

Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 0 889 453 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.01.1999 Bulletin 1999/01

(51) Int. Cl.⁶: **G08C 19/28**

(21) Application number: **98111928.2**

(22) Date of filing: **27.06.1998**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(71) Applicant:
**Ferport S.a.s. di M. Biassoni e C.
20052 Monza (MI) (IT)**

(72) Inventor: **Biassoni, Massimo
20052 Monza (MI) (IT)**

(74) Representative: **Monti, Umberto
Via Washington 48
20146 Milano (IT)**

(30) Priority: **03.07.1997 IT MI971572**

(54) **A programmable code remote control system**

(57) A remote control system comprising a transmitter (10), provided with a memory (M) in which an enabling code (CODE) can be stored, and a receiver (20) adapted to receive a signal sent out by said transmitter (10) and containing said code (CODE). Two or more

encoding devices (30, 40, 50, 60) are provided for supplying to and storing into said transmitter (10) and receiver (20) hierarchically arranged partial codes (Cp, Cd, Ci, Cu).

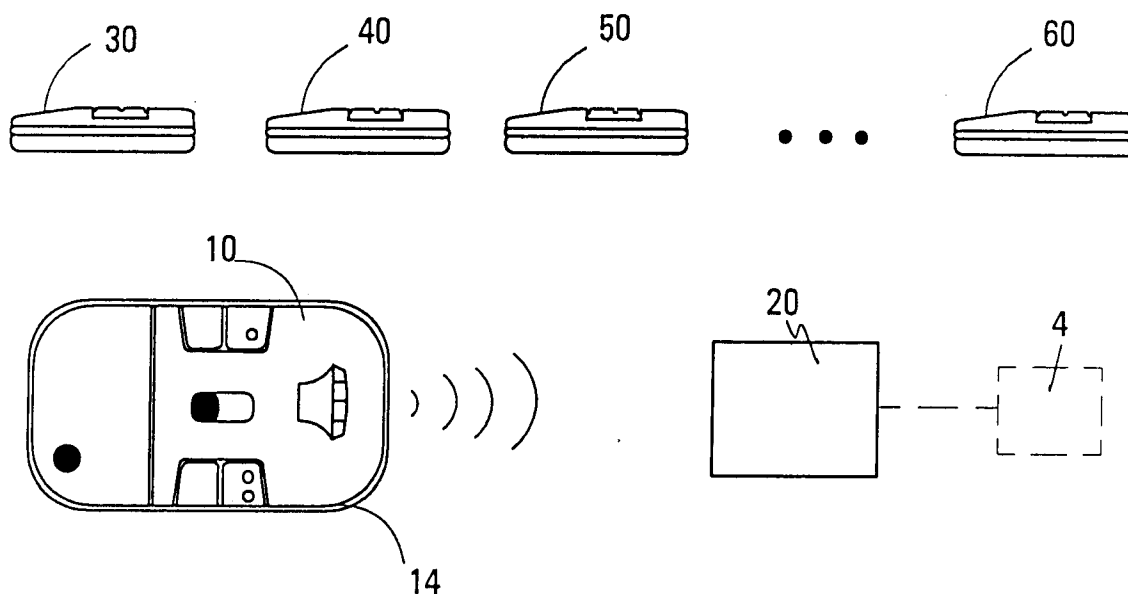


Fig. 1

EP 0 889 453 A2

Description

This invention concerns a remote control system, particularly a type suited to perform remote control operations like opening/closing a door, connecting/dis-

connecting a burglar alarm system, etc.

More particularly this invention concerns a remote control system incorporating a multi-channels transmitter and a receiver capable of driving an actuator to accomplish a desired operation when receiving from the transmitter a predetermined numerical code equal to a code stored in the receiver.

The invention has a preferred and particular application, in remote control systems using infrared, radio-frequency, ultrasounds, etc., and it will be disclosed in the following with reference to such an application, which however is not to be understood as limiting the scope of the invention.

Remote control systems are devices of widespread use and generally include one or more remote control transmitters, provided with a memory in which at least a code is stored, and one or more remote control receivers, fitted to the actuating device or to vehicle to be controlled, and adapted to extract from the transmitted signal an unique code that enables the execution of a desired operation. By using a code made up by a relatively long binary combination, the remote control transmitter becomes a sort of quite safe "key" for the user.

