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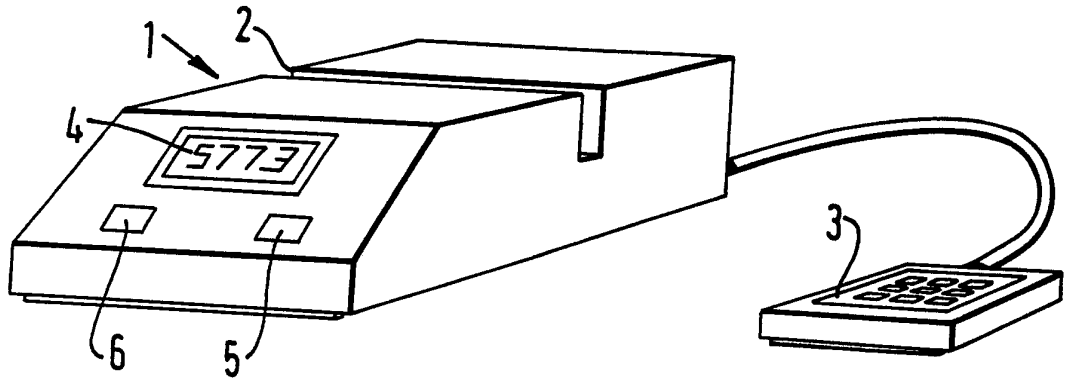

(57) Abstract

Apparatus for verifying the identity of a credit-type cardholder comprises a swipe card reader (2) for reading an identification number from a card and a keyboard (3) for the cardholder to input an identifying number. The user input identifying number and the number from the card are compared and if a match is found, verification of the identity of the cardholder can be assumed. In one embodiment the comparison is made by a comparator and in another embodiment the comparison is made by a suitably programmed microprocessor or personal computer. The apparatus provides first verification of the holder's identity without the need for expensive links with central data bases and the like.

* See back of page

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FRAUD DETECTION IN CREDIT CARDS

The invention in general relates to an apparatus and a method for use in fraud detection in credit cards and the like, and in particular relates to an apparatus and method for verifying the identity of a holder of a credit type card.

As credit cards have become more widely used there has been a corresponding increase in the number of fraudulent transactions using misappropriated cards. These transactions run into millions of pounds per year and the cost is borne in the first instance by the credit card companies. However, the costs of fraudulent transactions are eventually passed on to cardholders in the form of higher interest rates and service charges and to retail consumers in general (because credit card companies also charge retailers for credit card transactions).

Clearly therefore, it would be desirable to be able to minimise credit card fraud and indeed many systems and procedures for checking credit worthiness or credit card validity have been proposed and are in use. One such procedure which has been in use for a

long time requires the retailer (ie. shopkeeper, hotel owner, restaurateur, etc.) to seek authorisation from the credit card company before accepting a credit card in payment. Authorisation may be given verbally over a telephone line or automatically by way of specialised equipment which receives authorisation electronically over a telephone line. Authorisation is required for all transactions over a predetermined monetary value and may also be requested at the traders discretion if so required.

The verbal authorisation procedure is cheap because it only involves the cost of a telephone call, but it is unpopular particularly with large department stores for example, because there is usually a delay of a number of minutes associated with this procedure. The electronic authorisation procedure is quicker because there is usually only a delay of a few seconds, but it is expensive because it requires the use of electronic point of sale terminals connected over telephone lines via MODEMs and the like to a remote computer.

A final check in the form of the cardholders signature provides verification that the person using the card is the card holder. The requirement for a signature to be given can often be the downfall of would be thieves because the signature will be written

in front of the retailer on a credit card sales slip. Whilst there are always variations in a signature the manner in which the cardholder behaves when signing can sometimes arouse suspicion in the mind of the retailer. If the cardholder does not appear to be relaxed this may indicate that the card is not his to use. This signature verification is limited however in that signatures can be forged and indeed although difficult to do, an original signature can be removed from a card and replaced with a bogus signature. Furthermore, if a card is stolen in transit before it reaches the cardholder a bogus signature can easily be written onto the card.

