five or six, the number of digits can be increased as required. Furthermore, in the same embodiment, only the circuit section MSD or both the circuit sections MSD and MSD-1 are used for the comparison reference digit, however the number of the digits can be increased as required. For instance, if digits from the highest digit up to the third digit are used, money up to 9,990,000-yen can be dispensed out.

With reference now to a block diagram of FIG. 5, a carrying circuit adapted to carry the digit in the register used in the money dispensing machine according to the present invention will be outlined below.

An amount of money to be dispensed is registered in a shift register MR by means of a 10-key (which has 10 keys "0" to "9") or a paper tape reader. In such a shift-register, there are a number of digits from the most significant digit MR₁ to the least significant digit MR_n. For instance, a register for money to be dispensed out in 10,000-yen paper money is provided with the most significant digit MR₁ and the next digit MR₂, a register for 5,000-yen and 1,000-yen paper money is similarly provided with the digit MR₃, and a register for 500-yen paper money is also provided with the digit MR₄. Reference symbol R is a dispensed money detector. The detector R detects the money dispensed and produces a pulse signal representative thereof. The pulse signal from the detector R is fed to a dispensed money counter WR which counts the amount of dispensed money. The digits of the counter WR are composed of decimal two digits WR₁ and WR₂. The digits WR₁ and WR₂ correspond to the most significant digit MR₁ and the next digit MR₂ in the shift register MR, respectively. A comparator means BC comprises two comparators BC₁ and BC₂. The comparator BC₁ makes a com-

parison between the content on the digit MR_1 in the shift register MR and that on the digit WR_1 of the dispensed money counter WR, while the other comparator BC_2 makes a comparison between the content on the digit MR_2 and that on the digit WR_2 . When the content in the shift register MR coincides with that in the counter WR, the comparator BC feeds a coincidence signal to an automatic carry circuit CT. This carry circuit CT supplies a carry signal to a shift pulse generator SPG when the circuit CT receives a coincidence signal from the comparator BC or when the digit MR_2 in the shift register MR becomes "0." The shift pulse generator SPG, produces a shift pulse signal thereby to shift the digits of the shift register.

The operation of the money dispensing machine as described above will be explained below: There are two methods for dispensing money: the first method dispenses money with a minimum number of sheets thereof that is, a method of dispensing a predetermined amount of money with a combination of a minimum number of sheets; for instance, when 198,500-yen is to be dispensed, the combination is 19 sheets of 10,000-yen paper money, a sheet of 5,000-yen paper money, three sheets of 1,000-yen paper money and a sheet of 500-yen paper money and the second method dispenses money separately according to monetary kinds (that is, a method of dispensing the money of a specific monetary kind with a desired number of sheets).

The former method will be explained first. In the case when the predetermined amount of money is 198,500 yen, an amount of money, namely, 190,000 yen to be dispensed out in 10,000-yen paper money is registered on the digits MR_1 and MR_2 in the shift register MR. Upon commencement of dispensing 10,000-yen paper money, the dispensed money is detected by the detector R and the number of dispensed sheets thereof is counted by the dispensed money counter WR. When the content in the counter WR coincides with the content on the digits MR_1 and MR_2 which are digits adjacent to each other and including the most significant digit of the shift register MR, the operation of dispensing 10,000-yen paper money ceases. At the same time, a coincidence signal is fed to the automatic carry circuit CT from the comparator BC thereby to operate the shift pulse generator SPG, whereby the content in the shift register MR is shifted one digit higher. Hence, "9" and "8" are registered as the digits in MR_1 and MR_2 , respectively, and further comparison and counting operations are effected with respect to only the digit MR_2 . In addition, when the content in the shift register MR is shifted one digit higher, the detector R is reset. As a result, the registered number "8" shifted to the digit position MR_2 is subjected to comparison and counting operation as described above, and when the predetermined number of sheets of 1,000-yen paper money (including 5,000-yen paper money) are dispensed out, the content of the shift register MR is further shifted one digit higher. Now, 500-yen paper money corresponding to a registered number newly shifted to MR_2 in the shift register is dispensed through the same process as mentioned above. Thus, in the method of dispensing money with a minimum number of sheets thereof, a registered number which is shifted to a specific digit position in the shift register MR is subjected to comparison and counting operation and money corresponding to a total amount of money set therein is dispensed. In the money dispensing machine

operating to dispense money with a minimum number of sheets, when the high digit (990,000 yen is the highest amount of money in the register MR shown in FIG. 5) is not registered in the case of registering an amount of money to be dispensed in the register MR, or when for instance only 500 yen is registered therein, the register MR is registered to display "0005000" beginning from its most significant digit. In this case a registered number "5" should be shifted to the digit position MR_2 of the shift register MR at the same time as a money-dispensing instruction is issued.

