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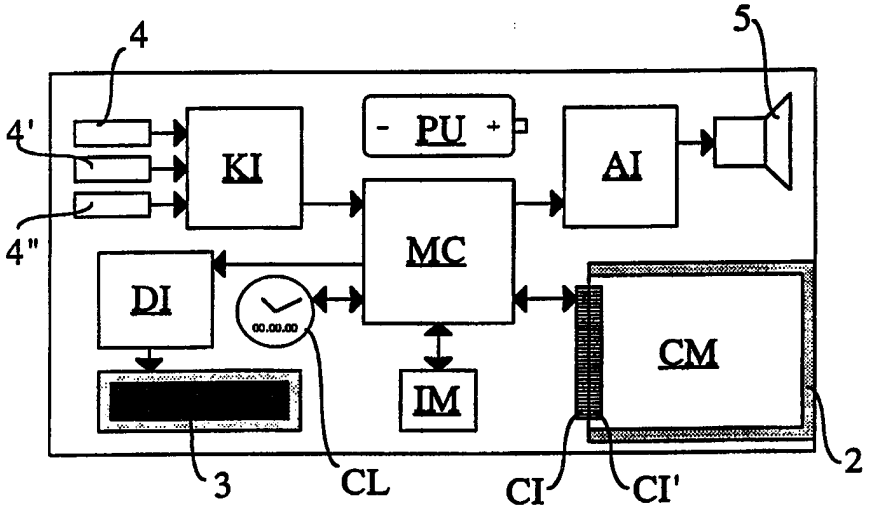

(57) Abstract

A process for transmitting confidential communications by telephone, characterized in that it includes the following operative steps: associating said communications with a series of codes stored in at least one memory (CM) of a transmitting device (13); selecting in the transmitting device one or more preset codes associated with said communications; adding the selected codes to a set of data contained in at least one memory (CM, IM) of the transmitting device; encoding said set of data in the transmitting device through at least one algorithm based on the contents of a periodical counter (CL) connected thereto; transforming the encoded data into an acoustic signal; transmitting said acoustic signal from the transmitting device through a telephone (12) acoustically coupled thereto; receiving the acoustic signal through a receiving device (8, 9) connected to the telephone network (10); transforming the received acoustic signal into a set of encoded data; decoding the data received in the receiving device through at least one algorithm based on the contents of a periodical counter connected thereto. The present invention also relates to a transmitting device and a receiving device which carry out said process.

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A PROCESS FOR TRANSMITTING CONFIDENTIAL COMMUNICATIONS BY TELEPHONE AND ELECTRONIC DEVICES FOR CARRYING OUT SAID TRANSMISSION

The present invention relates to a process for transmitting by telephone confidential communications, e.g. bank transactionss or orders of disabling debit and/or credit cards, as well as a transmitting device and a receiving device which carry out this process. In particular, the present invention relates to a transmitting device of small size and easy to operate which provides the transmission of said communications with a high degree of security.

It is known that in case of theft or loss of debit and/or credit cards the probability of said cards being fraudulently used is directly proportional to the time required by the legitimate owner to communicate to his bank and/or to other bank cards issuing companies the request of disabling the lost or stolen cards. In fact, statistics show that 80% of the frauds related to the loss or theft of bank cards takes place in the four hours following said events. Presently, in order to carry out said disabling request as soon as possible, the owner of the lost or stolen cards must contact by telephone a specific service and communicate his personal and banking data. The operator performing said service, upon checking the correctness of the supplied data, provides the disabling of the lost or stolen cards by introducing said data in a peripheral computer connected through a network to the central computer of the card issuing company, which contains the database of the authorizations associated with all the cards issued by the company.

It is clear that, in order to be effective, the above-mentioned disabling service must be available every day 24 hours a day and must be provided with a sufficient number of lines so as to reduce as much as possible the probability that the caller finds the line busy. However, despite the fact that the issuing companies invest significant economical and human resources in order to expand the disabling service, the average time presently required to carry out all the above-described operations is about 4 minutes. This time has obviously to be multiplied for each card issued by each different issuing company, with a subsequent increase in the answering time and in the

risk of fraud.

Moreover, the use of telephone lines does not assure the confidentiality of the communications to the disabling service, whereby it is not possible to prevent someone from tapping the disabling order so as to obtain the confidential data of the owner and use them unlawfully.

Therefore, the object of the present invention is to provide a process for transmitting by telephone in a simple, quick and secure way the confidential communications, such as bank transactions or the disabling orders of debit and/or credit cards.

Another object of the present invention is to provide a transmitting device and a receiving device which allow to carry out the process according to the present invention.

These objects are achieved through a process whose main features are defined in the first claim, a transmitting device and a receiving device whose main features are defined in the fifteenth and in the twenty-fourth claim.

The process according to the present invention, while maintaining a high degree of transmission security, does not require a particular commitment by the user, who can carry out said transmission quickly and without any difficulty.

