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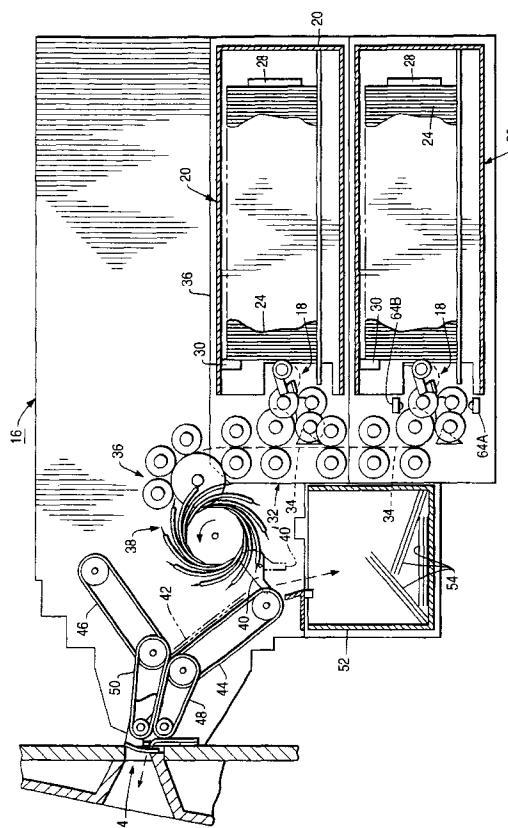
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(54) Improved transaction terminal

(57) In an ATM (2) in which notes are picked from a cassette (20) by a vacuum operated pick arm (41) operating on a pick cycle, and controlled by a CPU (60), the CPU is arranged to calculate the mispick rate, and when the calculated mispick rate exceeds a preset acceptable rate, causes the pick arm (41) to pick one note every two pick cycles.

FIG. 2



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Description

This invention relates to a transaction terminal such as an automated teller machine (ATM).

One function of an ATM is to dispense bank notes to a user. As is well known, a user inserts a user identity card into the machine, and enters data e.g. a personal identification number (PIN) and the required amount of currency by means of a key pad, and the ATM processes the transaction, updates the user's account, dispenses the notes, and returns the card.

In order to dispense cash, bank notes in one or more storage cassettes in the ATM are extracted by pick means, and fed to stacking means then to an output slot. A common malfunction is a mispick when the pick means does not succeed in picking a note from a cassette. The problem may be caused by changes in ambient temperature adversely affecting the operation of the rubber suction pads of the pick means, or by poor quality currency.

Conventionally, an ATM is arranged to attempt e.g. three further picks after a mispick; if these further attempts also fail, a pick failure is noted. After a certain number of pick failures, e.g. four, operation of that pick means and cassette is suspended.

To correct such a malfunction the ATM may need to be shut down while a trained operator corrects the operation.

It is an object of the present invention to alleviate such problems and to enhance the operation of a transaction terminal.

According to the invention a transaction terminal comprises bank note storage means; pick means to pick bank notes from the storage means; transport means to transport picked notes to a delivery position; and sensing means to sense a mispick of notes; characterized by control means to derive a sensed mispick rate, to compare the sensed mispick rate with a stored acceptable mispick rate, and when the sensed mispick rate exceeds the stored mispick rate, to cause the pick means to operate at a reduced rate.

In this specification, "mispick rate" means the number of mispicks within a predetermined number of picks.

Conventionally the pick means operates on a pick cycle. In this specification, "pick cycle" means the placing of a pick head of the pick means in contact with a bank note in the storage means; the application of suction to the pick head; and the movement of the pick head away from the storage means.

Preferably the pick rate is reduced from one pick per pick cycle to one pick per two pick cycles when said stored mispick rate is exceeded.

Preferably the original pick rate is resumed when the sensed mispick rate falls below the stored acceptable rate.

Optionally the control means is arranged to further reduce the pick rate, e.g. from one pick per two pick cy-

cles to one pick per three pick cycles, if the sensed mispick rate does not recover, but increases to a second stored rate, and to restore first one pick per two cycles and subsequently one pick per pick cycle when the sensed mispick rate returns to the second and first stored rates respectively.