However, when the money dispensing machine operates to dispense money separately according to monetary kinds, an amount of money of a predetermined specific monetary kind is dispensed, for instance, six sheets of 1,000-yen paper money may be dispensed for a required total amount of 6,000 yen. The comparison and counting operation with respect to the digit MR_2 of the register MR is carried out in the same manner as described in the method of dispensing money with a minimum number of sheets. In this case also, since "006000" is registered in the shift register MR, a registered number "6" should be shifted to the digit position MR_2 at the same time as a money dispensing instruction is issued.

The automatic carry circuit, according to the present invention, when it is used in the money-dispensing machine used for both money dispensing methods described above, automatically carries out two operations of shifting the content in the register; in one operation the content in the register is shifted by a coincidence signal produced from the comparator BC for every monetary kind included in a predetermined amount of money, and in the other operation a content is shifted register in the when "0" is registered on a digit subjected to the comparison and counting operation.

With reference now to FIG. 6, the automatic carry circuit, of the instant invention is shown which comprises: the digit MR_2 of the shift register which is the second digit from the most significant digit of the register MR; AND gates AN_1 and AN_2 in which a low potential L is logic "1," inverters I_1 and I_2 , an OR gate OR in which a low potential L is logic "1," NAND gates NA_1 and NA_2 in which a high potential H is logic "1," a mono-stable multi-vibrator OSM using a side which is H in its output level when no signal is applied thereto, a flip-flop G, a clock pulse oscillator OSC, a NAND gate NA_3 in which a high potential H is logic "1," and a contact means S in which terminals c and a are connected by a pole when an instruction of starting a money dispensing operation is issued and terminals c and b are connected by the pole when the money dispensing operation is completed. A terminal E is connected to an output terminal of the comparator BC and obtains a high potential H when a coincidence signal is issued. A terminal A assumes a high potential H when 10,000-yen paper money is dispensed. When a shift pulse for carry arrives at terminal P, the mono-stable multi-vibrator OSM is triggered by the first building-up of the shift pulse and produces an output pulse of a low potential L. At this time, a time width T of an output wave form of the mono-stable multi-vibrator OSM is selected so as to be sufficient for shifting an amount of money registered in the register MR one digit higher. Reference symbols L_1 to L_4 designate outputs from the digit MR_2 in the shift register MR, respectively and run from terminals on the low potential

sides of all the bits of the digit MR_2 , said terminals being of low potential when the circuit is reset.

In the circuit shown in FIG. 6, when the memorized content in the shift register MR and that in the dispensed money counter WR coincide (except "0"), the shift pulse generator SPG is triggered by an output at the terminal E. When there is "0" before the first effective numeral of an amount of money registered in the shift register MR, the shift pulse generator SPG is triggered by an output of the NAND gate NA_2 , as a result the first effective numeral of the amount of money is shifted to the digit MR_2 . The reason why the shift instruction composed of two systems is provided is as follows. The shifting operation can be made only by the output signal from the terminal E if the content in the register is shifted every one digit; however if there are several digits of "0" in the digits which are higher than those of the first effective numeral, the content in the register must be continuously shifted to the digit position MR_2 . At the same time, it is required to provide a delay time period between the one-digit shifting operations in order to stabilize the shifting operation of the shift register MR, but which cannot be accomplished by only the output signal from the terminal E. In addition, the terminal A is provided for the following reason. When an amount of money, for instance, 108,500 yen is registered in the shift register MR, it is obvious that the digit position MR_2 registers "0". In this case, the shifting operation of the shift register must be prohibited. This is the reason why the terminal A is provided therein.

Now, the operation of the automatic carry circuit according to the present invention will be described below:

In the case when the amount of money required is, for instance, 500 yen; the content in the shift register MR is "000500" beginning from the most significant digit, which means that "0" is registered in the digit position MR_2 of the shift register MR. Therefore, all the outputs L_1 to L_4 of the digit MR_2 assume low potentials L. Hence, the output of the AND gate AN_1 is L and the signal at the terminal A is also L. Accordingly, the output of the AND gate AN_2 is L, and the output of the inverter I_1 becomes H. At the same time, the dispensed money counter WR is in the state of reset, and therefore the signal at the terminal E is H. However, because the output of the AND gate AN_2 is L, the output of the NAND gate NA_3 becomes H. Accordingly, the output of the NAND gate NA_3 cannot be a shift instruction signal. The output of the mono-stable multi-vibrator OSM is H when no signal is applied thereto. Under this condition, when a money dispensing start signal, is received the contact means S is switched over to the side a whereby the side $\bar{F}$ of the flip-flop G becomes H. As a result three inputs of the NAND gate NA_1 become H, the output of the NAND gate NA_1 becomes L, and therefore the output of the inverter I_2 becomes H. Accordingly, one of the inputs of the NAND gate NA_2 becomes H, whereby a clock pulse from the clock pulse oscillator OSC flows through the gate NA_2 . The clock pulse further passes through the gate OR and becomes a shift instruction signal thereby to generate a shift pulse. The mono-stable multi-vibrator OSM is triggered by the first building-down of the shift pulse, whereby the output pulse signal of a low potential L is produced from the multi-vibrator OSM and is applied to the NAND gate NA_1 . As a result, the output of the NAND

