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D-81245 München (DE)**(54) **Medium processing apparatus for collectively outputting a plurality of mediums.**

(57) A medium processing apparatus for reading first information on a first medium and second information representative of a balance level on a second mediums, the apparatus comprises a device (18) for simultaneously receiving and returning the first medium and the second medium, a device (27) for transporting the first medium and the second medium received the receiving and returning device (18), a device (22) for reading the first information and the second information on the first and second mediums transported by the transporting device (27), control device (70) for calculating a value level in response to the first information and reducing the

balance level in response to the value level calculated by the control device (70), device (38) for recording the reduced the balance level reduced by the control device (70) on the second medium, device (20) for accumulating the first medium and the second medium recorded by the recording device (38), and device (24) for regulating the transporting device to transport the first medium and the second medium to the reading device separately and allowing the first medium and second medium accumulated by the accumulating device (20) simultaneously returning to the receiving and returning device (18).

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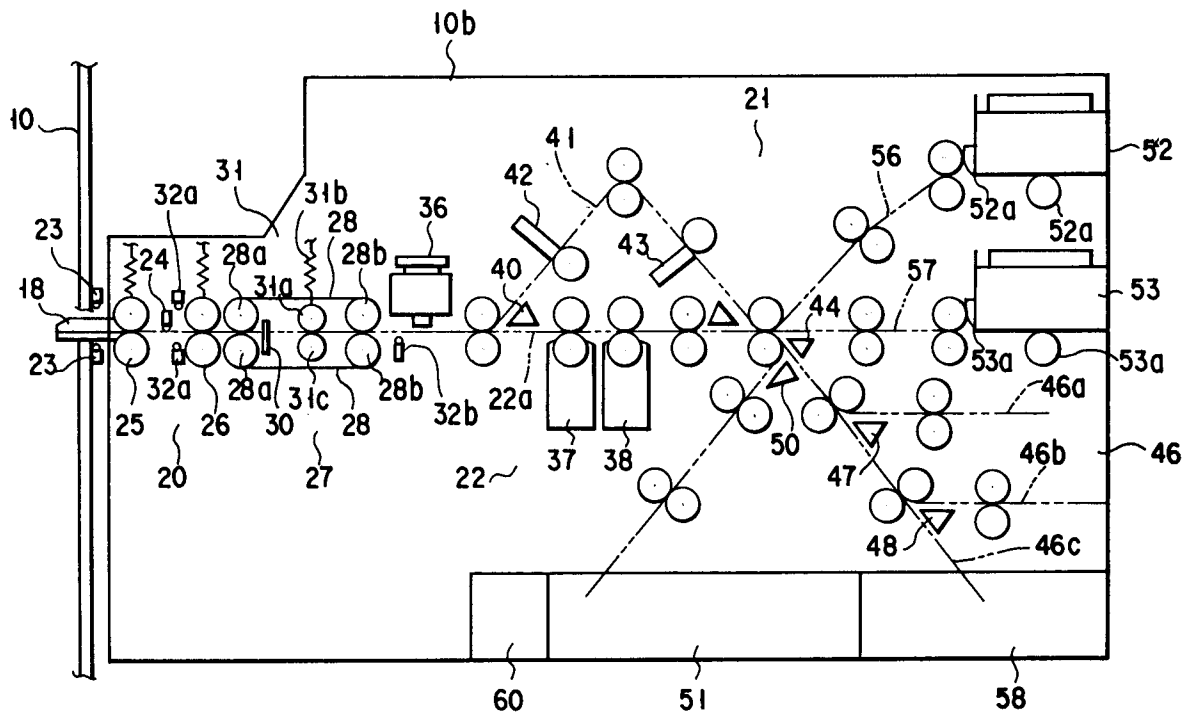


FIG. 2

The present invention relates to an improved card processing device and an automatic fare adjustment device incorporated in an automatic fare adjustment machine or an automatic ticket vending machine to efficiently processing card-like tickets.

In recent years, season ticket printing and issuing machines, automatic ticket vending machines, and automatic fare adjustment machines have been developed to save labor in stations of traffic facilities. In the case of such machines, operating of various devices is performed by means of a normal passenger-ticket, a season ticket, or a money card such as a prepaid card, on which relevant data are magnetically recorded, thereby decreasing the work load of station employees, or resulting in a reduction or elimination of labor.

As a shown in TOKKAIHEI 1-173277, when a plurality of cards such as season tickets or money cards are inserted into or discharged from conventional labor-saving ticket processing machines, they can only be inserted one at a time, and discharged accumulated a plurality of cards at a time.

Because of this, operation at the opening portion of conventional ticket processing machines can be time-consuming, causing inconvenient when many customers wish to use the machines.

An object of the present invention is to provide a card processing machine which can issue a plurality of card-like tickets simultaneously, thereby reducing the ticket-discharge time and thus reducing the possibility of customers forgetting to take all tickets discharged.

According to the present invention, there is provided a medium processing apparatus for reading first information on a first medium and second information representative of a balance level on a second mediums, the apparatus comprising: means for simultaneously receiving and returning the first medium and the second medium; means for transporting the first medium and the second medium received the receiving and returning means; means for reading the first information and the second information on the first and second mediums transported by the transporting means; control device for calculating a value level in response to the first information and reducing the balance level in response to the value level calculated by the control device; means for recording the reduced the balance level reduced by the control device on the second medium; means for accumulating the first medium and the second medium recorded by the recording means; and means for regulating the transporting means to transport the first medium and the second medium to the reading means separately and allowing the first medium and second medium accumulated by the accumulating means simultaneously returning to the receiving and returning means.