Remote control transmitters and receivers are manufactured as mass production devices and subsequently customized with proper identification codes.

In the known systems, the code is selected in advance and stored in the devices by the equipment manufacturer. As an alternative the final user can select his/her own identification code and have it stored by means of a suitable programming device.

In systems where the choice of the identification code is left to the user, the code can be stored either manually or by using a programmer. Where the storing is manually accomplished, usually through a plurality of microswitches or "dip" switches located inside in transmitter and possibly also in receiver, serious safety problems arise, for example in case the device is (even temporarily) lost, because such code can be discovered through a mere inspection of the switches.

In systems that use a programming unit or programmer, the user is compelled to purchase also this unit, or to have the code stored by the installer, which implies a number of drawbacks even in respect of the safety.

In remote control systems where the manufacturer takes care of selecting and storing the codes, the storage is carried out so as to render quite difficult an unauthorized duplication of the code, and a better degree of safety is obtained. However this procedure involves both a loss of flexibility and considerable difficulties and complications.

Other inconveniences of those known systems

known as "Rolling code" originate from the fact that, in order to provide the final user with a new transmitter, the installer has to go to the controlled premises and store the code in the receiver. On the other hand, in systems known as "Random", the installer must keep a card with a non volatile memory for each installation, in order to be able to reprogram a transmitter without physically going to the controlled plant or premise.

The object of this invention is to overcome the above described limits and drawbacks of the prior art devices, and in particular to provide a system in which the final user is able to select and store a code of his/her own both in the transmitter(s) and the receiver(s) of a remote control system, with the utmost safety and without need of using complex equipments, nor to accomplish manual operations on the receiver and the transmitter.

These objects are achieved through a remote control system according to claim 1. Further advantageous characteristics are recited in the dependent claims.

The remote control system according to this invention provides for using code portions or partial codes of different level in order to improve the system safety. More particularly, according to an embodiment of the invention, there are defined a distributor code, an installation code, a plant code and a personal code that together make up the complete identification code (CODE) of a given device, plant or car, with each partial code being entered and stored separately in both the receiver and the transmitter as steps of a programming procedure.

The invention will now be disclosed with reference to the attached drawings of preferred but non limiting embodiments thereof, in which:

Fig. 1 illustrates a remote control system according to the invention;

Fig. 2 is a block diagram of a remote control transmitter according to the invention;

Fig. 3 illustrates a programming step of the transmitter according to the invention; and

Fig. 4 shows a hierarchical structure of partial codes.

With reference to Fig. 1, a remote control system according to the invention comprises - in its simplest arrangement - a remote control transmitter, indicated by reference 10, and a remote control receiver 20, connected to an actuator 4 (shown in dotted lines) or other circuit or device adapted to carry out the required operations, e.g. the opening/closing of a door. The remote control transmitter 10 is preferably provided with 2/4/8 or more channels, with each channel being associated to a different code.

Usually there are provided two or more remote transmitters, for example one being given to a second user, and two or more receivers, for example to control more than one gate or door through the same device.

Besides, the transmitters and receivers can be of various types, for example infrared devices, radiofrequency devices (radio control), ultrasounds devices, with the programming being carried out (preferably) through infrared signals, without this being construed as a limitation. Preferably, the receiver is of the so called "autolearning" type, i.e. capable - when properly enabled to do so - of receiving and permanently storing the code from the transmitter, i.e. to be programmed. However also this feature is not to be construed as a limitation.

The transmitter 10 is housed in a plastic material container 14 and usually equipped with a plurality of independent channels, each of which is univocally associated with a receiver 20 by an enabling digital code. A transmitter is generally provided with one code for each channel, while the receiver is usually responsive to one code only.

The system according to the invention further provides for at least two separate encoders (30, 40, 50, 60 in Fig. 1) in order to enter a desired digital code in the receiver and the transmitter, that is "to program" or set these devices.

The encoders can be either portable devices with a construction like that of the transmitter. or bench type apparatuses capable of setting a large number of transmitter and receivers, and in this case they are provided with a holder in which the device to be set is located, and the code transmission is continuous in order to speed up the encoding of a large number of devices.

According to the invention, said two or more encoding devices 30, 40, 50, 60, are employed in succession to store in the transmitter(s) 10 and the receiver(s) an identification code CODE or a portion thereof.

More particularly, according to the illustrated embodiment, a complete identification code CODE comprises a bit string, and each encoder supplies a portion (partial code) of this string.