gate NA_1 becomes H, and therefore the output of the inverter I_2 becomes L, whereby the NAND gate NA_2 prohibits the passage of the clock pulse issued from the clock pulse oscillator OSC. In other words, only one pulse of the clock pulse signal is produced as a shift instruction. (In this case, the clock pulse signal is made sufficiently greater than the shift pulse signal.) The time width of the output pulse from the clock pulse oscillator OSC is such that the shift register MR is able to shift one digit. Therefore, under the conditions that a one-digit shifting operation has been carried out and the shift register MR is stabilized, the output of the mono-stable multi-vibrator OSM reverts to H. In this case, if there is still "0" registered on the digit MR_2 , the one-digit shifting operation is again effected through the same process as described above. The shifting operation is continued until an effective numeral appears on the digit MR_2 in the shift register MR. Furthermore, when the content on the digit MR_2 of the shift register MR and that on the digit WR_2 of the dispensed money counter WR are coincident with exception of "0," the output at the terminal E becomes H. In this state, since the outputs of the AND gates AN_1 and AN_2 are H, both inputs of the NAND gate NA_3 become H. As a result, the output of the NAND gate NA_3 becomes L and the one-digit shifting operation is carried out. As described before, when the predetermined amount of money is 108,000 yen, for instance, "0" is registered on the digit MR_2 ; however, in this case a signal at the terminal A becomes H, whereby the output of the inverter I_1 becomes L and the shifting instruction is not issued.

We claim:

1. An automatic money dispensing machine for automatically dispensing a desired monetary quantity said machine comprising:

data input means receptively operable to data fed thereto, which data is composed of a combination of individual digits numerically representing the monetary quantity to be dispensed;

storage means operably connected to said data input means and having a plurality of individual storage positions the number of which at least corresponds to the number of digits in said monetary quantity, for consecutively storing respective ones of said individual digits in numerical order beginning with the most significant digit of said monetary quantity and ending with the least significant digit thereof;

money dispensing means operatively associated with said storage means for dispensing individual groups of monetary quantities the sum of which equals the monetary quantity stored in said storage means, the highest significant digit of each of said individual groups of monetary quantities corresponding to successive digits of said monetary quantity commencing with the highest significant digit thereof;

counting means operatively associated with said money dispensing means for counting each of said individual groups of monetary quantities dispensed therefrom;

selecting means operatively associated with said storage means for successively operatively selecting each individual digit stored in said storage positions;

comparator means operatively associated with said storage means, said counting means and said se-

lecting means for comparing the highest significant digit of consecutive respective dispensed ones of said individual groups of monetary quantities with respective consecutively selected ones of said digits stored in said storage means and selected by said selecting means beginning with the highest significant digit thereof, whereby said monetary quantity is dispensed from said machine in said individual groups of monetary quantities.

2. An automatic money dispensing machine as claimed in claim 1 wherein said comparator means has output signal producing means which delivers an output signal when a respective highest significant digit of one of said groups of individual monetary quantity counted by said counting means coincides with a corresponding respective one of said digits selected by said selecting means, said output signal being applied to said selecting means whereby said selecting means selects the digit numerically following said corresponding respective one of said digits in said storage means.

3. An automatic dispensing machine as claimed in

claim 2 wherein said storage means is a shift register which comprises said plurality of storage units and said selecting means is a shift circuit which operates to cause a particular one of the digits in said storage means to shift to the next higher storage position thereof when the digit in that higher position coincides with the highest significant digit of a respective one of said individual groups of monetary quantities being counted by said counting means.

4. An automatic money dispensing machine as claimed in claim 3, in which the most significant digit and, at least the following digit in said storage means are employed as comparison reference digits, the first comparison with a respective highest significant digit of one of said groups of individual monetary quantities being dispensed, being effected with respect to all the comparison reference digits, the following comparison being effected with respect to the least significant digit only of said comparison reference digits.

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