The processing apparatus of the present invention processes a predetermined number of mediums as following. At mediums inserting, this apparatus receives them one by one. However, at discharging, the apparatus accumulates the mediums, and discharges them collectively, not one by one. As a result, the time required to discharge the mediums is greatly reduced, thereby avoiding inconvenience to customers.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view showing the external appearance of an automatic fare adjustment machine according to an embodiment of the present invention;

Fig. 2 is a schematic diagram showing the internal structure of the automatic fare adjustment machine of the embodiment;

Fig. 3 is a block diagram showing a control system of the automatic fare adjustment machine of the embodiment;

Fig. 4 is a diagram depicting a card receiving operation of the gate mechanism of the embodiment;

Fig. 5 is a diagram depicting a card discharging operation of the gate mechanism of the embodiment;

Fig. 6 is a diagram depicting a card accumulating operation in an accumulating section of the gate mechanism of the embodiment; and

Fig. 7 is a flowchart showing an operation of the embodiment.

An embodiment of the present invention will be described with reference to Figs. 1 to 5.

Fig. 1 schematically shows the external appearance of a card processing apparatus, e.g., an automatic fare adjustment machine 10. The automatic fare adjustment machine 10 comprises a cash processing mechanism 10a for processing coins and banknotes and a card processing mechanism 10b for processing a card 17 such as a season ticket 17a and a prepaid card 17b, i.e. a money card.

The automatic fare adjustment apparatus 10 has, in its front surface portion, a service section 13 including a display section 11 for displaying information of an amount of shortage and operational instructions, and an operation section 12 having operation keys 12a for inputting a route or a junction and instructions to issue a new prepaid card. The apparatus 10 has, under the operation section 12, a coin inserting port 14, a banknote inserting port 16, and an opening 18 for receiving and discharging a normal passenger-ticket (not shown) and a card 17 such as a season ticket 17a or a prepaid card 17b.

Relevant data or a picture is printed on the front surface of the card 17. In a case where the card 17 is a normal passenger-ticket, the issue station, the issue date, the fare, and the like are recorded on the rear surface of the card which is coated with magnetic film. In the case of a season ticket 17a, the designated section, the available period, the sex, the age, and the like are recorded. In the case of a prepaid card 17b, the balance converted to a binary code is magnetically recorded.

The structure of the card processing mechanism 10b incorporated in the automatic fare adjustment machine 10 for processing cards 17 will now be described in detail.

As shown in Fig. 2, the card processing mechanism 10b includes transfer means 22 for transferring cards 17 inserted through the opening 18 to card processing means 21 via gate means 20 and returning it to the opening 18.

The gate means 20 is provided at a portion of a transfer path 22a, adjacent to the opening 18. It receives the cards 17 inserted through the opening 18 and transfers them to the card processing means 21 or discharges the cards 17 supplied from the card processing means 21 to the opening 18. For this purpose, as shown in Figs. 4 and 5, the gate means 20 includes a fetch sensor 23 arranged in proximity to the opening 18 to detect insertion of a card. The gate means 20 also includes a lever 24 serving as restricting means, which is arranged on the transfer path 22a with a gap corresponding to the thickness of a piece of card. The lever 24 is rotatable in a direction indicated by an arrow s, although prevented from rotating in a direction indicated by an arrow t.

First and second pinch roller pairs 25 and 26, rotatable forward and backward, are respectively arranged in front and rear of the lever 24. Upper rollers 25a and 26a of the first and second rollers 25 and 26 are normally pressed against lower rollers 25c and 26c by first and second springs 25b and 26b. However, the upper rollers 25a and 26a can be moved up by the springs 25b and 26b in accordance with the number of the cards 17 which pass through the transfer path 22a.

When the first and second pinch rollers 25 and 26 are rotated in the forward direction, i.e., when cards 17 are taken into the machine through the opening 18, only the lower rollers 25c and 26c are driven, while the upper rollers 25a and 25b are maintained in a neutral state. On the other hand, when the pinch rollers 25 and 26 are rotated in the backward direction, i.e., when cards are discharged through the opening 18, the upper and lower rollers 25a, 25c, 26a, and 26c are rotated so as to pinch the cards until they are discharged. An accumulating section 27 wherein the cards 17 are accu-

mulated is formed between the second pinch rollers 26 and the card processing means 21.

The accumulating section 27 includes first and second pulleys 28a and 28b and a pair of transfer belts 28 which are put on the pulleys 28a and 28b. It also includes a stopper 30 which is moved up and down by a driver means 30a so as to project in the transfer path 22a in order to temporarily stop the cards 17. It further includes a pair of third pinch rollers 31 rotatable forward and backward. An upper roller 31a of the third pinch rollers 31 is normally pressed against a lower roller 31c by a third spring 31b, but can be moved up by the spring 31b in accordance with the number of the cards 17 accumulated in the accumulating section 27. A sensor 32b counts the number of cards which are being accumulated.

A sensor 32a detects the front and the rear ends of the cards 17. The detection result is input to an calculating section 70a of a control device 70 (to be described later), in which the length of the cards 17 is detected and the number of cards passed by is counted.