The invention will now be described by way of example only with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of an automated teller machine;

Figure 2 is a schematic side view of a currency note delivery system within the ATM;

Figure 3 is a detailed view of part of Figure 2; and

Figure 4 is a schematic diagram of a control system for an ATM.

Figure 1 shows an ATM 2 having a user interface device 6 including a slot 8 to receive a user identity card, a keypad 10 to permit data to be entered, a display screen 12, and an output slot 14 to dispense currency to a user.

Figure 2 shows a cash dispense unit 16 including a pair of pick devices 18 each adjacent a storage cassette 20, the cassettes being arranged one above the other. Each cassette contains a stack of bank notes 24 urged by a spring backed pusher member 28 towards a stop 30 at the front of each cassette.

At the front end of each cassette adjacent the associated pick device 18 there is a series of feed rollers 32 which can feed notes from the cassette along a feed path 34 to a transport mechanism 36 which feeds a stacking wheel 38. A stripper plate 40 strips notes from the stacking wheel 38 to stack a bundle of notes to be dispensed 42 on a first endless belt 44; once the required bundle of currency notes is assembled on the belt 44, a second endless belt 46 is moved adjacent the first belt in a rocking movement to trap the bundle, and the belts 44, 46 are driven to pass the bundle 42 through a further pair of endless belts 48,50 to the output slot 14.

Adjacent each pick device 18 there is an optical bank note location sensor 64A,64B to sense the presence or absence of a bank note; only one such sensor is shown in Figure 2. The sensors are connected to a control system described below with reference to Figure 4. If the control system, responding to signals from the note location sensors, indicates that the requested currency has not been correctly assembled in the bundle 42, the control system operates the stripper plate 40 to move from its illustrated position to that shown by the dotted line 40', allowing the partial bundle 42 to fall into a mispick bin 52, illustrated as containing mispicked bundles 54.

The moving parts are driven by a drive motor and a

stepping motor, not shown in Figure 2. The note location centres are connected to the control system shown in Figure 4. The mechanical and control arrangements of Figure 2 are well known.

Figure 3 shows one pick device 18; it has a pick arm 41 carrying a suction pad 142, the arm being connected through a swivel elbow connector 144 to a rubber tube 146 which in turn is connected to a suction pump 70 (Fig. 4) to a solenoid valve 72 (Fig. 4).

The pick arm 41 is connected through a gearing system 148 to a cam device 150 and bell crank lever 152 fixed to a stud 154 and loaded by a spring 56. The gearing system, cam device and bell crank lever operate to move the pick arm 41 between the position shown, i.e. out of contact with the notes in the cassette (see Figure 2) through an anti-clockwise rotation of about 80 degrees, to a position in which the suction pad 142 contacts the bank note at the front of the cassette 20.

The suction pump 70 is switched on before the suction pad 142 contacts the note, but the solenoid valve 72 is opened only after the pad contacts the note, thus providing a short dwell time to allow vacuum to build up to a required level. The pick arm 41 is then rotated clockwise, holding the note by suction and passing it to the feed rollers 32 (Fig. 2).

If the pick arm fails to make good contact with the note and a note is not picked, sensor 64 indicates a mispick; this is often caused by currency in the cassette 20 being of poor quality. When a mispick occurs, vacuum is lost; this has the result that vacuum strength will be reduced in the next pick cycle, so the risk of a second mispick is higher.

The ATM 2 is arranged so that the pick arm operates on a timed cycle, with a pre-set time between each pick, and with the pick arm 41 being held in contact with the note for a pre-determined interval of time. The time of opening of the solenoid valve is also controlled within this cycle. The arrangement is that one note is picked per pick cycle.

Referring now to Figure 4, the control system of a transaction terminal according to the invention comprises a central processing unit (CPU) 60 to which the ATM user interface device 6 is connected. The CPU 60 is connected through an input/output card 61 to a card reader 62, and to a plurality of bank note location sensors 64.