Another method which is used extensively with automatic teller machines, that is to say machines which can provide banking services and vend money to bank or credit card customers, involves the use of a personal identification number or PIN number. PIN numbers are known only to the bank and the holder of the credit card holder and are stored together with other information in the form of a magnetic pattern in a magnetic strip on one side of the card. When a card is inserted into a machine the magnetic strip is read electronically and the PIN number extracted. The user also inputs the PIN number via a keyboard and this input number is compared with the number read

electronically from the card's magnetic strip. If the two numbers match the user is allowed to request services etc. from the machine.

Whilst this method offers verification that the person using the card is the person entitled to do so it involves the use of high technology apparatus in conjunction with telecommunication lines to provide verification from a central computer of the user's identity and subsequently the required services. This method is therefore expensive. Moreover, if the card is stolen and the thief also obtains the PIN number the system can be bypassed because there is no other requirement for the user to identify himself.

The present invention aims to provide a solution to the above by providing a cheap stand alone apparatus for use in providing a first verification of the identity of a card user.

To this end the invention in one of its aspects provides an apparatus for use in verifying the identity of the holder of a credit type card, which apparatus comprises reading means for reading a predefined identifying code from a card, input means by which the holder can enter an identifying code, and comparing means for comparing the holder input code with the code read from the card and for indicating whether a predefined relationship exists between the

two codes thereby providing verification of the identity of the card holder.

The invention in another aspect provides a method for verifying the identity of the holder of a credit type card, the method comprising obtaining a predefined identifying code from a card, obtaining an identifying code from the card holder, and comparing the predefined identifying code from the card with the identifying code from the card holder to determine whether or not a predefined relationship exists between the two codes.

The invention in another of its aspects, provides a method for providing first verification of the identity of a credit-type card user, in which method an encoded identity code is read from the card and compared with a code supplied by the user, and wherein where a predefined relationship is found to exist between the two numbers, verification of the identity of the cardholder can be assumed.

Other features and advantages of the invention, together with these abovementioned will become apparent from a description of an embodiment of the invention hereinafter. The description of the embodiment will be given with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of an

apparatus for use in confirming the identity of a credit-type cardholder; and

Figure 2 is a schematic diagram of a verification circuit used in the apparatus of Figure 1.

Figure 3 is a block diagram of a second embodiment of a card holder identifying device.

Figure 4 is a flow diagram of the operation of the second embodiment.

Turning now to Figure 1 of the accompanying drawings, a verification device indicated generally at 1 comprises a card swipe slot 2, a keyboard 3, a liquid crystal display 4 and card "confirm" and reject indicators 5 and 6. The "confirm" indicator 5 may for example be a green LED arranged to light up when a match is found between the PIN number input by the card user and the PIN number held on the card and the "reject" indicator 6 may for example be a read LED arranged to light up when the PIN numbers do not match. Credit cards have a magnetic strip on one side which carries information unique to that card in the form of a coded magnetic pattern. Behind and associated with the swipe slot 2 is a swipe reader. The swipe reader, which for example may be an off the shelf reader such as the HSR4 swipe reader available from McCorquodale Ltd., is arranged to read data relating to a PIN (Personal identification Number)

from the magnetic strip as a credit card is swiped therethrough. At present, the magnetic strip on credit cards is divided into three tracks, each of which carries data relating to the credit card and its user. The PIN number is encrypted into a twenty digit number which is held in track 2 of the card.

The exact manner of encryption is kept secret by the card companies for security reasons and since the method of encoding the PIN number is not material to the invention there is no need for it to be disclosed herein. In any case it is regarded as being well within the scope of the skilled man to devise his own technique for storing coded information relating to a PIN number on the magnetic strip, or indeed any other form of data storing medium of a credit type card. For example, as an alternative to using the existing encrypted data on a card it would be possible, subject of course to the necessary permission being granted by the company that owns the card, to encode a PIN number onto one of the other tracks, say track 3.