The card processing means 21 includes, along the transfer path 22a, a punch device 36 for punching a hole in a card to indicate rough balance and first and second read/write magnetic heads 37 and 38 for reading data recorded on the cards 17 and writing an amount of money thereon.

First and second thermal print heads 42 and 43 for printing balance on a prepaid card are arranged along a branch transfer path 41 branching from the transfer path 22a at a first branching gate 40.

A second branching gate 44 guides the cards 17 to a card reservation section 46. Third and fourth gates 47 and 48 guide the cards 17 supplied through the transfer path 22a to one of first to third card reservation portions 46a to 46c. All rollers 49 in the transfer path 22a and the branch transfer path 41 extending from the punch device 36 to the third card reservation portion 46c are rotatable forward and backward.

A fifth gate 50 guides a normal passenger-ticket (not shown) to a card collecting portion 51.

First and second card hoppers 52 and 53 store unused cards 54 to be issued as new prepaid cards. First and second take-out rollers 52b and 53b take out cards 54 from bottom portions 52a and 53b of the first and second card hoppers 52 and 53, and supply them to first and second supply paths 56 and 57.

A card collecting portion 58 collects invalid cards such as a season ticket which has passed the time limit, a prepaid card which has been used up, or a new prepaid card 54 on which incorrect data is written or printed. Punch chips produced in the punch device 36 are collected in a chip collecting portion 60.

The cash processing mechanism 10a includes a sensor 62 for judging whether a coin or a banknote is counterfeit and a discriminator 63 for discriminating the type of a coin or banknote, which are arranged in coin and banknote transfer paths (not shown).

The automatic fare adjustment machine 10 comprises a control device 70 which controls the entire operation of the machine and which has a calculating section (not shown). The calculating section calculates an amount to be adjusted on the basis of data read by the first and second read/write magnetic heads 37 and 38 from the normal passenger-ticket or the season ticket 17a. Subsequently, it calculates a balance on the prepaid card 17b or an adjusted amount from data on an amount of money inserted through the coin inserting port 14 or the banknote inserting port 16, judged by the sensor 62 of the cash processing mechanism 10a and discriminated by the discriminator 63.

Fig. 3 is a block diagram showing the control system of the automatic fare adjustment machine 10. The control device 70 of the automatic fare adjustment machine 10 is connected through an input interface 71 to operation keys 12a, a fetch sensor 23, discriminating sensors 32a and 32b, and the sensor 62 and the discriminator 63 of the cash processing mechanism 10a.

The control device 70 is also connected through an input/output interface 72 to first and second read/write magnetic heads 37 and 38 which are controlled by first and second magnetic controllers 73a and 73b and first and second amplifiers 73c and 73d.

To drive the automatic fare adjustment machine 10, the control device 70 is connected through an output interface 74 to a mechanical controller 76 and a mechanical driver 76a which is connected to the card transfer means 22 including the pinch rollers 25, 26, and 31, the pulleys 28a and 28b, the driver means 30a, and the branching gates. The mechanical driver 76a is also connected to cash transfer means 80 and the punch device 36. The control device 70 is further connected to first and second thermal print heads 42 and 43 which are controlled by first and second print controllers 77a and 77b and first and second print amplifiers 77c and 77d. The control device 70 is also connected to a display section 11 which is controlled by an operation controller 78 and an operation amplifier 78a.

An operation of the automatic fare adjustment machine 10 will now be described. When a passenger having a season ticket 17a has got off at a station beyond the section designated by the season ticket 17a, he or she inserts the season ticket 17a into the opening 18 of the automatic fare

adjustment machine 10 to adjust a fare. When the fetch sensor 23 detects the season ticket 17a, the card transfer means on the transfer path 22a, such as the first and second lower rollers 25c and 26c and the first and second pulleys 28a and 28b, are driven.

As a result, the season ticket 17a is pinched by the first lower roller 25c and the upper roller 25a, which is rotated in accordance with the rotation of the first lower roller 25c. The ticket 17a is transferred through the transfer path 22a to the lever 24. The lever 24 which is prevented from rotating in the direction indicated by the arrow t by means of a stopper pin 24a and arranged above the transfer path 22a with a gap corresponding to the thickness of a piece of card. Therefore, if a plurality of cards 17 are inserted, the lever 24 prevents a second or subsequent cards from being further transferred and only the lower-most card 17 is allowed to be transferred by the first lower roller 25c. Thus, only one card can pass under the lever at a time. The first upper roller 25a is moved up in accordance with the number of the inserted cards 17 as indicated by the dot line.

The season ticket 17a separated by the lever 24 is pinched by the second pinch roller 26 and transferred by the transfer belt 28. At this time, the length of the ticket 17a is detected by the discriminating sensor 32 which detects the front and rear ends of the ticket, to judge whether the ticket is valid. If the discriminating sensor 32 judges the ticket not to be any one of a normal passenger-ticket, a season ticket 17a, and a prepaid card 17b, the ticket is immediately discharged through the opening 18, not transferred to the card processing means 21.

When the ticket 17a is inserted, the stopper 30 is located below the transfer path 22a. Hence, the ticket 17a is not stopped by the stopper 30 and transferred to the ticket processing means 21.

The ticket 17a is transferred to the first read/write magnetic head 37 through the punch device 36. The recorded data such as the designated section, the available period, or the sex is read by the magnetic head 37 and the ticket 17a is reserved in the first card reservation portion 46a.