Figure 4 also indicates the mechanical drive components which are a drive motor 68 which drives the gear train 148, and a suction pump 70 which provides vacuum to the pick device 18 through a solenoid valve 72. The three drive components are also connected to the CPU 60 through the input output card 61 and are also conventional.

In the ATM according to the invention, at each mispick the note location sensor 64 associated with that pick head/cassette indicates a mispick to the CPU 60; the CPU 60 is arranged to calculate the mispick rate, i.e. the number of mispicks within a given number of picks (or attempted picks) by each pick head, and compares

the sensed mispick rate with a stored pre-set rate which is regarded as acceptable. For example, three mispicks in ten picks may be acceptable, but four may be unacceptable.

If the sensed rate exceeds the pre-set rate then the CPU 60 operates to start the suction pump 70 at the beginning of the pick cycle, but to keep the solenoid valve 72 closed during the first pick cycle; the pick arm 41 is rotated so the head contacts a note in the cassette, and then rotates away again without a note; on the second pick cycle, the valve 72 is opened when the head is in contact with the note. In this mode of operation, a higher vacuum is generated, the chance of a mispick is lower, and picking occurs only once every two pick cycles instead of every pick cycle.

If the mispick rate then decreases to fall below the pre-set level, the CPU controls the pump 70 and valve 72 to restore the previous pick rate of one pick per pick cycle.

However, if the mispick rate increases further and exceeds a second pre-set level, the cycle can be slowed yet further, to operate at a pick rate of one pick per three pick cycles. As the mispick rate reduces, an increased rate, and finally a normal rate of picking can be restored.

An ATM operating according to the invention will have a lower mispick rate than a conventional ATM with fewer pick failures, an improved operating efficiency, and a lower rate of call out of maintenance staff.

The use of an increased vacuum may increase the rate of double picks, i.e. two notes picked at a time, especially after a faulty note is removed from a cassette, but double picks can be detected by conventional means (not shown) and incorrectly assembled bundles of notes purged to the purge bin 52, as is conventional.

Claims

1. A transaction terminal comprises bank note storage means (20); a pick means (18) to pick bank notes from the storage means (20); transport means (32, 26, 38, 44, 46, 48, 50) to transport picked notes to a delivery position (14); and sensing means (64) to sense a mispick of notes; characterized by control means (60) to derive a sensed mispick rate, to compare the sensed mispick rate with a stored acceptable mispick rate, and when the sensed mispick rate exceeds the stored mispick rate to cause the pick means (18) to operate at a reduced rate.
2. A transaction terminal according to claim 1 in which the pick means (18) operates on a pick cycle in which one note is picked per pick cycle, characterized in that the reduced rate of operation of the pick means comprises picking one note in every two pick cycles.
3. A transaction terminal according to claim 1 or claim

2 characterized in that the control means (60) is arranged to restore the original pick rate when the sensed mispick rate decreases to the stored mispick rate.

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4. A transaction terminal according to any preceding claim characterized in that the control means (60) is arranged to compare the sensed mispick rate with a second stored mispick rate and further to reduce the pick rate when said second stored mispick rate is reached.

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5. A transaction terminal according to claim 4 characterized in that it is arranged to restore the pick rate from the further reduced rate to the reduced rate when the sensed mispick rate decreases to the second stored mispick rate, and to restore the pick rate to the normal rate when the sensed mispick rate decreases to the stored mispick rate.

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6. A transaction terminal according to any preceding claim characterized in that the means to sense the mispick rate comprises a note location sensor (64).

7. A method of controlling a pick means for picking bank notes from a bank note storage means characterized by the steps of:

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sensing a mispick of bank notes from the storage means;

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deriving a sensed mispick rate;

comparing the sensed mispick rate with a stored mispick rate; and

operating the pick means at a reduced rate when the sensed mispick rate exceeds the stored mispick rate.