Thanks to its simple construction and to the low cost of its components, the transmitting device according to the present invention can be advantageously mass-produced on a large scale with a subsequent decrease of the manufacturing costs. In this way, the production of a high number of transmitting devices is however cheaper than maintaining the present disabling service. Furthermore, the transmitting device according to the present invention can easily be reduced to pocket size, whereby it can be easily carried by the user, preferably in a place separate from the credit and/or debit cards.

Another advantage stems from the fact that the receiving device according to the present invention includes a computer connected through a network to the central computer containing the database with the files of each user, whereby all the communications transmitted by the user through the transmitting device according to the present invention, e.g. the disabling orders, are forwarded to said database in real

time.

A further advantage is given by the fact that, since its internal memory is preferably programmable and removable, the transmitting device according to the present invention can be used to transmit a wide range of confidential communications to several receiving devices, belonging not only to banks, but to commercial companies, information services, etc. as well. To this purpose, the internal memory is preferably mounted in a known way on a thin, rectangular plastic substrate, provided on its surface with a plurality of electrical contacts, of the type used in the production of smart cards.

Further advantages and characteristics of the process and devices according to the present invention will be clear to those skilled in the art from the following detailed description of some embodiments thereof, with reference to the annexed drawings wherein:

- Fig. 1 shows an axonometric view of an embodiment of the transmitting device according to the present invention;
- Fig. 2 shows a block diagram of the internal structure of the device of fig. 1:
- Fig. 3 shows an axonometric view of a second embodiment of the transmitting device according to the present invention;
- Fig. 4 shows a block diagram of the internal structure of the device of fig. 3:
- Fig. 5 shows a simplified diagram of the connection between a transmitting device and a receiving device according to the present invention; and
- Fig. 6 shows a flow chart of the process according to the present invention.

With reference to figure 1, there is seen that the transmitting device according to the first embodiment of the present invention includes an outer case 1, preferably shaped as a parallelepiped and made of plastic, having a slot 2 in one of its smaller faces. This slot is used to introduce into the device a permanent memory (not shown in the figure) whose function will be described further on. The upper face of case 1 is provided with a liquid crystal display 3 and a keyboard including three keys 4, 4', 4" used to control the operation of the transmitting device. The latter is also provided with a speaker 5 preferably arranged on the face opposite to the face with the keys 4, 4' and 4", so that it is possible to strike said keys even when the speaker 5 is in

contact with the microphone of a telephone. In particular, keys 4 and 4' are used to select an option of the transmitting device, such as the selection of the card or cards to be disabled, while key 4" is used to control the carrying out of said option. It is clear that in other embodiments of the transmitting device according to the present invention the keyboard may include a higher or lower number of keys. In particular, it may resemble or be identical to the keyboard of a conventional telephone.

Referring now to figure 2, there is seen that the transmitting device according to the present invention includes therein a central electronic processor MC controlling the working of the whole device. This processor receives an input of electric signals emitted by a keyboard interface KI upon striking of the keys 4, 4', 4".

The options selected through these keys, as well as other service information, are displayed by display 3 through the electric control signals emitted by a video interface DI connected to processor MC.

The latter is also connected to an electronic periodical counter CL, in particular a quartz clock which provides a numerical signal indicating the current time and date, which can obviously be set directly by the user through keys 4, 4' and 4".

Processor MC is connected to a permanent memory IM, preferably a ROM memory, containing the operating program of the processor. Memory IM also contains a univocal serial code associated with each transmitting device unit. In this way it is possible to recognize, and possibly prevent, the receiving of communications from devices which were lost, stolen or however not authorized.

Processor MC is connected through a plurality of electric contacts CI to a further permanent memory CM, preferably re-writable, which is mounted in a known way on a thin, rectangular plastic substrate provided on its surface with a plurality of electric contacts CI' complementary to contacts CI. This known type of permanent memory is presently used for producing smart cards which can be used as telephone cards, identity cards, credit cards, etc. In particular, memory CM of the transmitting device according to the present invention is factory-programmed with a group of numerical data containing the following information:

- univocal user identification code (e.g. his fiscal code);
- preset codes associated with each confidential communication which can be

transmitted by the user (e.g. the numbers of the cards of the user);

- secret code enabling the writing/modification of the stored data (preferably unknown to the user);
- secret code enabling the use of the transmitting device (preferably known only to the user);
- one or more telephone numbers of the receiving device;
- current date and time.

On the basis of the data and program stored in the memories IM and CM, of the time signal emitted by clock CL and of the commands given through keys 4, 4' and 4", processor MC emits an electric signal which is converted by an audio interface AI into a sequence of tones emitted through speaker 5. The transmitting device according to the present invention finally includes a current supply PU, in particular a conventional circular battery, providing the electric power to all the members of the device.