With reference to Fig. 3, in a preferred embodiment of the invention, a portable encoder is housed in a container 34 substantially equal to the container 14 housing the transmitter 10, and provided with two pushbuttons T1 and T2 and with two emitters, for example two LEDs, respectively 31 and 32.

The encoder can further comprise a plurality of microswitches or dip switches 33 through which a partial code is set up. As an alternative, the partial code can be stored in a non volatile memory.

In an alternative embodiment (not shown), preferably for use at (dealer) distributor level, the setting means of the encoders can include a keyboard, or an interface for a PC connection.

According to a preferred embodiment to be disclosed later, there are provided four (levels of) encoders, of the infrared type, each being enabled for entering the code in the transmitter in a hierarchical manner.

As shown in Fig. 3, the transmitter 10 is provided with a receiving portion RI comprising an infrared photo-

transistor 12 for receiving the code or portions thereof, and with a radio transmitting portion TX for sending the code to the receiver 20.

Referring now with more details to Figures 2 and 3, the transmitter 10 is contained in a housing 14, preferably of a plastic shockproof material. Device 10 comprises a transmitting portion TX capable of sending command codes to receiver 20, and a receiving portion RI capable to receive codes from the encoder.

The housing 14, in correspondence of the transmitting section TX, provides an infrared emitter 11, particularly a LED, and two pairs of pushbuttons, CH1, CH3 and CH2, CH4, for transmitting an activation code over one of four channels. A switch 13, provided with two positions A and B, allows to double the number of available channels, since when the switch 13 is in position A, channels from 1 to 4 are operable, and in position B, the CH keys enable channels from 5 to 8.

On the outer surface of housing 14 the receiving section RI of the transmitter 10 there is located an infrared receiver 12, for example a photodiode, a PIN or similar device, which is used either in the codes entering procedure or in the autolearning procedure.

As better shown in the diagram of Fig. 2, besides receiver RI and RF transmitting portion RX, the transmitter 10 further comprises a memory M, of non volatile and re-writable type, that stores the digital enabling codes for the several channels, and a microcontroller or a microprocessor indicated with μC . Preferably memory M is an EEPROM (Electrically Erasable Programmable Read Only Memory).

The code portions Cp, Cd, Ci and Cu of a given channel are supplied in different locations and at different times by the different encoders 30, 40, 50, 60 and are stored in memory M. As schematically shown in the enlarged detail of Fig. 2, the portions Cp1, Cd1, Ci1 and Cu1 of a same code are stored at different memory locations and not adjacent to each other, but however the microprocessor is capable to retrieve the code portions and join them together to obtain the complete code. When the user pushes one of the control pushbuttons CH, the microcontroller μC reads from memory M the partial codes that make up the complete code of a given channel and pack them again to build the string of the complete code that is then transmitted by portion TX. A similar storing arrangement can be provided in the receiver(s) 20.

The length of the partial codes Cp, Cd, Ci and Cu is in some way dependent from the number of different encoders that are assigned to a given code/channel. For example, the number of bits forming the Cd partial code assigned to the distributor must allow to identify each distributor with his own code. By using 5 bits for the partial code Cd, $32 (2^5)$ different codes are available and as a result an equal number of encoders can be assigned to as many distributors. The number of bits identifying a distributor can also be increased, however it is preferable to assign a larger number of bits (i.e. of

identifiable combinations) to the installers. In other words it is preferred to lengthen the partial code C_i in order to ensure the maximum customization of a transmitter.

As shown in the hierarchical diagram or tree in Fig. 4, a transmitter is manufactured including a partial code C_p (manufacturer) of 5-10 bits that identifies the reseller. This way resellers that are geographically near to each other cannot have transmitters that could be compatible.

Then the distributor or reseller, by means of an encoder supplied by the manufacturer, can select and store at suitable locations of memory M a partial code C_d of his own (or second level code), made up for example by 10 or more bits, that identifies the installers who depends on a same distributor. Also in this case, to installers which are near to each other there are assigned devices that are not compatible to avoid interference. The distributor will also supply the installer an encoder of 20 or more bits that will allow this latter to customize the transmitters sold by him to the final users.

Finally, the installer can supply to the final user an encoder with 20 or more bits so that the user can store a personal code C_u of his/her choice. Moreover the final user can change the final portion C_u of the code every time this is deemed necessary or desirable.