When a credit card sale is to be effected, the card is swiped through the swipe slot 2 and at least the PIN number extracted from the magnetic strip on the card. Once the card has been swiped through the swipe slot 2 the cardholder keys in the PIN number at the keyboard 3 and as the numbers are keyed in they

are displayed on a liquid crystal display 4. Thus enabling the cardholder to verify that the correct PIN number has been entered. The keypad includes numerical key pads representing the numbers zero to nine together with at least one additional key pad to identify an error (and to reset to enable the correct number to be entered). Once the pin number has been entered via the keyboard 3, it is compared with the encoded number on the card's magnetic strip and if a predetermined relationship, ie. a match, is found to exist between the keyed-in PIN number and the PIN number read from the card the card valid indicator 5 is lit to indicate the match. If the relationship is bad, i.e. the two PIN numbers are found not to match, then the "invalid" indicator 6 is lit. The cardholder may be given another opportunity to enter his PIN number or the trader may contact the card company for positive verbal confirmation that the card is valid. Thus the device 1 provides a means by which a first verification of the identity of a card user can be obtained.

As can be seen in Figure 2, the device 1 includes a verification circuit comprising the circuitry associated with the card swipe slot 2 and with the keyboard 3 which are connected via respective data lines 6, 7 to a comparator 8. When a card is swiped

through the swipe slot 2, the swipe circuit reads at least the coded PIN number from the card and outputs a signal representing that code along data line 7 to one input of the comparator 8. Similarly, when the user keys in the PIN number on the keyboard 3 a signal is output to the other input the comparator 8 via data line 7. These two signals are compared and if a match is found then the output 9 of the comparator is activated and used to energise the LED validity indicator 5.

Although shown as discrete components in Figure 2 of the drawings, it will be appreciated that the circuit can be readily implemented by way of a suitably programmed microprocessor. The following description of the operation of the device will be given with reference to the flow diagram shown in Figure 3 of the accompanying drawings and it will be appreciated that this flow diagram may be regarded as representing stages of operation in a suitably programmed microprocessor. A second embodiment of the invention is shown in Figure 3 of the accompanying drawings. In this second embodiment, the device comprising a swipe reader 2 interfaced via an R5232 or other similar interface 10 to a personal computer 11. a personal computer 11 has been used in prototype versions of the device but it will be appreciated that

in practice dedicated circuitry or a dedicated microprocessor would instead be used. The personal computer 11 may be an IBM PC/AT or an Amstrad PC1512 for example. The keypad 3 and the accept and reject LED's 5, 6 are connected to the personal computer 11 via a suitable multichannel interface 12 (e.g. a 48 Channel 1/0 card).

Referring now to Figure 4 of the accompanying drawings, the first stage of operation 15 is to locate and print information on the liquid crystal display. This information may for example be a message that the device is ready to receive a card for PIN number verification. Either before or after the message is displayed, the system is initialized to a state at which all variables required to decode data from the card once it has been read are available. This stage is represented by block 16.

Once the system is set up in its initial state a card can be swiped through the reader 2 and data read therefrom as represented by block 17.

When a card is swiped through the reader, the system enters a decoding routine represented by block 18 where it reads the encrypted PIN number from the card decodes the PIN number and performs other checks to ensure that the card has been correctly read and is generally in order. If the reading of the card fails

this initial check the routine starts again and the card must be reswiped through the swipe reader 2.

If the reading of the card is successful at block 18, the keyboard is scanned repeatedly in a scanning cycle represented by blocks 19 to 28 in Figure 4. Once all digits of the PIN number have been entered by the user (and in block 28 the PIN number is assumed for the sake of example to be four digits in length) the entered PIN number code is compared with the decoded PIN number from the card. This comparison is represented by block 29 in Figure 4. If the match is found to be good then the green "confirm" LED is illuminated and a message to the shopkeeper to proceed with the transaction is displayed in written form, e.g. on the liquid crystal display 4 or the display of the personal computer 11. If the two PIN numbers do not match the read "reject" LED is lit and a suitable message not to proceed is displayed.

Appendix 1 is a source code listing in BASIC of the sequence of operations represented by the flow diagram in Figure 4.

Once this verification of the card users identity has been given the purchase can proceed, with the card user signing a credit card sales slip in the usual manner to provide further proof of his or her identity. In the event that the cardholder forgets

his PIN number or for some other reason the PIN number input by the cardholder does not match the number from the card, the trader can call the card company for verification that the card is valid.