The data read by the first read/write head 37 is input to the calculating section of the control device 70. An amount to be adjusted is calculated by the calculating section and displayed on the display section 11. If there is a plurality of routes to the station, instructions to input the route which the user has used are displayed on the display section 11. In this case, the amount to be adjusted is calculated after the user inputs the route through the operation keys 12a.

When the amount to be adjusted is displayed on the display section 11, the user inserts one or

two prepaid cards 17b through the opening 18. The inserted prepaid card 17b is transferred in the same manner as the season ticket 17a to the first read/write head 37 which reads the remainder on the card. Then, the second read/write head 38 magnetically writes a balance after the fare adjustment. If the remainder on a first prepaid card is less than the amount to be paid, the first prepaid card is reserved in the second card reservation portion 46b. When a second prepaid card is inserted, the first read/write head 37 reads the remainder on the second prepaid card and the second read/write head 38 writes a balance after the fare adjustment on the second prepaid card.

If a shortage is to be adjusted by cash after one or two prepaid cards 17b are inserted, the user inserts an amount of money corresponding to the shortage through the coin inserting port 14 or the banknote inserting port 16. In this case, if the amount of inserted money is greater than the shortage to be paid, the change is not given back to the user but a new prepaid card on which a balance corresponding to the change is recorded is issued.

More specifically, an unused prepaid card is taken out of the first or second card hoppers 52 and 53 by the first or second take-out rollers 52b and 53b, and the balance is magnetically written thereon by the second read/write head 38.

While the new prepaid card is being issued, the first and second prepaid cards 17b are reserved in the second and third card reservation portion 46b and 46c.

Then, an operation of discharging cards 17 is performed.

When a new prepaid card 17b is issued by instructions through the operation keys 12a, relevant data is first recorded on the card by the second read/write head 38 and then the data is checked by the first read/write head 37. If necessary, a punch hole can be formed by the punch device 36 at a position corresponding to the balance. Thereafter, the card is transferred to the accumulating section 27. It is possible to issue a plurality of new prepaid cards 17b by instructions through the operation keys 12a.

If necessary, after the prepaid card 17b is punched, it can be transferred to the blank transfer path 41, in which the balance is printed on the rear surface of the card by means of the second thermal print head 43, before transferred to the accumulating section 27.

In the accumulating section 27, when the discharging operation is started, the driver means 30a is driven so that the stopper 30 projects in the transfer path 22a. Hence, the new prepaid card 17b is brought into contact with the stopper 30 and stopped.

The transfer rollers 49 in the first card reservation portion 46a are rotated backward to transfer the season ticket 17a to the second read/write head 38, which magnetically records completion of the fare adjustment on the season ticket 17a. The recorded data is checked by the first read/write head 37 and the season ticket 17a is transferred to the accumulating section 27.

The season ticket 17a is transferred by the transfer belt 28 to a position on or under the new prepaid card 17b which has been stored in the accumulating section 27. Thus, the season ticket 17a and the prepaid card 17b are accumulated.

The used-up prepaid cards 17b are taken out from the second and third card reservation portions 46b and 46c and transferred to the punch device 36. The punch device 36 forms a hole in each of the used-up card at a position indicating that the card is used up. Then, the used-up prepaid cards are transferred to the accumulating section 27 and accumulated together with the new prepaid card 17b and the season ticket 17a. The upper roller 31a of the third pinch rollers 31 are sequentially moved up in accordance with the thickness (number) of the accumulated cards 17 against the spring 31b.

When all the cards 17 to be discharged to the user are accumulated in the accumulating section 27, the stopper 30 is moved down below the transfer path 22a. The accumulated cards 17 moves up the upper roller 26a, against the spring 26b, from the position indicated by the dot line to the position indicated by the solid line, as shown in Fig. 5. In the meantime, they are pinched by the second pinch rollers 26 and transferred to the lever 24. Since the lever 24 is freely rotated in the direction of the arrow s, the accumulated cards 17 are not stopped by the lever 24. The cards 17 moves up the upper roller 25a, against the spring 25b, from the position indicated by the dot line to the position indicated by the solid line, as shown in Fig. 5. In the meantime, the accumulated cards are pinched by the first pinch rollers 25. Thus, while the cards are pinched by the first and second pinch rollers 25 and 26, they are kept accumulated and collectively discharged through the opening 18. In this manner, all the fare adjustment operation is completed.

The user takes collectively all the cards 17 discharged through the opening 18, such as the season ticket 17a and the used-up and new prepaid cards 17b. Thereafter, he or she goes out of the station through an automatic ticket examination gate using the season ticket 17a on which the completion of the fare adjustment is recorded.

When a normal passenger-ticket, instead of the season ticket 17a, is inserted to the fare adjustment machine, an adjustment ticket is issued by a ticket

issuing device (not shown) and discharged through the opening 18 together with a card-like ticket 17 used to adjust the fare.

Fig. 6 is a diagram depicting a card accumulating operation of the gate mechanism according to the embodiment. As shown in Fig. 6, the cards 17 are consecutively inserted aslant to the accumulating section 27 under the lower most card, without abutting against the edges of the already-accumulated cards, by means of pinch rollers 81 and 82 arranged between the accumulating section 27 and the transfer path 22a. With this structure, a plurality of cards can be accumulated smoothly.