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FIG. 1

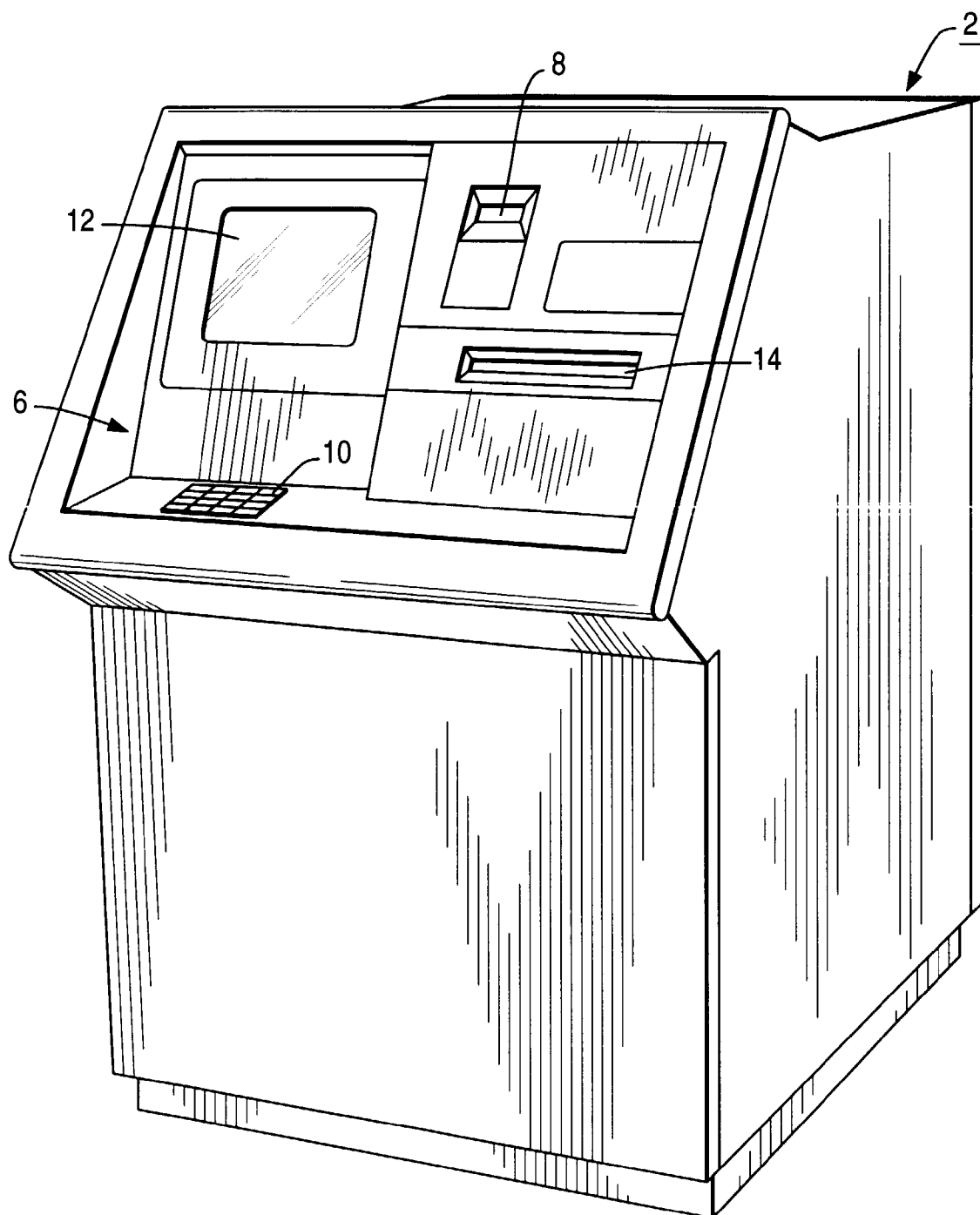


FIG. 2

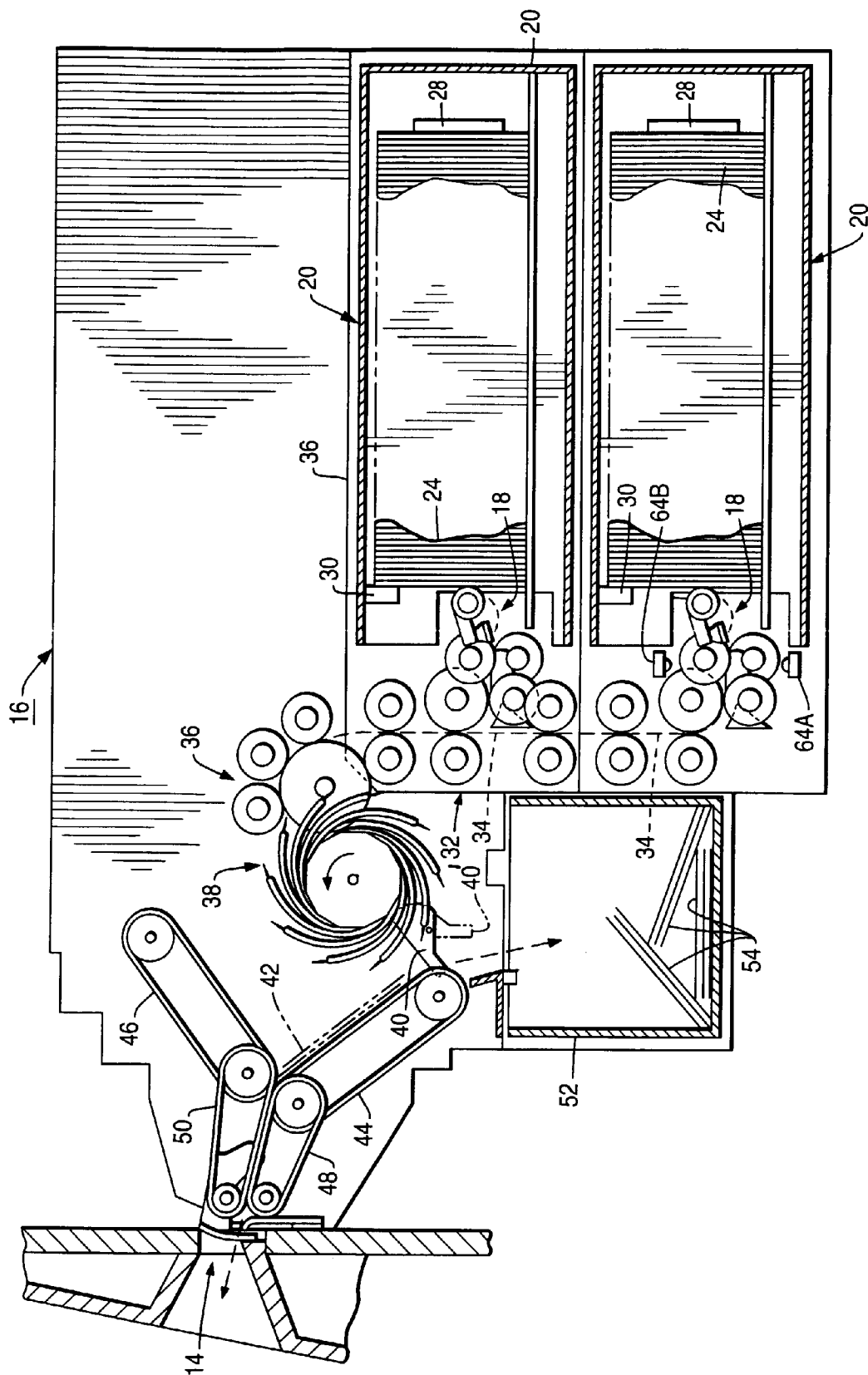


FIG. 3

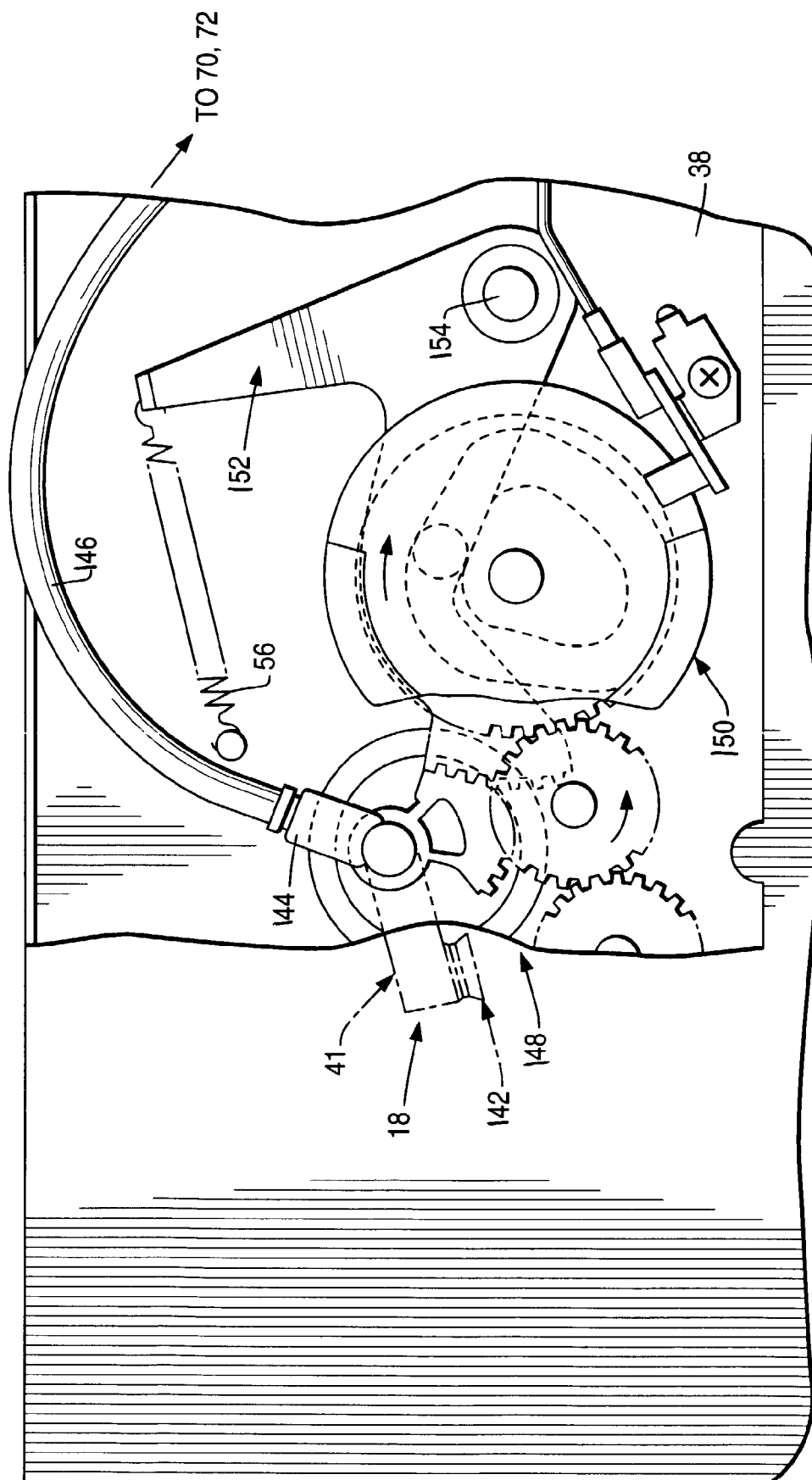
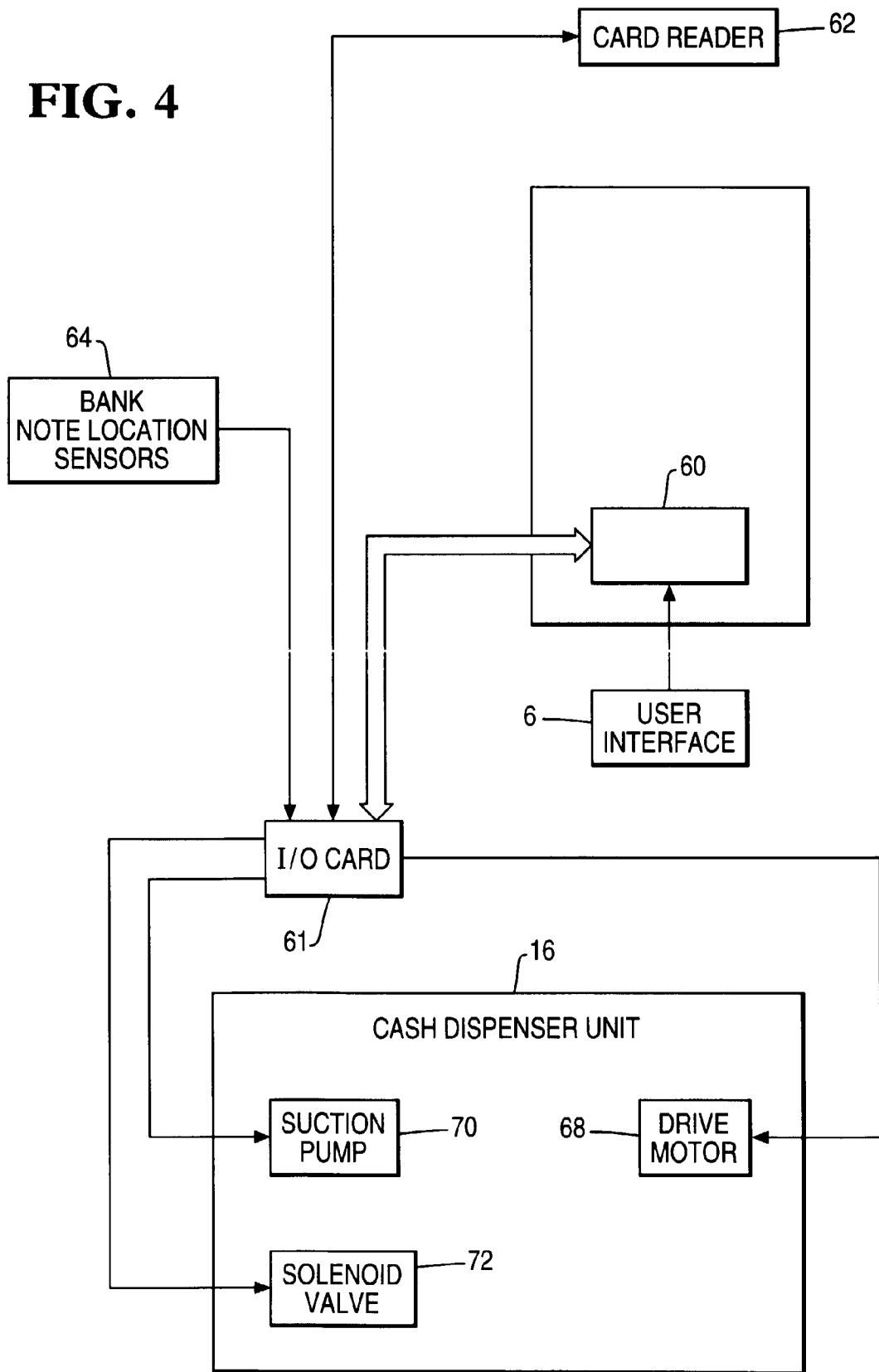


FIG. 4





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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 3388

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	IBM TECHNICAL DISCLOSURE BULLETIN, vol. 35, no. 4a, September 1992, pages 237-241, XP000314750 "Adaptive Feed Method"	1-3,6,7	G07D11/00
A	* the whole document * ---	4,5	
A	EP 0 459 529 A (DIEBOLD) * claims 1-7; figure 9 * ---	1,7	
A	EP 0 448 385 A (NCR CORP.) * column 11, line 29 - column 12, line 34; figure 2 * -----	1,7	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			G07D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 September 1997	Examiner Neville, D
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			

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