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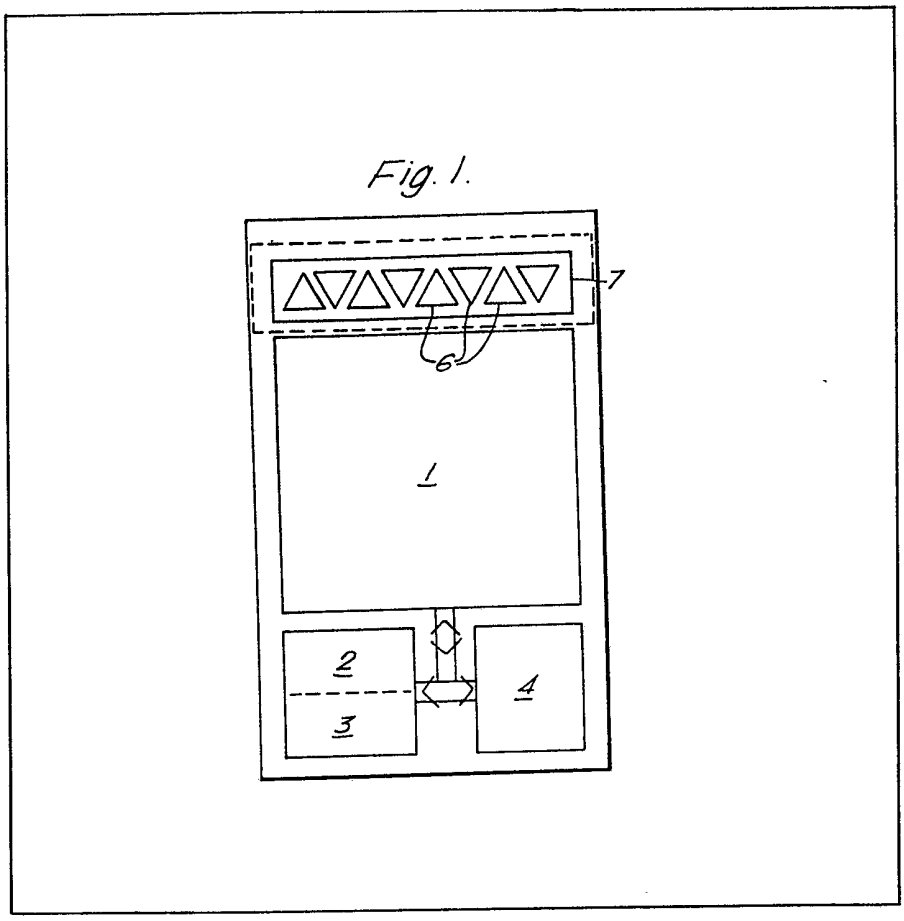
(54) **Portable memory module**

(57) A portable memory module having a first semiconductor storage block 1 for storing working data, a second semiconductor storage block 2 for storing the current status of the module, and a third semiconductor storage block 3 for storing permanent information relating to the module, access to each storage block being provided by way of externally accessible connections 6 only, to reduce the risk of data corruption.

The module is suitable for automatic sale transactions employing credit cards where security is of prime importance and the amount of data is not great. The module may be used in a fuel dispensing system.




The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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Fig. 1.