In the accumulating section, the number of cards are counted by the sensor 32b and an appropriate number of cards are accumulated by an operation of the stopper 30. These operations are controlled by the control device 70 shown in Fig. 3.

Fig. 7 is a flowchart showing an accumulating operation of the above embodiment. First, input cards are processed in a predetermined manner (S11). Next, the stopper 30 is moved up so that the cards can be accumulated (S12). Thereafter, the control device 70 calculates the number of cards to be discharged (S13). Then, the control device counts the number of cards to be accumulated (S14) by means of the sensor 32b and judges whether all the cards to be discharged are accumulated (S15). If all the cards are accumulated, the stopper 30 is moved down and the cards are discharged collectively (S16).

Claims

1. A medium processing apparatus for reading first information on a first medium and second information representative of a balance level on a second mediums, the apparatus comprising:
 - means (18) for simultaneously receiving and returning the first medium and the second medium;
 - means (27) for transporting the first medium and the second medium received the receiving and returning means (18);
 - means (22) for reading the first information and the second information on the first and second mediums transported by the transporting means (27);
 - control device (70) for calculating a value level in response to the first information and reducing the balance level in response to the value level calculated by the control device (70);
 - means (38) for recording the reduced the balance level reduced by the control device (70) on the second medium;
 - means (20) for accumulating the first medium and the second medium recorded by the

recording means (38); and

means (24) for regulating the transporting means to transport the first medium and the second medium to the reading means separately and allowing the first medium and second medium accumulated by the accumulating means (20) simultaneously returning to the receiving and returning means (18).

2. A medium processing apparatus according to claim 1, characterized in that transferring means (27) takes the mediums one at a time by means of a lever (24).
3. A medium processing apparatus according to claim 1, characterized in that the mediums includes a normal passenger-ticket or a pre-paid card.
4. A medium processing apparatus according to claim 1, characterized by further comprising:
 - means (32b) for detecting the number of the accumulated mediums;
 - means (70) for calculating the number of mediums which should be discharged simultaneously; and
 - means (70) for judging whether the mediums to be discharged have been accumulated, so that the outputting means simultaneously output the accumulated mediums.
5. A medium processing apparatus according to claim 1, characterized in that the transporting means (27) includes a stopper (30).
6. A medium processing apparatus according to claim 1, characterized in that mediums are inserted one by one aslant to the accumulating means (20) under the lower most medium of the mediums which have been already accumulated.
7. A method of outputting mediums from a medium processing apparatus for reading a first information on a first medium and second information representative of a balance level on a second mediums, the method characterized by comprising:
 - simultaneously receiving the first medium and the second medium;
 - reading (S11) the first and second information on the first and second mediums transported by the transporting means;
 - calculating (S11) a value level in response to the first information and reducing the balance level in response to the value level calculated by the control device;
 - recording (S11) the reduced the balance

level reduced by the control device (70) on the second medium;

accumulating a plurality of mediums (S12) read or calculated or recorded in the steps;

calculating the number of mediums which should be output simultaneously (S13); 5

counting the number of the mediums (S14) accumulated in the accumulating step;

judging whether the accumulated mediums should be output simultaneously by comparing the number calculated in the calculating step and the number counted in the counting step (S15); and 10

outputting the accumulated mediums (S16), if it is judged that they should be output in the judging step. 15

8. A method according to claim 7, characterized in that the judging step (S15) is executed by a sensor for detecting the passage of a medium and a microcomputer (70) which receives a signal from the sensor and counts the number of mediums. 20

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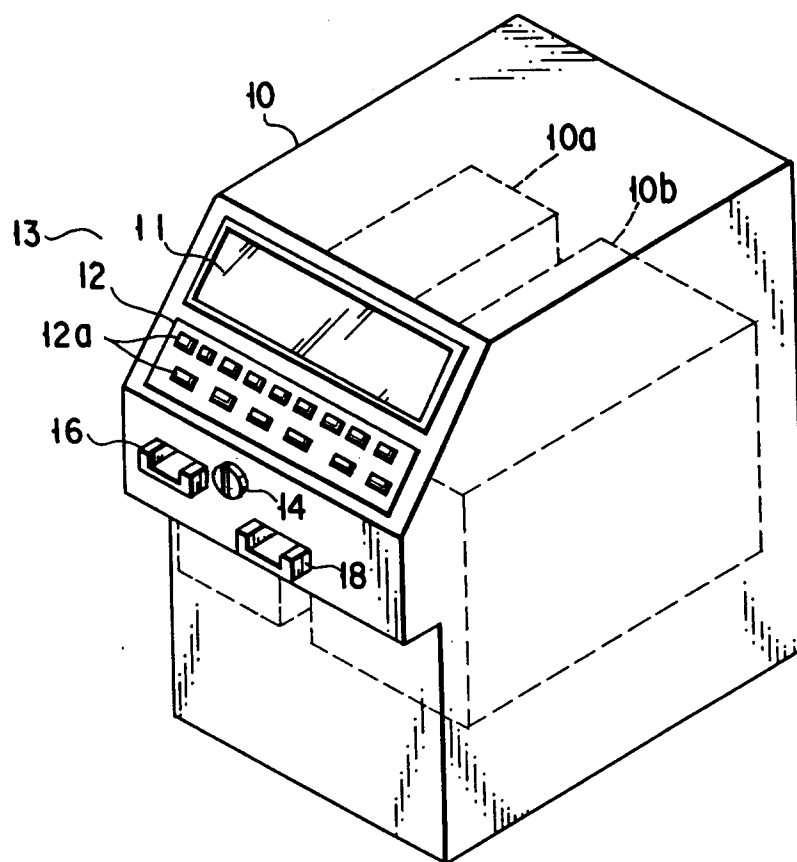