The allocation of the partial codes in Fig. 2 is shown as sequential, in case interleaved with that of other channels, however many different arrangements of the memory allocation are possible, either in accordance with particular algorithms or with different bits interleaved. It is however to be noted the hierarchical arrangement of the partial codes according to the invention. More particularly, the microcontroller will prevent writing of a partial code unless all the hierarchically higher partial codes have already been stored.

The remote control receivers or receiving units 20 are provided with a memory and with a microcontroller (or microprocessor) similar to those used in the transmitter and for this reason have not been disclosed in details. The receivers can store either the entire code (i.e. distributor code + installer code + final user code + personal code), or only two or more partial codes, such as for example the distributor code + the final user code, and so on. The encoder for the receivers is in principle equal to the portable encoder described with reference to Fig. 3, but without the (dip) switches 33 since the relevant code is supplied by the manufacturer with a serial number and cannot be changed.

Once the complete code has been stored in the transmitter, the receiving unit is ready for operation.

In addition to conferring a high degree of safety to the plant or other article to be controlled, the sequence of partial codes learnt by the receiving unit is useful as a safeguard for the distributor's and installer's sales. For example, in case the installer code and the final user code are correct, but the distributor code does not match, then the transmitter will not be capable of com-

manding the desired operation, since it comes from a different distributor from the one who sold the previous transmitters. Thus the sales of the distributor are safeguarded.

In the system of the invention, the installer will further be able to further customize and make safer the plant with the encoding of the receiving units.

An encoder with a code preset by the manufacturer and different for each installer, allows to enable autolearning of the transmitted code by the receiver unit. The enabling of the receiver unit to learn the transmitter code takes place after the encoder code has been set by means of infrared transmission.

For example, after the installer has customized the receiving unit using his own encoder, the code of the transmitter(s) learnt by the receiver unit cannot be changed, unless the encoder code of the installer who supplied the transmitters is introduced again in the device.

This way, an installer who is servicing a plant he has not installed, will not be able to release the receiver unit with his encoder and to store a new code. In order to customize all the plants of an installer, only an encoder for receiving units will be sufficient. In case an encoder is lost or stolen, it will be possible to get from the installer an encoder enabled to release only, and only by fulfilling predetermined conditions (for example supplying the serial number of the lost encoder), and the new encoder can have either the same original code or a different one, as desired by the installer.

The simplicity of use, together with the safeguard of the sales at various levels (distributor, installer, etc.) makes the system of the invention extremely advantageous, also owing to its easy programming.

Although the invention has been disclosed with reference to preferred embodiments, it is generally susceptible of other applications and changes which fall within the scope of the invention, as it will become evident to the skilled in the art.

Claims

1. A remote control system comprising:

- at least one remote control transmitter (10) equipped with one or more channels, provided with a memory (M) in which an enabling code (CODE) for actuating a controlled device can be stored;
- at least one remote control receiver (20) adapted to receive a signal sent out by said transmitter (10) and containing said code (CODE); and
- at least one encoding device (30) for storing codes in said transmitter (10) and receiver (20), said system being characterized in that it comprises at least a further encoding device (30 40, 50, 60), said (or each of said) at least

one encoding devices (30, 40, 50, 60) being adapted to supply to and store into said transmitter (10) and receiver (20) a portion or partial code (Cp, Cd, Ci, Cu) of said enabling code (CODE).

EEPROM.

5

2. A remote control system as claimed in claim 2, characterized in that said code portions (Cp, Cd, Ci, Cu) are hierarchically arranged.

10

3. A remote control system as claimed in claim 1 or 2, characterized in that within said remote control transmitter (10) said partial codes (Cp, Cd, Ci, Cu,) are stored at different locations in said memory (M) that can be traced by a microcontroller or by a microprocessor (C) and joined together to form the complete code (CODE).

15

4. A remote control system as claimed in claim 1 or 2, characterized in that within said remote control receiver (20) said partial codes (Cp, Cd, Ci, Cu) are stored in memory at different locations in said memory (M) that can be traced by a microcontroller or by a microprocessor (C) and joined together to form the complete code (CODE).

20

25

5. A remote control system as claimed in the preceding claims, characterized in that it provides four of said partial codes (Cp, Cd, Ci, Cu), each generated by a respective encoder (30, 40, 50, 60).