Thus the present invention provides an independent stand alone device for obtaining a first method of identification of a cardholder. The device requires no costly telecommunications or other links with a central computer and thus is simple and cheap to manufacture, install and maintain. The described embodiments are both sufficiently small to be powered by batteries and to be transportable.

Although the term "credit card" has been used herein, it will be appreciated that this term is not limited to cards owned by credit companies but extends to all type of plastics identity cards having an information carrying magnetic strip and thus includes, for example, charge cards, account cards and cheque guarantee cards.

An embodiment has been described and it will be clear to those possessed of the appropriate skills that many modifications are possible without departure from the ambit of the invention.

APPENDIX 1

```
0     ' CARD READ SYSTEM REEF DEVELOPMENT 1989/90 * PROFILE
      AUTOMATION*
1     'BARCLAYCARD ONLY
2     SCREEN 1
5     ON ERROR GOTO 2000
10    CLS
15    LOCATE 1,1 : PRINT"REEF DEVELOPMENT"
16    LOCATE 2,1 : PRINT"CARD READER     "
140   COM.PORT1 = 771 : COM.PORT2 = 775          "SET  COMMAND
                                                 PORT ADDRESS
150   PO.ADDR = 768 : P1.ADDR = 769 : P2.        'PORTS 0-2 SET
      ADDR = 770
160   P3.ADDR = 772 : P4.ADDR = 773 : P5.        'PORTS 3-5 SET
      ADDR = 774
170   OUT COM.PORT1,128                          'P0,P1,P2  all
                                                 outputs
180   OUT COM.PORT2,155                          'P3,P4,P5  all
                                                 inputs
190   GOSUB 600
191   '
195   LOCATE 1,2 : PRINT"PLEASE ASK CUSTOMER":PRINT" TO
      ENTER CODE ON KEYPAD"
200   OUT P0.ADDR,8    'set top row high ie 5 volts on top
      keys
210   X = INP (P3.ADDR)  :  IF X = 0 THEN 250 'CHECK  TOP
                                                 KEYS IF NO KEY
                                                 JUMP
220   IF X = 4 THEN K$=  "1":SOUND 2000+         'KEY 1 PRESSED
      (X*50 ),1
230   IF X = 2 THEN K$=  "2":SOUND 2000+         'KEY 2 PRESSED
      (x*50 ),1
240   IF X = 1 THEN K$=  "3":SOUND 2000+         'KEY 3 PRESSED
      (x*50 ),1
250   OUT PO.ADDR,4 '2nd row
260   X = INP (P3.ADDR) : IF X = 0 THEN 300
270   IF X = 4 THEN K$=  "4":SOUND 2000+(X*100),1
280   IF X = 2 THEN K$=  "5":SOUND 2000+(X*100),1
290   IF X = 1 THEN K$=  "6":SOUND 2000+(X*100),1
300   OUT PO.ADDR,2 '3rd row
310   X = INP (P3.ADDR) : IF X =0 THEN 350
320   IF X = 4 THEN K$=  "7":SOUND 2000+(X*150),1
330   IF X = 2 THEN K$=  "8":SOUND 2000+(X*150),1
340   IF X = 1 THEN K$=  "9":SOUND 2000+(X*150),1
350   OUT PO.ADDR,1 '4th row
360   X = INP (P3.ADDR)  :  IF X = 0 THEN 400
370   IF X = 4 THEN K$=  "*":SOUND 2000+(X*200),1
380   IF X = 2 THEN K$=  "0":SOUND 2000+(X*200),1
390   IF X = 1 THEN K$=  "#":SOUND 2000+(X*200),1
400   IF K$="#" THEN 500  'CHECK FOR OTHER KEYS
401   IF K$="*" THEN 500
405   IF K$="" THEN 200
```

```
406  '
410  W$=W$+K$:K$="":LOCATE 2,27:PRINT W$
415  L=LEN(W$): IF L=4 THEN 450
420  OUT PO.ADDR,15 : X = INP (P3.ADDR) : IF X <> 0 THEN
     420
430  OUT PO.ADDR,0 :GOTO 200  'RESET IN/OUT BOARD
450  KY = VAL(W$)
455  CLS
460  IF CODE = KY THEN LOCATE 4,2 : PRINT"CORRECT CODE :
     ACCEPT CUSTOMERS CARD " :OUT PO.ADDR,32  'LIGHT GREEN
     LED
470  IF CODE <> KY THEN LOCATE 4,2 : PRINT"WRONG CODE :
     CHECK CARD " :OUT PO.ADDR,16 'LIGHT RED LED
500  FOR T = 0 TO 15000 : NEXT
510  RUN
512  '
600  LOCATE 4,1 : PRINT"Insert your card to read :"
602  OPEN  "com1:2400,n,8,1,1f"  AS  #1   'OPEN  CHANNEL  TO
     RS232 CARD/TALK ECT
605  A$="212"
610  PRINT #1,A$
615  LINE INPUT #1,B$  ' READ CARD DATA
620  C$= LEFT$(RIGHT$(B$,6),4  'EXTRACT No FROM B$ put into
     c$
625  CODE = VAL(C$) 'CODE = No on card
626  '
627  IF C$=" err" THEN RUN  ' CHECK FOR ERROR CODE FROM
     CARD
628  IF C$="issi" THEN RUN  ' CHECK FOR ISSI CODE FROM CARD
     IE WRONG TYPE
629  LOCATE 4,27:PRINT" OK":FOR T= 0 to 2000:NEXT
630  CLS : RETURN
2000 CLS:LOCATE 5,5 : PRINT"PLEASE CHECK CONNECTIONS ":FOR
     T= 0 to 10000:,NEXT,
RUN
```