With reference to figures 3 and 4, there is seen that a second embodiment of the transmitting device according to the present invention includes also a microphone 6 arranged at a distance from speaker 5 such that it is possible to acoustically couple said microphone and said speaker respectively to a speaker and a microphone of a telephone. Microphone 6 is electrically connected to the audio interface AI, whereby the acoustic signals received by said microphone are converted through said interface into electric signals which can be recognized by processor MC. By this arrangement, it is possible to control the operation of said processor through a series of acoustic control signals transmitted by telephone from the receiving device.

The present embodiment of the transmitting device includes also a serial interface 7 connected to processor MC. By this arrangement, it is possible to introduce from outside, in particular through a peripheral computer, the data required for the operation of the device. These data can be stored in memory CM or in memory IM. In this latter instance, memory IM must obviously be re-writable, so as to make optional the use of memory CM.

Referring to figure 5, there is seen that the receiving device according to the present invention includes at least a computer 8 of a known type controlled by a

suitable program and provided with an internal periodical counter, in particular an electronic clock. Computer 8 is connected to a communication device 9 of known type, e.g. an external modem, which is in turn connected to the telephone network 10. Computer 8 is also connected, through a local or wide area data network, to a central computer 11 containing the general database which may in turn be connected to other peripheral computers operating as receiving devices. In particular, the central computer 11 contains the files of the data, operations and authorizations of all the credit and/or debit cards issued by one or more banks.

To the telephone network 10 is obviously connected also the telephone 12 to which the transmitting device 13 according to the present invention must be acoustically coupled.

Referring to figure 6, there is seen that, in use, the transmitting device 13 according to the present invention must first of all be turned on, e.g. by pressing one or more keys 4, 4' and/or 4". After it is turned on, the device prompts the user for the introduction though said keys of the secret code stored in memory MC. Upon occurrence of three erroneous introductions of said code, the device would stop and could not be used anymore prior to re-programming of memory MC. By this arrangement, the use of the transmitting device by persons not authorized by the user is prevented.

After introducing the secret code, the transmitting device shows on display 3 the current time and date supplied by clock CL. If the displayed time and date are not correct, the user can set them correctly by acting on keys 4, 4' and 4". At this moment, the user must select the communication or communications he wishes to send, e.g. the disabling request of a particular lost credit card. The code corresponding to said request was already stored in memory CM, whereby the user only has to select this code with the aid of display 3 and keys 4, 4' and 4". If necessary, the user can also add some further information to the selected communication, for instance the data relating to the amount and the beneficiary of a bank transaction.

In order to send the selected communication, the user must place the transmitting device close to the microphone of telephone 12 and dial on the latter the

telephone number of the receiving device 8. Alternatively, he can select the telephone number stored in memory CM. In this case, processor MC sends the sequence of digits of the selected number to the audio interface AI, which emits through speaker 5 a sequence of telephone tones corresponding to the selected number. In this way, the transmitting device automatically dials the telephone number of the receiving device and connects thereto.

Once the transmitting device and the receiving device are connected, the receiving device prompts the user, through the speaker of telephone 12, for the confirmation of the sending of the communication through one of keys 4, 4' and 4''. Upon receipt of said confirmation, processor MC of the transmitting device takes from memories IM and CM the code of said communication, the user identification code and the serial code of the transmitting device, and combines said codes with the current time and date obtained from clock CL. The encoding algorithm used for said combination is also based on the current time and date and can be selected among the known algorithms by the writer of the program contained in memory IM or it can be created from scratch for the process according to the present invention.

To the set of numbers resulting from said encoding there is added a control code in order to identify possible transmission errors, e.g. caused by interference on the telephone line. The resulting sequence of numbers is sent to the audio interface AI, which converts the digits of said numbers into a sequence of tones which is emitted by speaker 5.

This sequence of tones is received and decoded by the receiving device 8 through an inverse algorithm with respect to the encoding algorithm used by the transmitting device. First of all, the receiving device 8 checks the control code. If said code is consistent with the received data, the receiving device 8 extracts from the remaining data the meaningful codes, i.e. the code of the transmitted communication, the user identification code and the serial code of the transmitting device, as well as the time and date of transmission. In order to obtain said data, the decoding algorithm, inverse with respect to the above-mentioned encoding algorithm, is based on the time and date provided by the internal clock of the receiving device. The latter also checks whether the transmitted time and date correspond with the time and date

provided by the internal clock. In case of lack of correspondence of said time reference, beyond a possible small tolerance, e.g. equal to one minute, the receiving device indicates a transmission error and stops the communication.

In order to increase the security, after about 2 to 10 seconds, preferably 5 seconds, from the end of the first transmission the transmitting device carries out said transmission for the second time. If the data obtained from the second transmission correspond with the data obtained from the first transmission, the receiving device checks in its database, through the user identification code and the serial code of the transmitting device, if the transmitted communication can be validated. If this check is positive, the receiving device 8 forwards in real time to the central computer 11 the contents of the communication, e.g. the confirmation of a bank transaction or the disabling order of a certain credit card. Finally, if said order has been carried out, the receiving device 8 sends to the user through telephone 12 a pre-recorded reply, e.g. by voice sampling, confirming the execution of the order and/or providing some information to the user, i.e. the actual balance of his account. In the opposite instance, as well as in case of error or code violation attempt, the receiving device 8 sends to the user a pre-recorded reply indicating the lack of execution of the order and possibly the reasons why said order was not carried out.