30

6. A remote control system as claimed in claim 5, characterized in that said four partial codes are the producer code (Cp), the distributor code (Cd), the installer code (Ci), and the personal code of the final user (Cu) that together make up said enabling code (CODE).

35

7. A remote control system as claimed in the preceding claims, characterized in that said transmitters (10) are RF transmitters of the infrared-programmable type.

40

8. A transmitter for a remote control system as claimed in the preceding claims, characterized in that it comprises a receiving portion (RI), a RF transmitter portion (RX), a non volatile and re-writable memory (M) containing said partial codes (Cp, Cd, Ci, Cu)

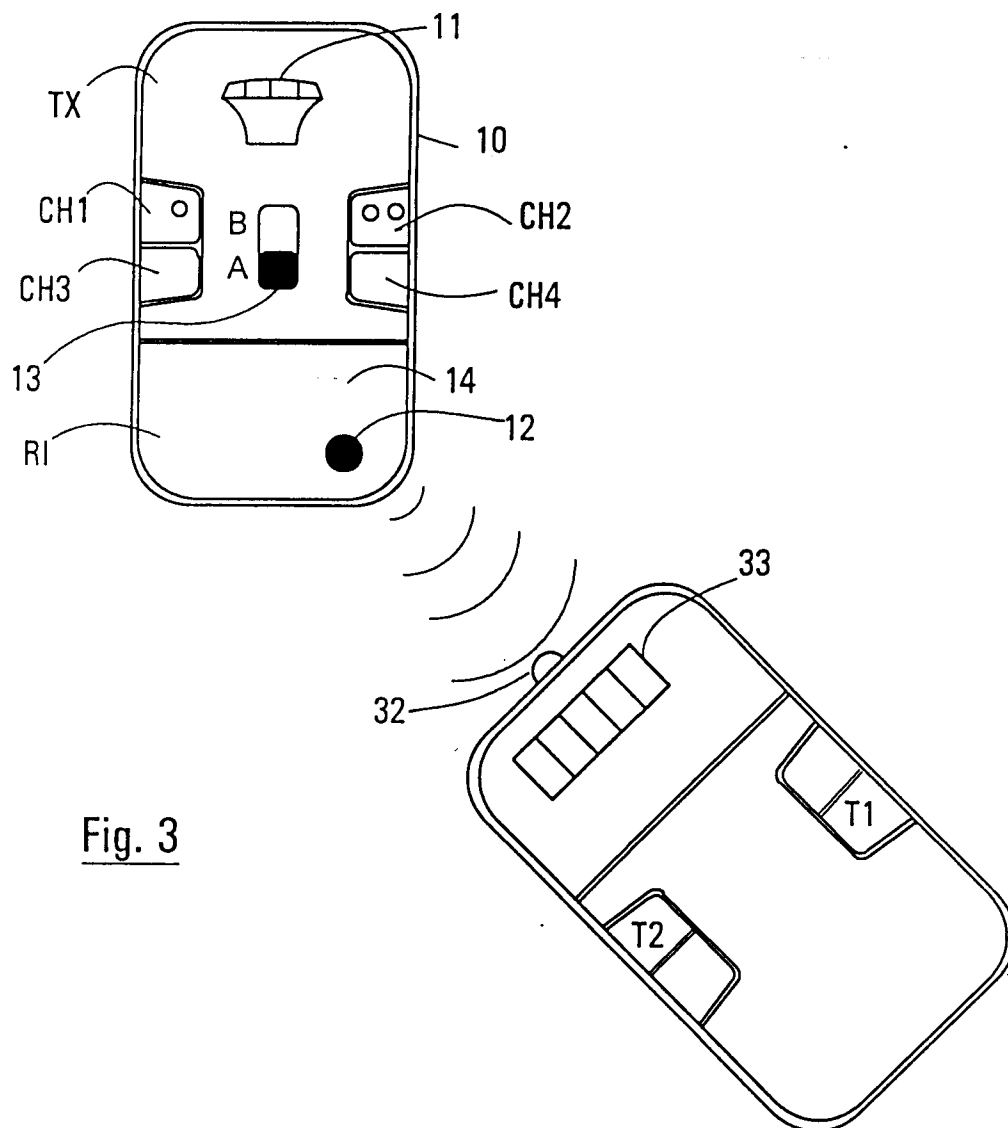
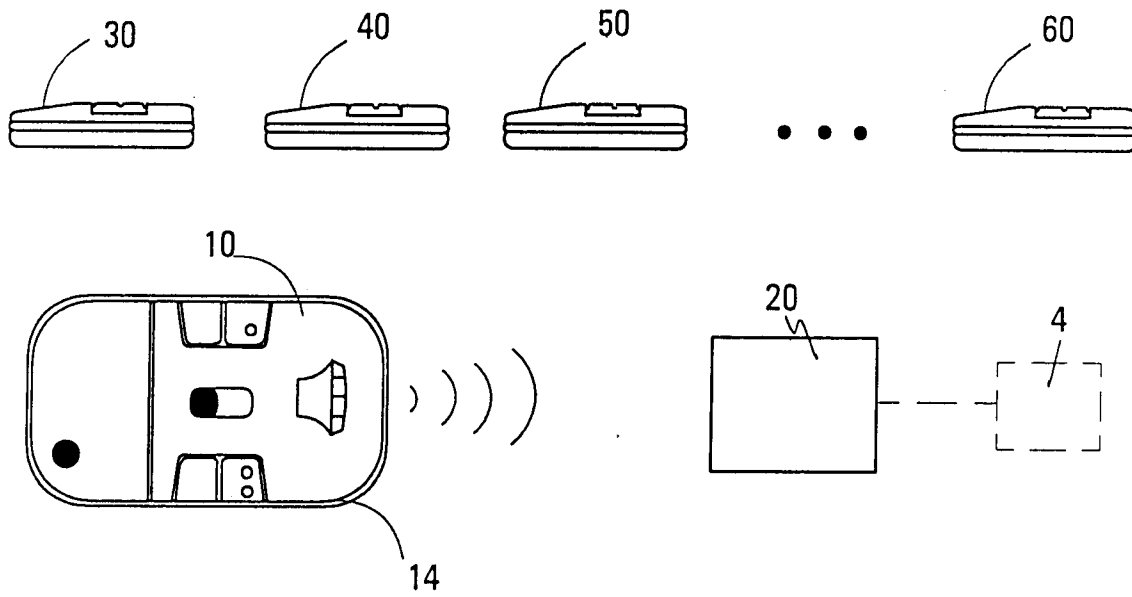
45