FIG. 1

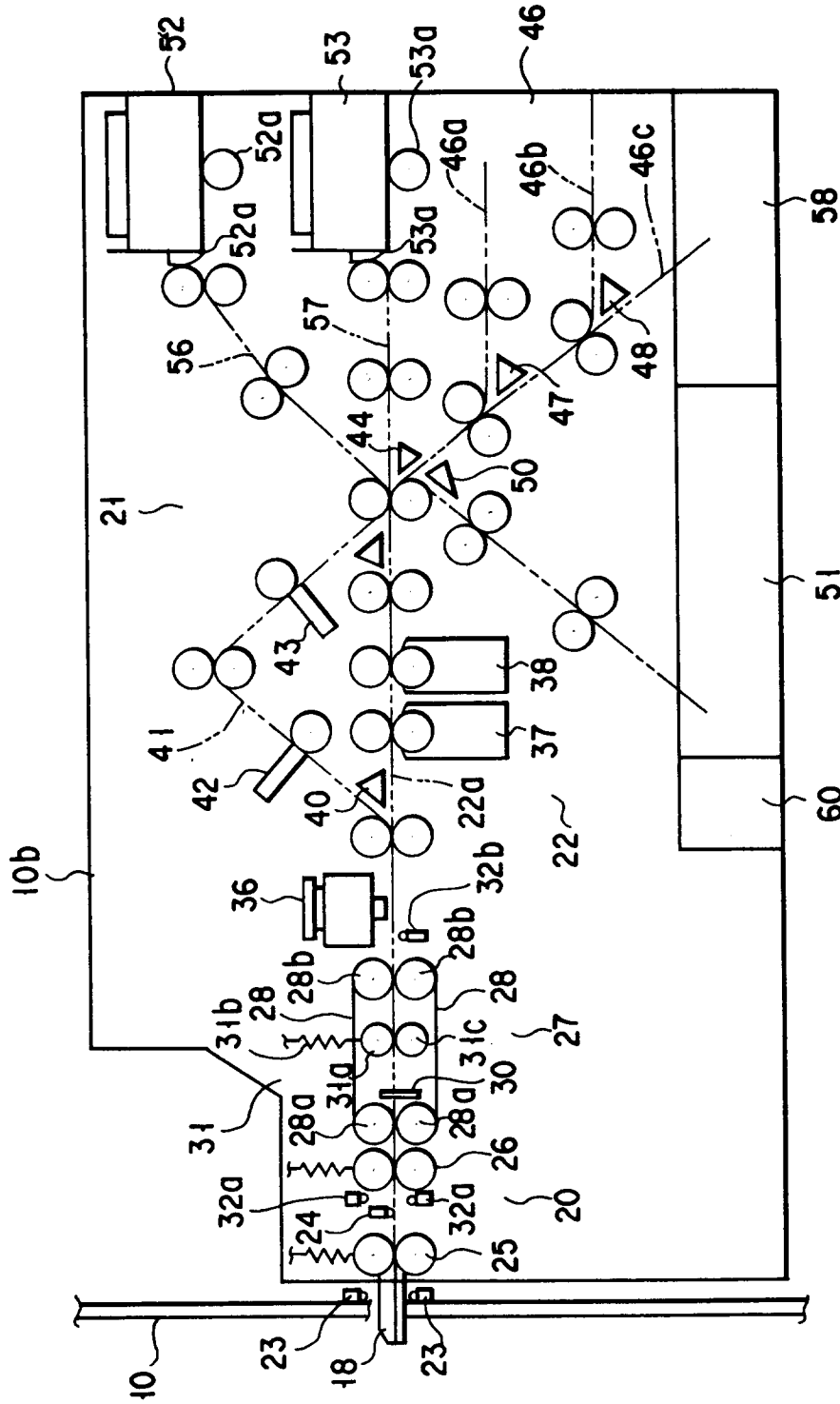


FIG. 2

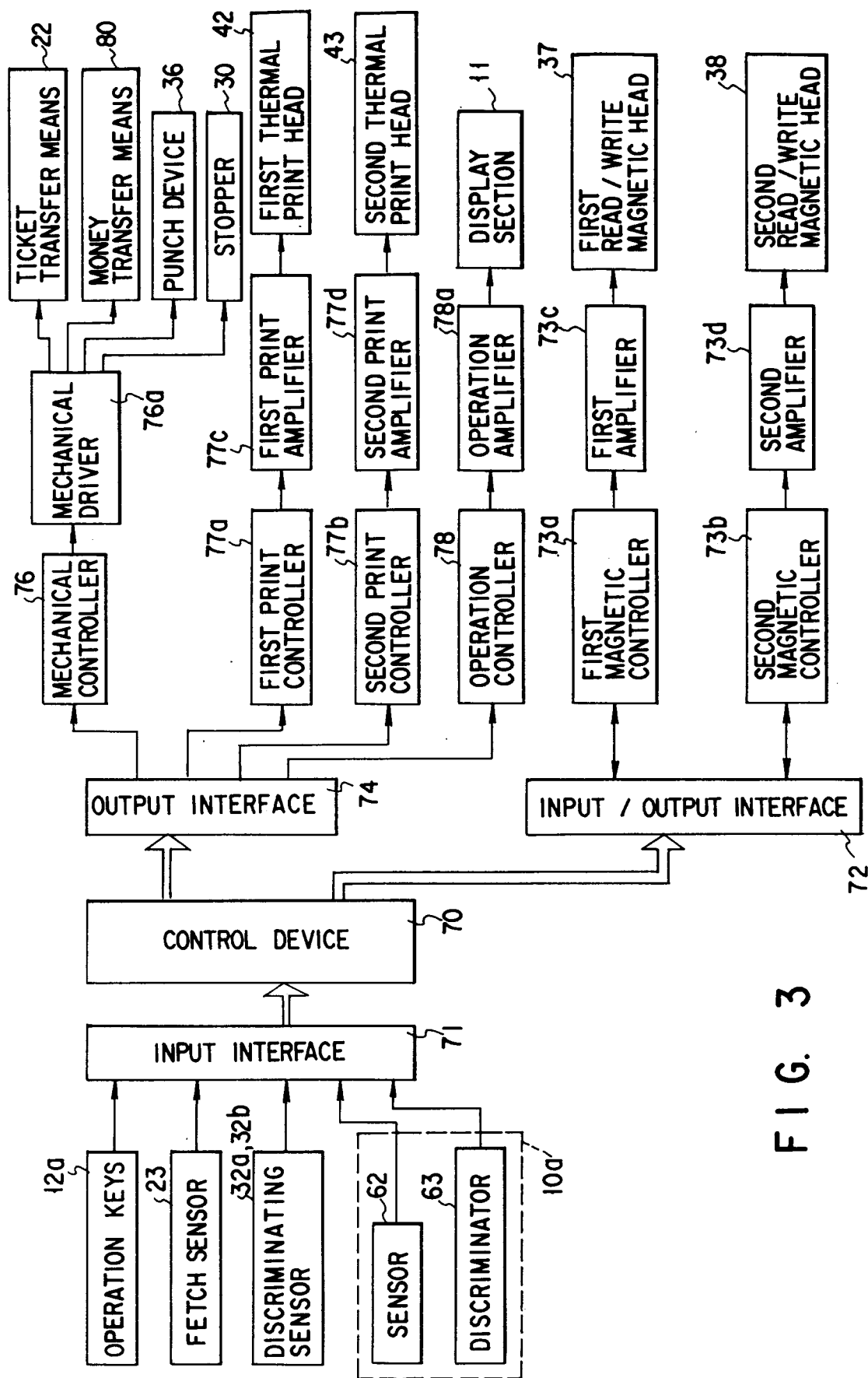