Upon receipt of the reply to the transmitted communication, the user can carry out another transmission or turn off the transmitting device and hang telephone 12.

In the case where, as in the second embodiment of the transmitting device according to the present invention, the transmitting device is provided with a microphone 6, the transmission of the communication by said device is controlled by the receiving device through acoustic control signals emitted by modem 9 and received by said microphone. In this case, the pre-recorded replies can be replaced by suitable acoustic signals which are converted by processor MC into a text shown on display 3.

It is obvious that in another embodiment of the transmitting device according to the present invention, the audio interface AI, the video interface DI, the keyboard interface KI, clock CL and/or the internal memory IM may be integrated with processor MC into a single microprocessor. By this arrangement, it is possible to

decrease the costs of mass-production on a large scale of the transmitting device.

It is also obvious that in another embodiment of the transmitting device according to the present invention, memory CM and/or memory IM can be made with electronic memory means different from those described above, e.g. fixed memories of the EPROM, EEPROM, NOVRAM, Flash EPROM and buffered RAM types, as well as removable memories of the PCMCIA type.

It is finally obvious that in a further embodiment of the transmitting device according to the present invention, the acoustic signal transmitted over the telephone line can be any acoustic signal suitable for the data encoding, e.g. a signal modulated on the basis of modem and/or fax protocols.

CLAIMS

1. A process for transmitting confidential communications by telephone, characterized in that it includes the following operative steps:
   - associating said communications with a series of codes stored in at least one memory (CM) of a transmitting device (13);
   - selecting in the transmitting device one or more preset codes associated with said communications;
   - adding the selected codes to a set of data contained in at least one memory (CM, IM) of the transmitting device;
   - encoding said set of data in the transmitting device through at least one algorithm based on the contents of a periodical counter (CL) connected thereto;
   - transforming the encoded data into an acoustic signal;
   - transmitting said acoustic signal from the transmitting device through a telephone (12) acoustically coupled thereto;
   - receiving the acoustic signal through a receiving device (8, 9) connected to the telephone network (10);
   - transforming the received acoustic signal into a set of encoded data;
   - decoding the data received in the receiving device through at least one algorithm based on the contents of a periodical counter connected thereto.
2. A process according to the preceding claim, characterized in that the periodical counters in the transmitting device and in the receiving device are synchronized with the current date and/or time.
3. A process according to one of the preceding claims, characterized in that the transmission of the acoustic signal from the transmitting device is repeated at least once.
4. A process according to the preceding claim, characterized in that the transmission of the acoustic signal from the transmitting device is repeated with a frequency between 2 and 10 seconds, preferably 5 seconds.
5. A process according to one of the preceding claims, characterized in that further

information is added by the caller to the selected codes associated with the confidential communications, before said selected codes are added to the set of data contained in the at least one memory of the transmitting device.

6. A process according to one of the preceding claims, characterized in that the sequence of the operative steps carried out by the transmitting device is controlled by the receiving device through acoustic control signals transmitted by telephone.

7. A process according to one of the preceding claims, characterized in that the activation of the sequence of the operative steps carried out by the transmitting device is dependent on the correct introduction of a secret code.

8. A process according to one of the preceding claims, characterized in that the acoustic signals transmitted by telephone include at least a sequence of tones univocally associated with the digits from 0 to 9.

9. A process according to one of the preceding claims, characterized in that the memory of the transmitting device includes at least a univocal identification code of the caller.

10. A process according to one of the preceding claims, characterized in that the memory of the transmitting device includes a plurality of preset codes associated with each confidential communication which can be transmitted by the caller.

11. A process according to one of the preceding claims, characterized in that the memory of the transmitting device includes at least one secret code enabling the writing/modification of the stored data.

12. A process according to one of the preceding claims, characterized in that the memory of the transmitting device includes at least one secret code enabling the use of the transmitting device.

13. A process according to one of the preceding claims, characterized in that the memory of the transmitting device includes at least one telephone number belonging to a receiving device.

14. A process according to one of the preceding claims, characterized in that the memory of the transmitting device includes the current date and time.