50

9. A remote control transmitter as claimed in claim 8, characterized in that said partial codes (Cp, Cd, Ci, Cu) are stored at different locations in said memory (M) that can be traced and joined together to form the complete code (CODE).

55

10. A remote control transmitter as claimed in claims 8 and 9, characterized in that said memory (M) is an



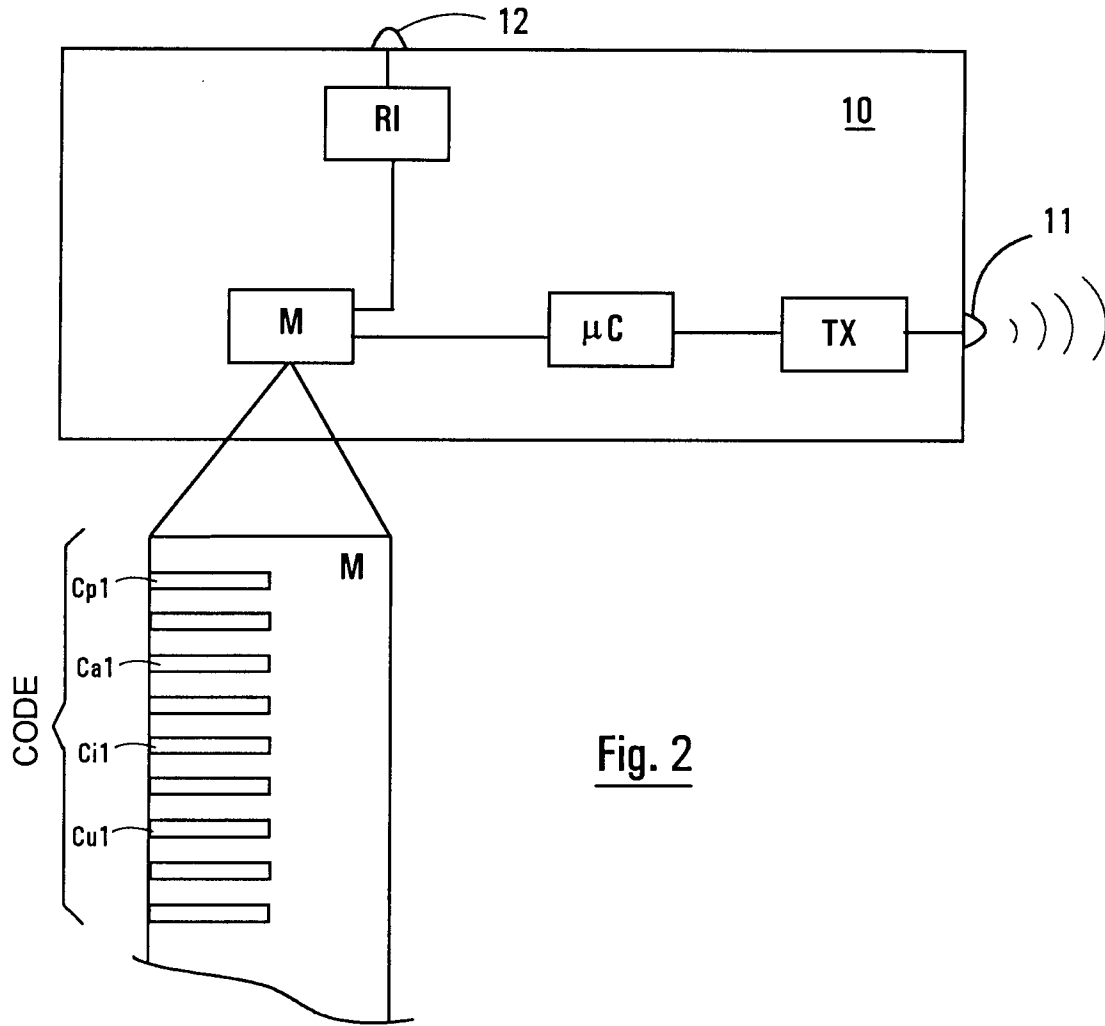


Fig. 2

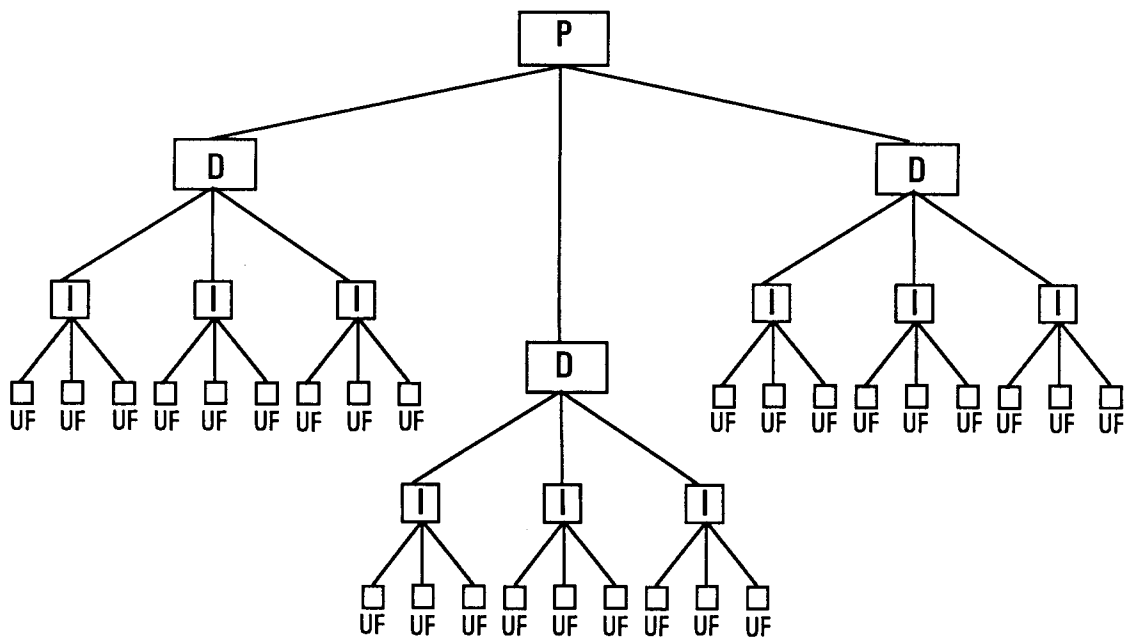


Fig. 4