FIG. 3

FIG. 4

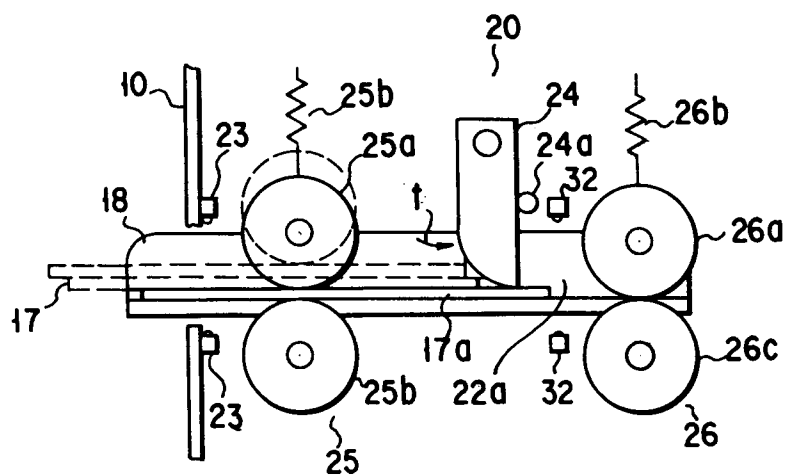


FIG. 5

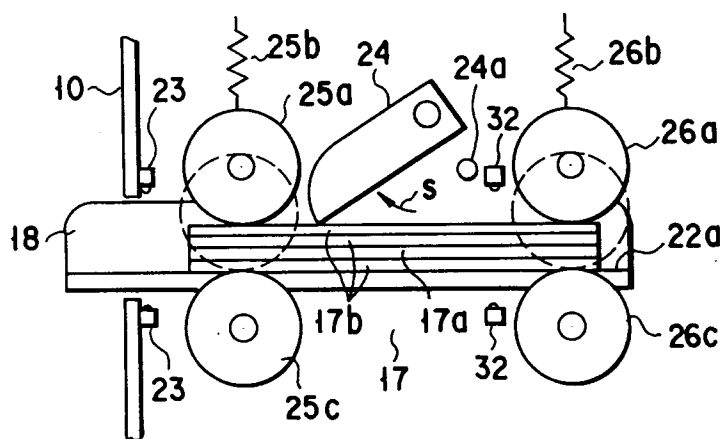