15. A transmitting device for carrying out the process according to one of the preceding claims, characterized in that it includes at least one keyboard (4, 4', 4"), an electronic memory (CM), a periodical counter (CL) and a speaker (5) electrically connected to at least one central processor (MC) suitable to:
    - associating the data stored in said memory (CM) with one or more codes selected through said keyboard (4, 4', 4");
    - encoding said data through at least one algorithm based on the contents of said periodical counter;
    - transforming the encoded data into an acoustic signal transmitted through said speaker.
16. A transmitting device according to the preceding claim, characterized in that said periodical counter is synchronized with the current date and/or time.
17. A transmitting device according to claim 15 or 16, characterized in that it further includes a display (3) suitable to show the codes of the communications to be transmitted, the options of the operative steps and/or the data stored in the memory.
18. A transmitting device according to the preceding claim, characterized in that said display is a liquid crystal display.
19. A transmitting device according to one of claims 15 to 18, characterized in that the memory is mounted on a rigid substrate which is removable through an opening (2) formed in the case (1) of the device, which device is provided with electric contacts (CI) mutually engageable with complementary contacts (CI') provided on said substrate for transferring the data stored in the memory.
20. A transmitting device according to one of claims 15 to 19, characterized in that it includes an external data interface (7) through which the data to be stored in the memory can be introduced.
21. A transmitting device according to the preceding claim, characterized in that said interface is a serial interface.
22. A transmitting device according to one of claims 15 to 21, characterized in that it

includes a further read-only memory (IM) connected to the central processor and containing at least one univocal serial code associated with each transmitting device unit.

23. A transmitting device according to one of claims 15 to 22, characterized in that it includes a microphone (6) connected to the central processor which transforms an acoustic signal received through said microphone into a sequence of data.

24. A receiving device for carrying out the process according to one of claims 1 to 14, characterized in that it includes at least a communication device (9) connected to the telephone network (10), an electronic memory, and a periodical counter electrically connected to at least one processor suitable to:
    - transforming the acoustic signal received through said communication device into a set of encoded data;
    - decoding said data through at least one algorithm based on contents of said periodical counter;
    - retrieving one or more communications stored in said memory according to at least one preset code contained in the decoded data.

25. A receiving device according to the preceding claim, characterized in that said communication device includes a generator of acoustic signals which can be transmitted over the telephone line to control the operation of the transmitting device.

26. A receiving device according to claim 24 or 25, characterized in that said communication device includes at least one modem.