CLAIMS:

1. An apparatus for use in verifying the identity of the holder of a credit type card, which apparatus comprises reading means for reading a predefined identifying code from a card, input means by which the holder can enter an identifying code, and comparing means for comparing the holder input code with the code read from the card and for indicating whether a predefined relationship exists between the two codes thereby providing verification of the identity of the card holder.

2. An apparatus as claimed in claim 1, wherein the reading means comprises a card swipe arranged to extract and decode and encoded identifying code held in a magnetic strip on the card.

3. An apparatus as claimed in claim 1 or 2, wherein the input means comprises a keyboard.

4. An apparatus as claimed in claim 1 or 2 or 3, wherein the comparing means comprises a suitably programmed computer or microprocessor.

5. An apparatus as claimed in any preceding claim, wherein the indicating means comprises at least a light emitting diode for providing a positive indication of the existence of said predefined relationship.

6. An apparatus as claimed in any preceding claim, adapted to be internally powered and to be transportable.

7. A method for verifying the identity of the holder of a credit type card, the method comprising obtaining a predefined identifying code from a card, obtaining an identifying code from the card holder, and comparing the predefined identifying code from the card with the identifying code from the card holder to determine whether or not a predefined relationship exists between the two codes.

8. A method for providing first verification of the identity of a credit-type card user, in which method an encoded identity code is read from the card and compared with a code supplied by the user, and wherein where a predefined relationship is found to exist between the two numbers, verification of the identity of the cardholder can be assumed.