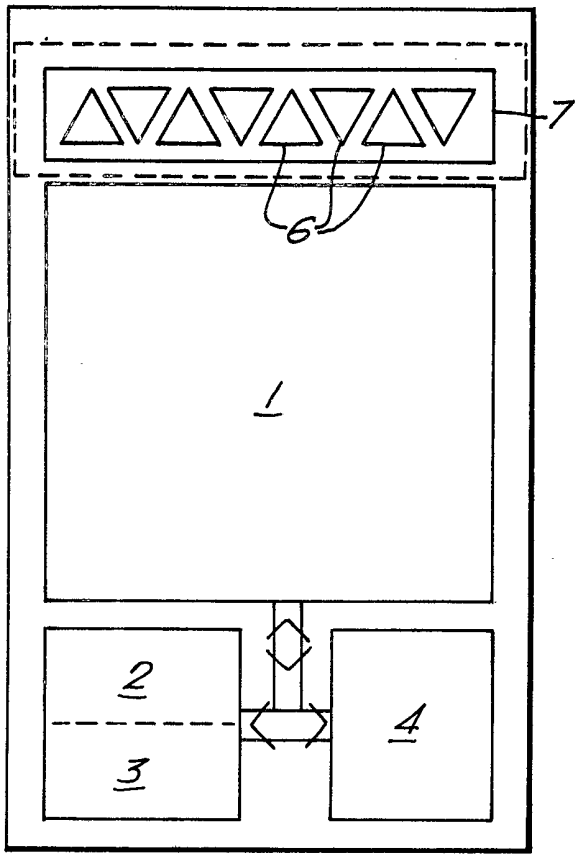



Fig. 2.

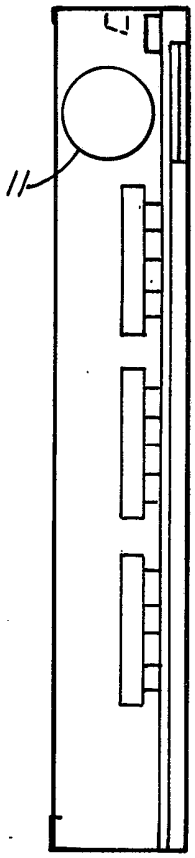



Fig. 3.

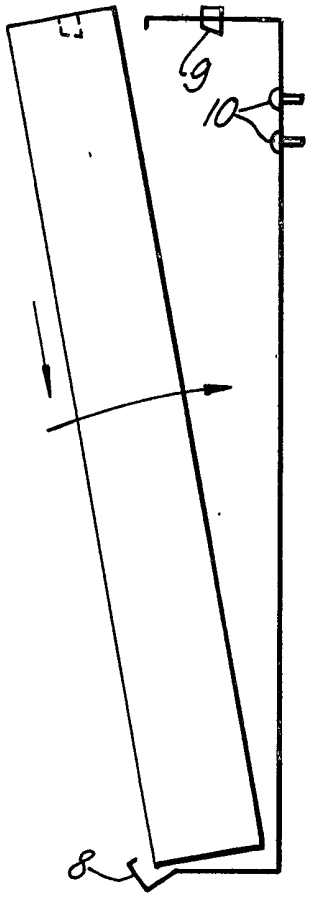
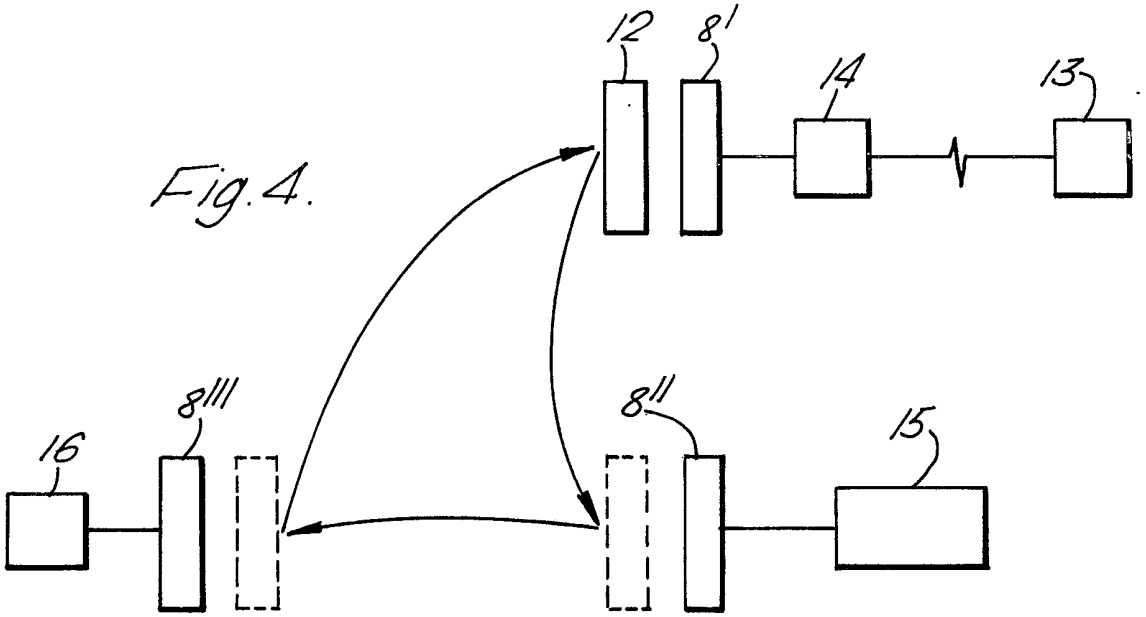