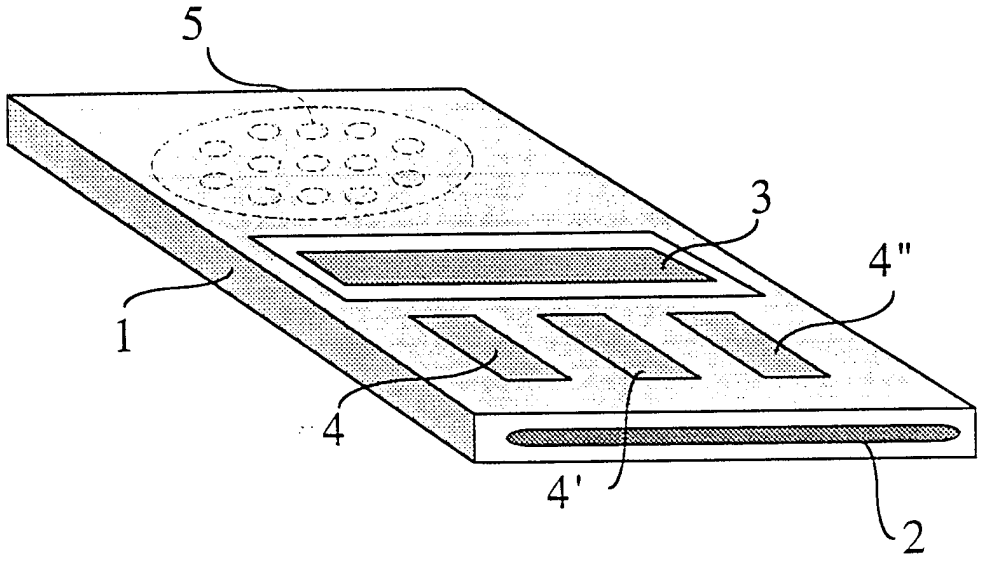

Fig.1

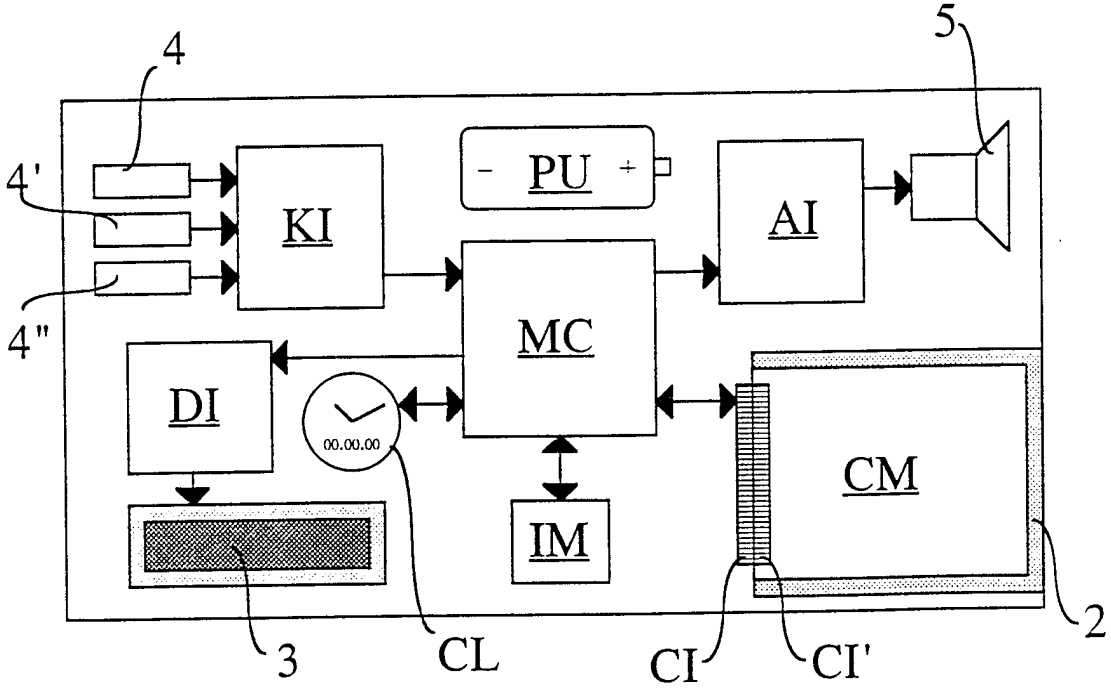

Fig.2

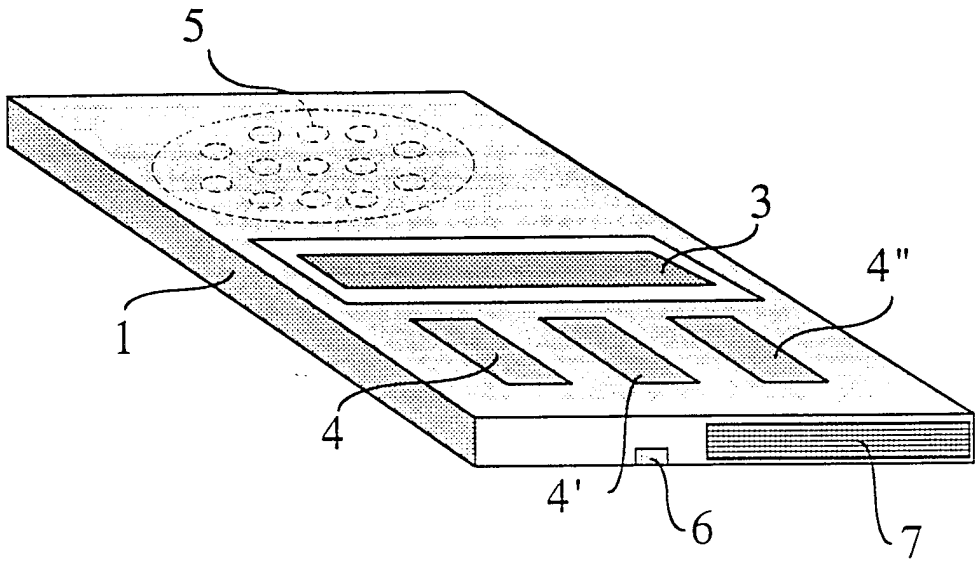

Fig.3

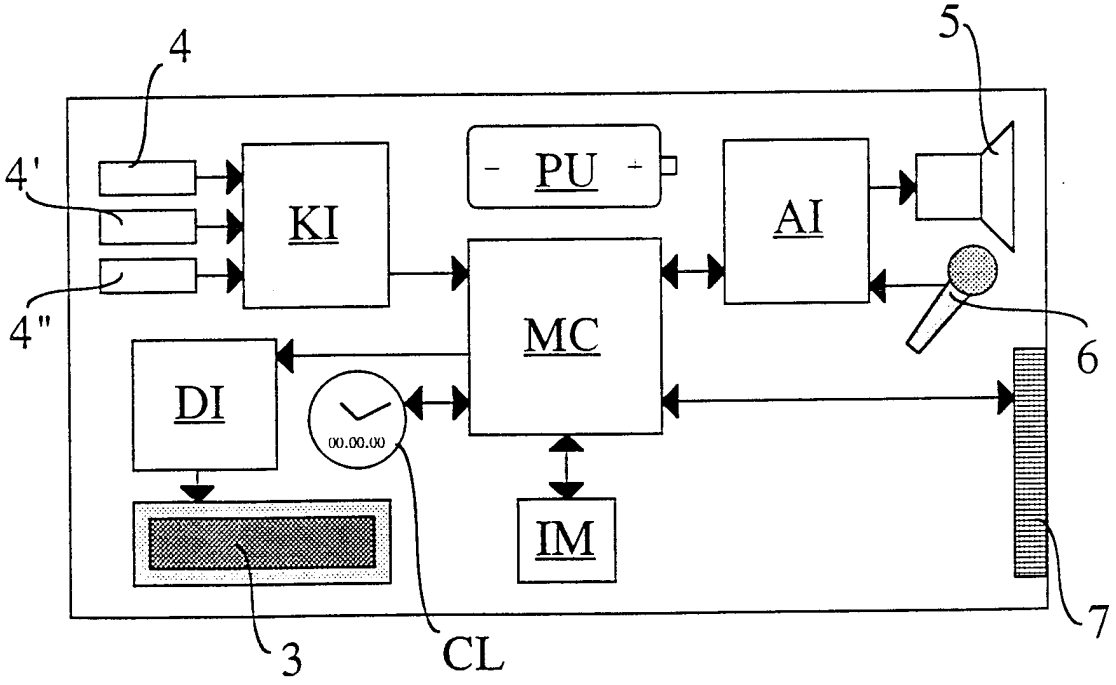

Fig.4

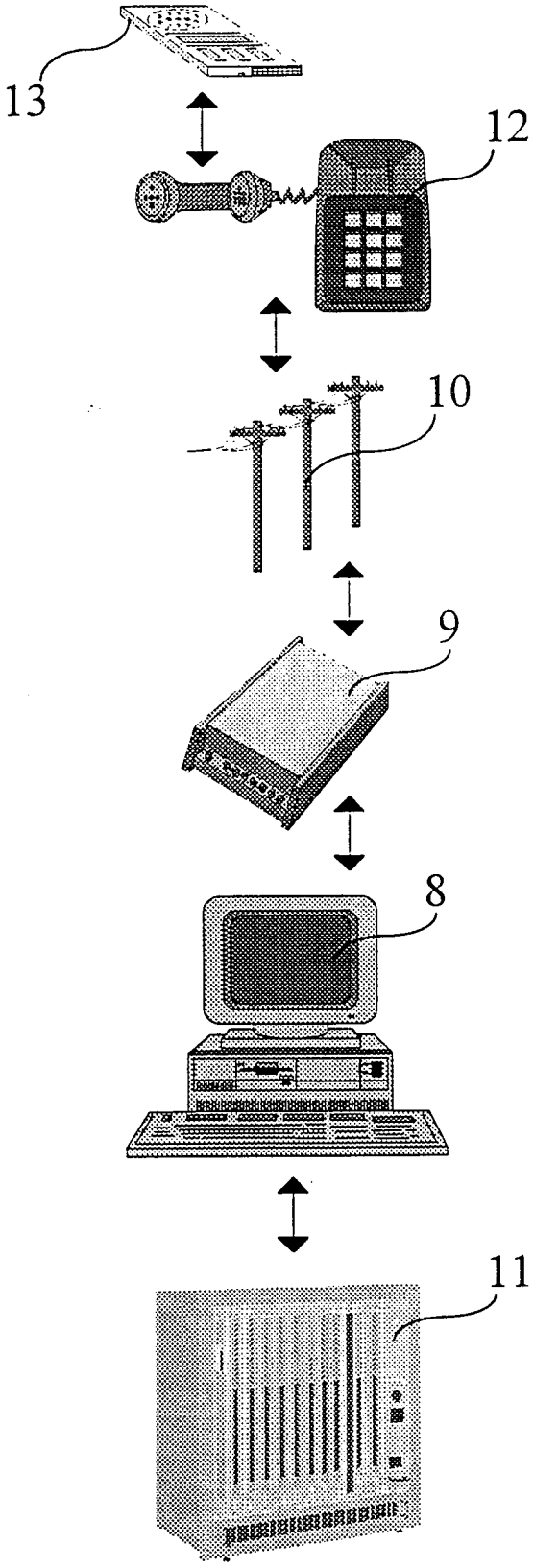

Fig.5

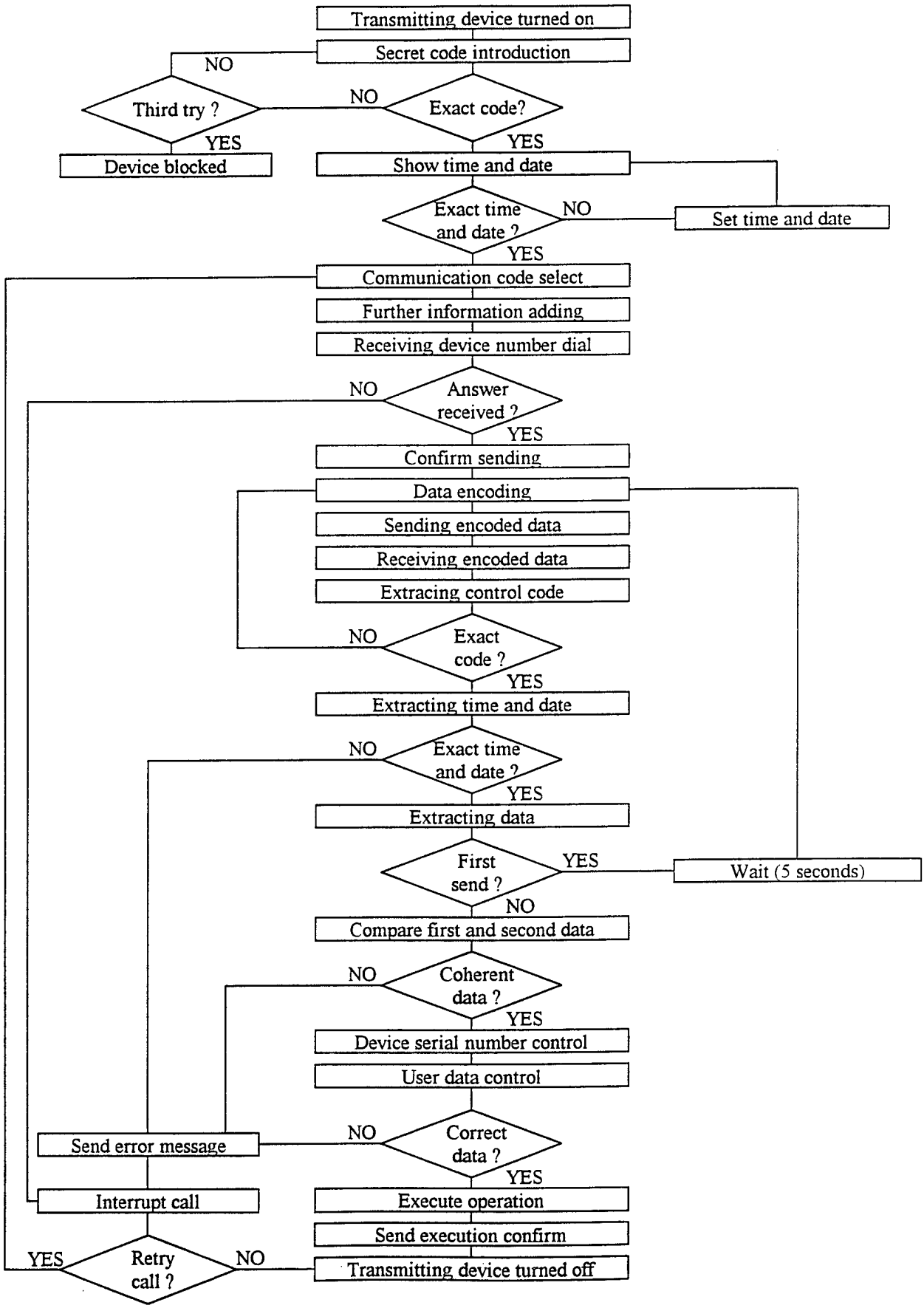
Transmitting device turned on
Secret code introduction
NO
Third try ?
NO
Exact code?
YES
Device blocked
YES
Show time and date
Exact time and date ?
NO
Set time and date
YES
Communication code select
Further information adding
Receiving device number dial
NO
Answer received ?
YES
Confirm sending
Data encoding
Sending encoded data
Receiving encoded data
Extracing control code
NO
Exact code ?
YES
Extracting time and date
NO
Exact time and date ?
YES
Extracting data
First send ?
YES
Wait (5 seconds)
NO
Compare first and second data
NO
Coherent data ?