9. A method or apparatus as claimed in any preceding claim wherein the code is a multi-digit number.

10. A method or apparatus as claimed in any preceding claim wherein the predefined relationship is a match.

11. A method or apparatus substantially as herein described with reference to the accompanying drawings.

FIG. 1

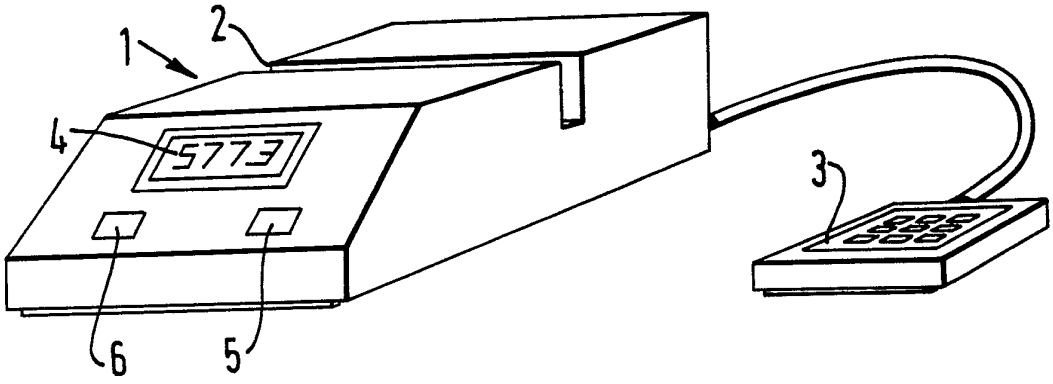
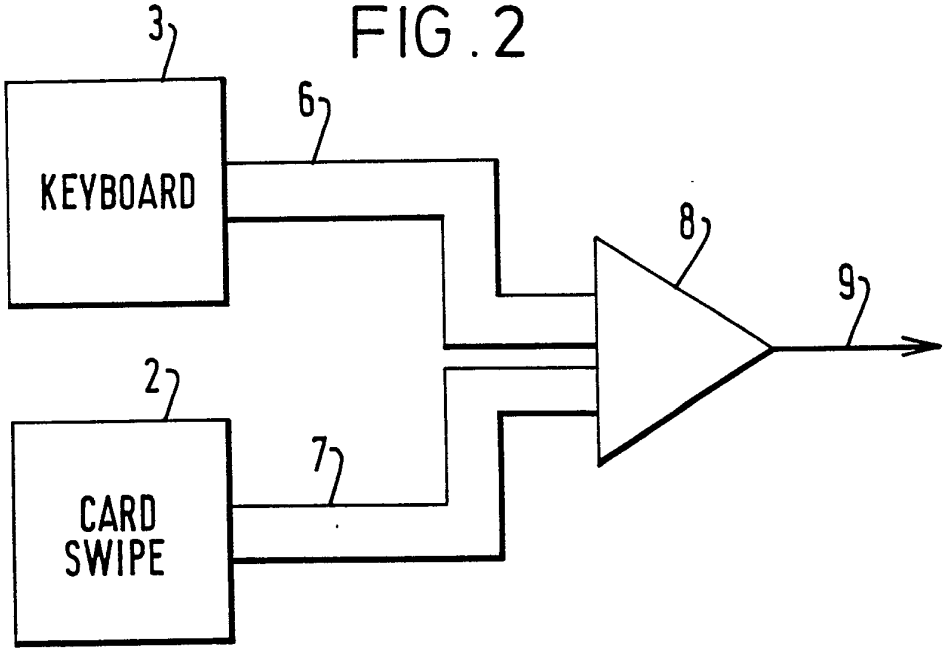