Fig. 4.



SPECIFICATION

**Memory module**

This invention relates to memory modules and particularly to portable memory modules for data collection and transmission to a processing centre.

In certain applications where data is produced in a sequence of separate operations, there may be a print-out of the data arising in the operation for checking or information purposes. It is however, frequently desirable to collect the data from such a sequence of operations in a totally machine-readable form for data processing purposes. A typical application of such data collection is in the field of credit-card transactions such as the purchase of petrol from petrol dispensers and the debiting of an account accordingly. Each operation, or sale transaction, involves a certain amount of data relating to customer identity, quantity of goods purchased, cost, remaining credit and similar information. The amount of data likely to arise in such a situation will commonly be on only a medium scale. A magnetic tape cassette has been proposed for such an application but the capital cost is relatively high and in addition the full tape capacity would frequently not be necessary. In considering any other type of memory however, security becomes of major importance since stored data from previous transactions must not be corrupted by wrong addressing, for example when intending to access parts of the overall store having quite different functions.

Assording to the present invention, a portable memory module for data storage includes a first semi-conductor storage block for storing working data, a second semiconductor storage block for storing the current status of the module, and a third semiconductor storage block for storing permanent information relating to the module, access to each storage block being provided by way of respective external connections exclusive to the particular storage block.

The memory module may include an input/output memory providing serial access to the storage blocks. The external connections are preferably sealed against the atmosphere and may comprise contacts covered by pressure-responsive conductive resilient material so that an electrical path can be established by pressure of an external electrical contact. The sealed contacts may be of plane form and of significant area such that several separate external contacts can engage each sealed contact.

According to a feature of the invention, where the memory module is incorporated in equipment arranged to access at least some of said store blocks, two external contacts are arranged to be short circuited by engagement with one of said sealed contacts and thus provide a check on the correct installation of the module. This one sealed contact may be a dummy contact having no connections to the storage blocks.

According to another aspect of the invention, fuel vending equipment comprises means for dispensing a controlled quantity of fuel, data input means whereby a customer account number and fuel quantity can be entered, means for recording transaction data concerning the account number and the quantity and cost of fuel dispensed, and a module housing whereby said transaction data can be transferred to a memory module as aforesaid engaged in the module housing.

The fuel vending equipment may be adapted to receive data from such a memory module by way of the module housing.

According to a further aspect of the invention, a credit-payment fuel vending system comprises at least one fuel vending equipment as aforesaid, a plurality of memory modules as aforesaid, each fuel-vending equipment housing a memory module, and a computer centre for receiving the memory modules, and reading and collating the data stored in each.

A memory module in accordance with the invention and a fuel vending system employing such a module, will now be described, by way of example, with reference to the accompanying drawings, of which

Figures 1 and 2 are front and side elevations of the module;

Figure 3 is a diagram showing the insertion of the module into a module housing for data transfer purposes; and

Figure 4 is a schematic illustration of a fuel vending system employing the module.