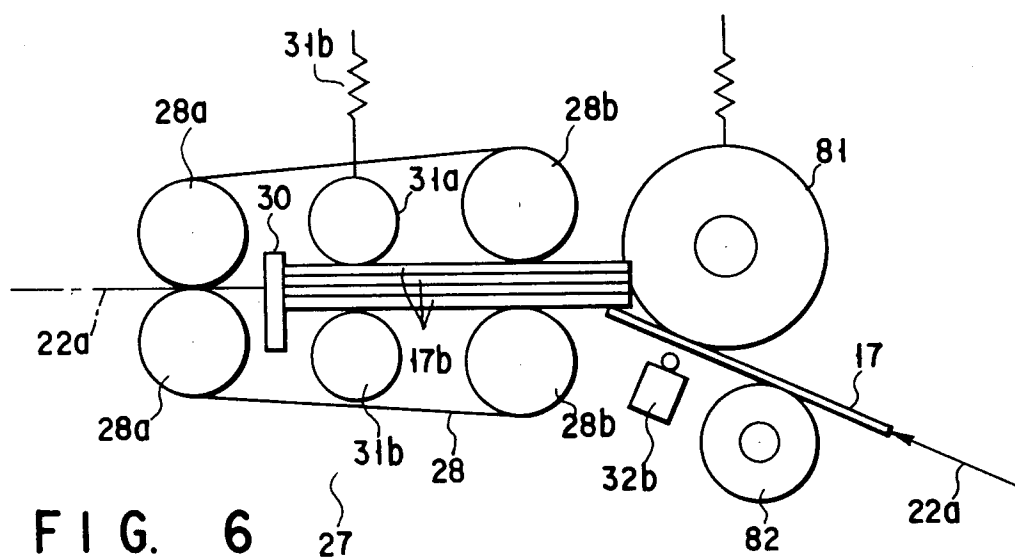


FIG. 6



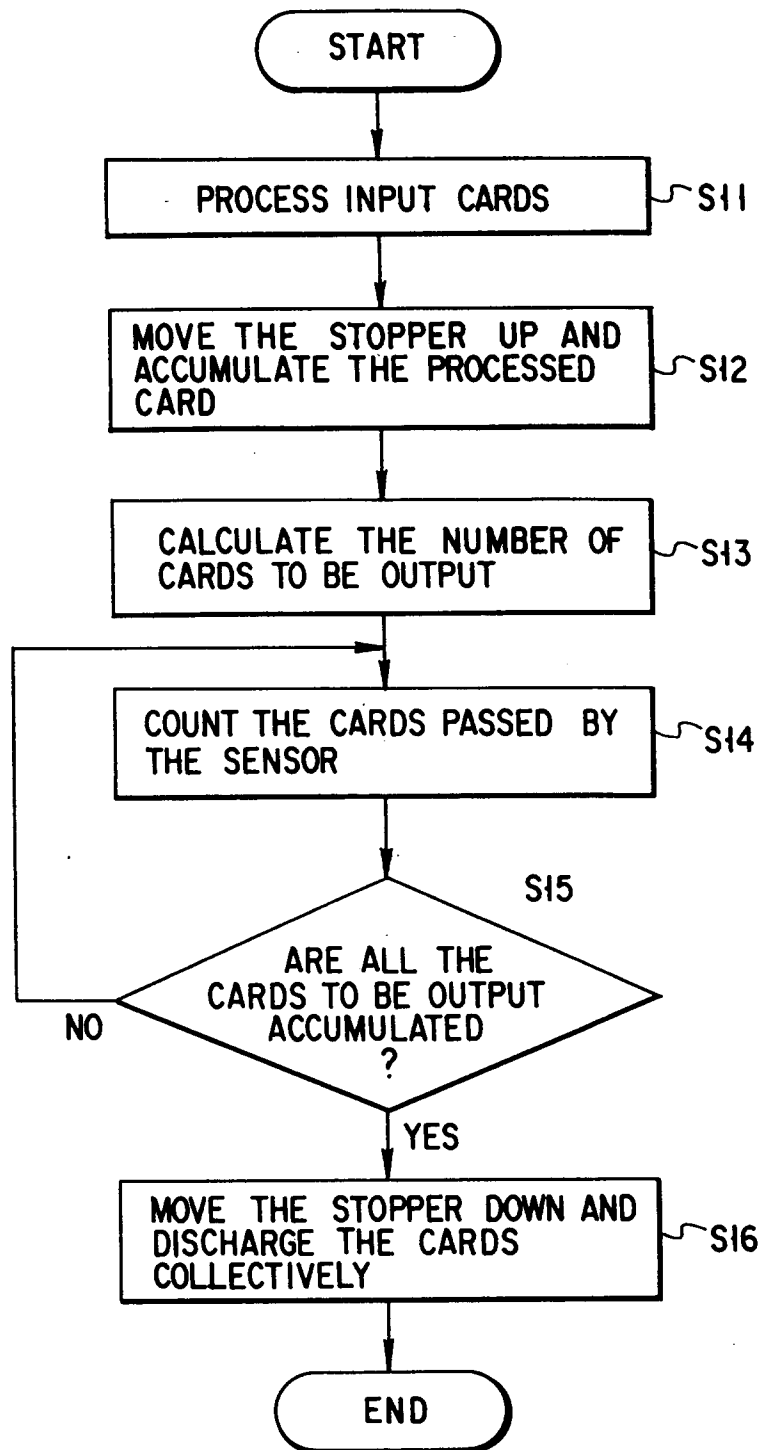


FIG. 7