FIG. 2



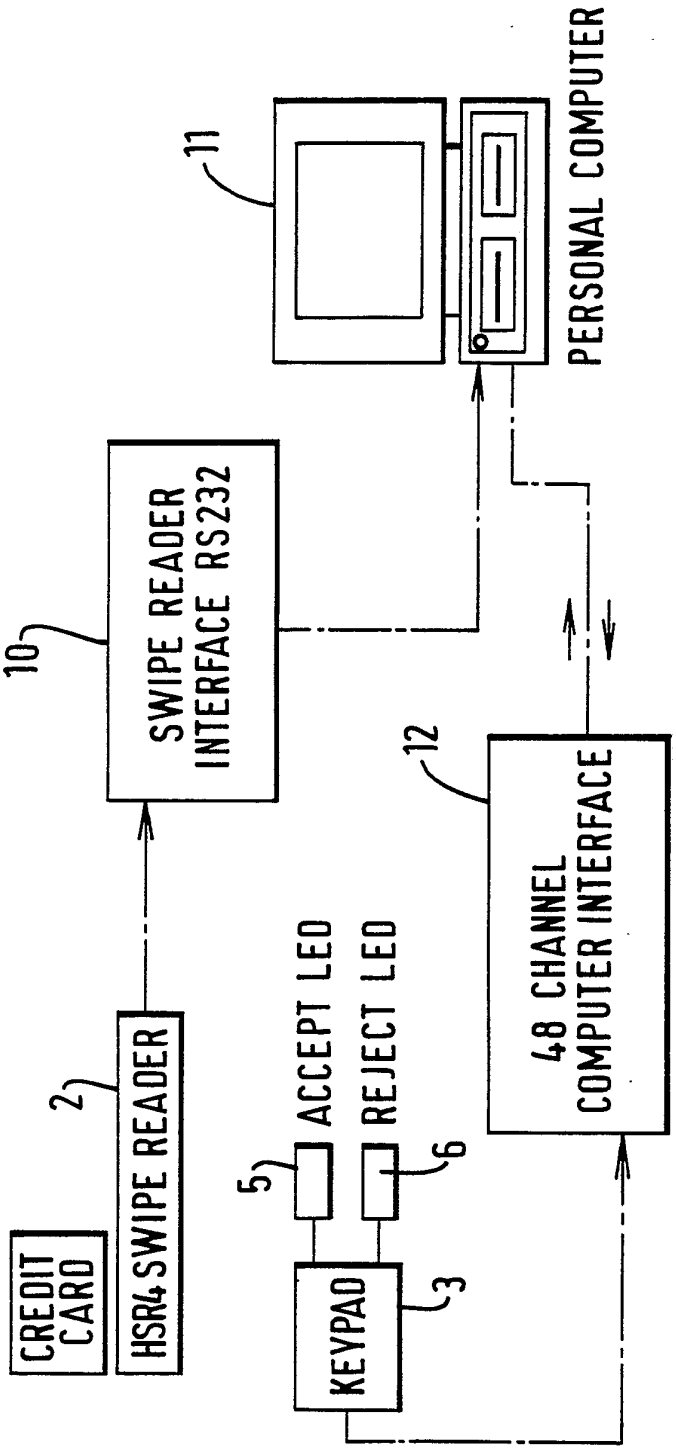
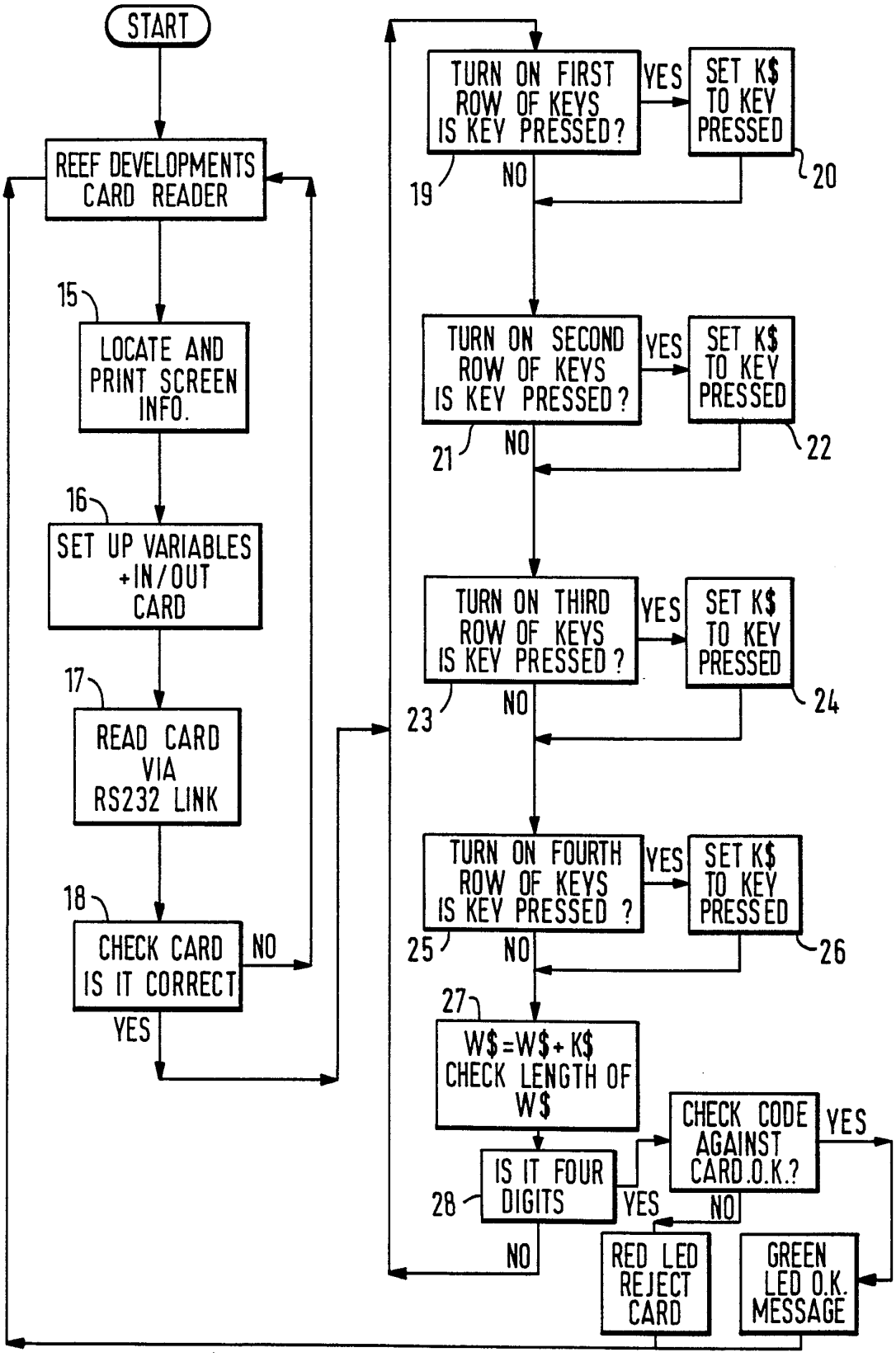