Referring to Figures 1 to 3 of the drawings, the module is approximately the size of a standard tape cassette. It has a main storage block area 1 for transaction data comprising a semiconductor random-access memory which conveniently has a capacity of 32K bits. A second storage block 2 is also a random-access memory but may have only 32 x 8 bits capacity. This second storage block is the status area and contains information as to the type of data stored in the main block, whether and how many times the data has been read out and processed, identity of last processing centre and suchlike information.

A third storage block 3 contains the module serial number and uses restriction coding for security and traceability. This permanent information is contained in a programmable read-only memory of 32 x 8 bits capacity.

It is important that there shall be no possibility of wrongly addressing the three storage blocks so that data is corrupted or information thought to emanate from one storage block is in fact coming from another. This possibility is avoided by isolating the data paths within the module completely. Thus each storage block is connected by way of an input/output buffer 4 directly to contacts 6 for external connection, without any commoning of the paths.

The input/output buffer 4 converts parallel data to serial for storage and controls the timing of the reading and writing generally.

The contacts 6 provide external connections to the storage blocks and are in the form of triangular

plates of sufficient order to allow multiple contacts on each contact 6. These contacts are covered by a strip 7 of pressure-responsive rubber which is normally insulating but becomes conductive under pressure. The contacts 6 are therefore sealed against atmospheric corrosion and also against accidental contact or tampering during carriage.

The module is adapted to engage a housing 8 as shown in Figure 3 and be trapped by a catch 9 with the contacts 6 pressed against fixed contacts 10. The rubber strip is thereby compressed and contact is made for the transfer of data. Power for the energisation of the circuits is also supplied by way of contacts 6, either directly or for re-charging a battery 11.

Referring now to Figure 4, this shows a typical sequence of operations in the use of the module in a fuel vending system. In this system the module is used to record a transaction consisting of the purchase of petrol from a petrol pump, including the debiting of the customer's account.

In addition to this transaction-recording function the module may be used to carry information from a computer centre to the individual vending equipments. For this purpose it is first connected to a computer 13 by way of a module housing 8' such as the housing 8 previously described. The module 12 is connected to the computer 13 via a modem 14 and is loaded with data by transmission of the data from the computer 13 through the modem 14 and the contacts 6 to their respective storage blocks 1 and 2. This data is typically a list of card account numbers of customers who have accumulated bad debts and therefore are not allowed to make further purchases. These card account numbers are listed in the main storage block while in the storage block 2 the stored data would indicate that the contents of the main storage block are bad debt accounts. Storage block 2 would also include data indicating the quantity of data stored in the main storage block 1, the date and time of loading and the source of the data in both storage blocks 1 and 2. All this data in storage block 2 is collectively called the 'status data' of the module referred to previously.

The data identifying the source of the input data is the computer 13's site code. When the module 12 has been primed, as it were, by the computer 13, it is then removed from the receptor 8' and inserted into a similar module 8" connected to a petrol or other fuel vending terminal 15.

The fuel terminal 15 first checks to see whether the module 12 has a valid status. This comprises checking the identity of the module 12 (as indicated by its serial number in storage block 3) against a list acceptable to that fuel terminal, and similarly checking the status data for 'acceptable' source, i.e. computer site code, and age of the data. The absence of valid status can be used to prevent any alteration or addition to the module's data.

Assuming the module has valid status, and in the case where the working data in storage block 1 is a list of bad debt accounts, this data is read by the vending terminal 15 and stored for comparison against subsequent account transactions.

Having accepted data from the module, the vending terminal will then transfer its own accumulated transaction data to the module. Thus storage block 1 will be supplied with data concerning all of the transactions that have taken place since the last 'unloading' of the vending terminal data stores. The transferred data will comprise, in respect of each transaction, account number, transaction value, date/time of transaction, account type (credit/deposit), and check digits for data verification. The vending terminal may have means for crediting a customer's account, by cash deposit or cheque supervised by an attendant, or automatically by credit card. The transaction value may therefore be positive or negative.