YES
Device serial number control
User data control
Send error message
NO
Correct data ?
YES
Interrupt call
Execute operation
Send execution confirm
YES
Retry call ?
NO
Transmitting device turned off

Fig.6

INTERNATIONAL SEARCH REPORT

Intern ial Application No
PCT/IT 98/00146

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L9/32 G07F7/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L G07F H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 524 072 A (LABATON ISAAC ET AL) 4 June 1996	1,12,15
A	see abstract see column 3, line 56 - column 4, line 49 see column 6, line 34 - column 7, line 30 see column 7, line 40 - line 44 see column 8, line 26 - line 29 see figures 1,2	2-4,6-9, 11,13, 14,16, 24,25
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 November 1998	09/11/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Gautier, L

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INTERNATIONAL SEARCH REPORT

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PCT/IT 98/00146

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 539 819 A (SONOYAMA YUKIO ET AL) 23 July 1996 see abstract see column 1, line 62 - column 2, line 30 see column 5, line 20 - line 45 see figures 5,6	1,15, 17-20, 22,23
A	EP 0 374 012 A (FRANCE ETAT) 20 June 1990 see the whole document	1,3,4

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern: ai Application No
PCT/IT 98/00146

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5524072 A	04-06-1996	IL 100238 A	24-01-1995
		US 5742684 A	21-04-1998
		CA 2125193 A	10-06-1993
		EP 0615673 A	21-09-1994
		JP 7505023 T	01-06-1995
		WO 9311619 A	10-06-1993
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