PERSONAL COMPUTER
11
SWIPE READER INTERFACE RS232
10
48 CHANNEL COMPUTER INTERFACE
12
ACCEPT LED
REJECT LED
5
6
KEYPAD
3
HSR4 SWIPE READER
2
CREDIT CARD

FIG. 3

FIG. 4


START
REEF DEVELOPMENTS CARD READER
15
LOCATE AND PRINT SCREEN INFO.
16
SET UP VARIABLES +IN/OUT CARD
17
READ CARD VIA RS232 LINK
18
CHECK CARD IS IT CORRECT
NO
YES
TURN ON FIRST ROW OF KEYS IS KEY PRESSED?
YES
SET K$ TO KEY PRESSED
19
NO
20
TURN ON SECOND ROW OF KEYS IS KEY PRESSED?
YES
SET K$ TO KEY PRESSED
21
NO
22
TURN ON THIRD ROW OF KEYS IS KEY PRESSED?
YES
SET K$ TO KEY PRESSED
23
NO
24
TURN ON FOURTH ROW OF KEYS IS KEY PRESSED?
YES
SET K$ TO KEY PRESSED
25
NO
26
27
W$=W$+K$ CHECK LENGTH OF W$
IS IT FOUR DIGITS
28
YES
NO
CHECK CODE AGAINST CARD.O.K.?
YES
NO
RED LED REJECT CARD
GREEN LED O.K. MESSAGE

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/01388

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 G06K7/08 ; G07F7/10

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	G06K ; G07F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	GB,A,2114348 (BURKE B.J.) 17 August 1983 see page 1, line 5 - page 2, line 120; claims 1-6; figures 1-2, 7 ---	1-5, 7-11
X	PATENT ABSTRACTS OF JAPAN vol. 6, no. 206 (P-149)(1084) 19 October 1982, & JP-A-57 111760 (FUJITSU) 12 July 1982, see the whole document ---	1-4, 7-10
X	US,A,3794813 (SPETZ) 26 February 1974 see column 1, line 3 - column 11, line 29; figures 1-2 ---	1-3, 7-9
X	DE,A,3632294 (SIEMENS AKTIENGESELLSCHAFT) 07 April 1988 see the whole document ---	1, 3-4, 6-10

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
14 JANUARY 1991	31. 01. 91
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	GYSEN L.A.D.

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB9001388

SA 39891

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 14/01/91
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
GB-A-2114348	17-08-83	None		
US-A-3794813	26-02-74	CA-A-	1010994	24-05-77
		DE-A-	2338365	21-02-74
		GB-A-	1439163	09-06-76
DE-A-3632294	07-04-88	None		