Storage block 2 of the module is then loaded with data indicating the type of data in storage block 1, i.e. transaction data, the quantity of such data, and its source, which will be the site code of the vending terminal 15. All of this status data replaces the previous data in storage block 2.

If the quantity of data indicated in the second storage block 2 reaches a certain limit corresponding to the main storage block being full, the module 12 responds by e.g. activating a warning light.

The module 12 is therefore removed from the module housing 8" either when it is full or when the vending terminal is completely unloaded. It may then be returned to the computer centre 13 or may, as an intermediate step be inserted into a similar housing 8"' connected to a read-out printer 16, which, after checking the status of the module as before, prints out the data stored in storage block 1. In this case the printer 16 cannot change the data stored in the module 12.

Either directly from the vending terminal or after this print-out procedure the module 12 is returned to the housing 8' of the computer centre 13whereupon, assuming the checking procedure shows that the status of the module 12 is valid, the computer 13 reads the storage blocks 1 and 2 and collates the information so provided with existing stored information on customers accounts and debit/credit position. Up-to-date accounts may then be sent to the customers or merely kept on record for further updating.

The results of this up-dating may produce further bad-debt information which is again loaded into the module as previously described and the cycle is repeated.

The advantages of the module lie in its being portable and small, and in the security it provides for the stored data. It provides this security in two distinct ways. First data cannot be wrongly addressed as the data paths within the module are isolated from one another and secondly mistakes arising from the module being connected to the wrong module housing, or being out of date or otherwise invalid, are prevented by the checking of the status of the module 12 whenever it is

transferred to different equipment.

With regard to the construction of the module 12, it will be clear that external connection may be made by means other than the sealed contacts 6. Thus capacitive coupling plates, optical coupling or magnetic sensors may be employed, all with the object of preventing accidental connection to the module or tampering with the connections.

CLAIMS

1. A portable memory module for data storage, including a first semiconductor storage block for storing working data, a second semiconcuctor storage block for storing the current status of the module, and a third semiconductor storage block for storing permanent information relating to the module, access to each storage block being provided by way of respective external connections exclusive to the particular storage block.

2. A memory module according to Claim 1, including an input/output memory providing serial access to said storage blocks.

3. A memory module according to Claim 1 or Claim 2 wherein said external connections are sealed against the atmosphere.

4. A memory module according to Claim 3, wherein said external connections comprise contacts covered by pressure-responsive conductive resilient material so that an electrical path can be established by pressure of an external electrical contact.

5. A memory module according to Claim 4, wherein the sealed contacts are of plane form and are of significant area such that several separate external contacts can engage each sealed contact.

6. A memory module according to Claim 5, incorporated in equipment arranged to access at least some of said store blocks, and wherein two external contacts are arranged to be short circuited by engagement with one of said sealed contacts and thus provide a check on the correct installation of the module.

7. A memory module according to Claim 6, wherein said one sealed contact is a dummy contact having no connections to said storage blocks.

8. Fuel vending equipment comprising means for dispensing a controlled quantity of fuel, data input means whereby a customer account number and fuel quantity can be entered, means for recording transaction data concerning the account number and the quantity and cost of fuel dispensed, and a module housing whereby said transaction data can be transferred to a memory module according to any preceding claim engaged in said module housing.

9. Fuel vending equipment according to Claim 8 adapted to receive data from a said memory module by way of said module housing.

10. A credit-payment fuel vending system comprising at least one fuel vending equipment according to Claim 8 or Claim 9, a plurality of memory modules each according to any of Claims 1 to 7, each fuel-vending equipment housing a said memory module, and a computer centre for receiving the memory modules, and reading and collating the data stored in each.

11. A memory module substantially as hereinbefore described with reference to Figures 1 to 3 of the accompanying drawings.

12. A fuel dispensing system substantially as hereinbefore described with reference to Figures 1 to 4 of the accompanying drawings.

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