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(71) Applicant(s)
Robert Bosch GmbH

(72) Inventor(s)
Stefan Schmitz

(74) Agent/Attorney
CALLINAN LAWRIE,Private Bag 7,KEW VIC 3101

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(71) Anmelder *(für alle Bestimmungsstaaten ausser US)*: ROBERT BOSCH GMBH [DE/DE]; Postfach 30 02 20, D–70442 Stuttgart (DE).

(72) Erfinder; und
(75) Erfinder/Anmelder *(nur für US)*: SCHMITZ, Stefan [DE/DE]; Seyfferstrasse 53, D–70197 Stuttgart (DE).

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(54) Title: METHOD FOR OPERATING A REMOTE CONTROL, AND REMOTE CONTROL

(54) Bezeichnung: VERFAHREN ZUM BETRIEB EINER FERNBEDIENUNG UND FERNBEDIENUNG

(57) Abstract

The invention relates to a method for associating a remote control to a base station. The base station (10) emits a search signal which the remote control (20) receives and compares with a reference signal. If the search signal corresponds to the reference signal the remote control (20) emits a contact signal. When the base station (10) receives certain predefined contact signals back, it emits an identification signal (114). The remote control (20) receives this identification signal (114) and sends a code signal (17) back to the base station. This code signal (17) identifies the remote control (20) uniquely.

(57) Zusammenfassung

Vorgeschlagen wird ein Verfahren zum Zuordnen einer Fernbedienung zu einer Basisstation, wobei die Basisstation (10) ein Suchsignal abgibt, die Fernbedienung (20) das Suchsignal empfängt, mit einem Referenzsignal vergleicht und bei Übereinstimmung ein Kontaktsignal abgibt. Bei Rückerhalt bestimmter Kontaktsignale gibt die Basisstation (10) sodann ein Identifizierungssignal (114) ab, auf dessen Erhalt hin die Fernbedienung (20) ein sie eindeutig bezeichnendes Codesignal (17) an die Basisstation zurückschickt.

Method for operating a remote control and a remote control

Prior Art

The invention relates to a process as described in the German patent application AZ: 196 45 769.6. According to it, the assignment of a remote control to a base station arranged in a motor vehicle in which the base station emits a search signal whereupon remote controls within the range of the search signal respond by sending back a contact signal at the characteristic times for the remote controls. By means of evaluating the input time of the contact signal responses, the base station detects the present remote controls. One of them selects it in order to carry out a challenge / response verification. Because the information about the present remote controls is contained not in the contact signal but in the time at which it is sent back, the contact signal can be constructed simply and the whole recognition can consequently follow very quickly. The recognition speed is determined only by means of the number of time windows made available for the individual remote controls. Where a very large number of remote controls are assigned to a base station, the method loses the advantage of speed.

It is the object of the invention to provide a method and a device appropriate for its implementation which permit the assignment of a large number of remote controls to a base station and carry out the assignment quickly.

According to the present invention there is provided a method for the assignment of a remote control to a base station, the base station emitting a search signal, the remote control receiving a search signal, comparing said search signal with a reference signal and, if agreement occurs, after a time period from the input of the search signal characteristic for the remote control determined by a group number emitting a contact signal,
said method further including the steps of:

the transmission of an identification signal by the base station after receiving a contact signal;

the reception of an identification signal by the remote control; and

the return of a device code clearly indicating the remote control by the remote control, wherein said remote controls with the same group number are distinguished from the rest by their respective device codes.

The method of the invention allows, by single time slots being assigned to several remote controls, the assignment of a large number of remote controls to one base station with no change in the high speed of assignment recognition. The number of time slots can be kept low, the assignment speed high. For the distinguishing of several remote controls in the same time slot, an additional control signal is advantageous, with which the base station causes the remote control to transmit its device codes. The base station uses the intelligibility of the returned device code as recognition information. For the selection of a certain remote control, the remote controls are activated to emit randomly set contact signals, the first clearly responding remote control being selected. By this means, the clear recognition of a remote control, also with a few steps and correspondingly quickly, takes place when several remote controls are assigned to the same time slot within the range of the base station.

An embodiment of the invention will be described in more detail on the basis of the invention in the following.

Figure 1 shows a block diagram of an assignment arrangement, Figure 2 a flow chart to illustrate its operation, Figure 3 the principle of time slot assignment and Figure 4 the construction of a search signal.

Description

In Figure 1 the reference number 10 indicates a base station which can be part of a device or of an object or which is permanently assigned to one. For example, the base station can be part of the access control device of a building or a motor vehicle. The reference number 20 indicates an activation device referred to in the following as remote control which is functionally assigned to the base station 10 via a signal transmission path 30. The remote control 20 can, for example, be a transponder. The base station 10 acts via operating connections not depicted or via the technical device to which or to part of which it is assigned.

A microprocessor 13 which in particular oversees and prompts the emission of signals by means of the base station 10 and evaluates ingoing signals forms the core of the base station 10. It is connected via an encoder / decoder 12 to a transmitter / receiver 11 for the transmission / reception of signals carried contactlessly over the signal transmission path 30. The encoder / decoder 12 serves to encode / decode the signals exchanged between the microprocessor 13 and the transmitter / receiver 11. A memory 15 is assigned to the microprocessor 13. In it is a serial number 16, a device code 17, a cryptic key code 31 and a directory 18 with the group numbers and the device codes 27 assigned to the group numbers of the remote controls 20 assigned to the base station 10. The device code 17 clearly indicates the device belonging to it, ie. the base station 10. It is provided by the manufacturer and cannot be changed. The serial number 16 is characteristic for base stations 10 and remote controls 20 assigned to one another. The group numbers 28 entered in the directory 18 distinguish the remote controls assigned to a base station 10 with the same serial numbers, the respectively assigned device code 27 serving, in connection with the cryptic key code 31, to verify a remote control 20 belonging to the group numbers. Equivalent to the separate storing of cryptic key codes 31 and device codes 27, the combinations used in the verification can be stored directly in the directory 18. Further, the device codes 27 of remote controls 20 no longer allowed which have, for example either been lost or stolen are stored in the directory

18. The serial numbers 16, which are assigned to the base stations 10 and the remote controls 20, are determined by the manufacturers of the technical device. When the arrangement is used, eg. in vehicles, the determining can be made by the motor vehicle manufacturer. He can also determine the cryptic code 31, by means of which the belonging of a remote control 20 to a base station 10 is verified.

The remote control 20 has a transmission / reception device 21 corresponding to the base station side transmitter / receiver 21 for the reception of signals emitted by the base station 10 or for the emission of contactlessly transmitted signals to the base station 10. Analogous to the base station, an encoder / decoder 22 for the encoding / decoding of encoded signals is connected upstream of the transmitter / receiver 21. A microprocessor 24 which undertakes in particular the evaluation of the signals being input via the transmitter / receiver, introduces measures dependent on the results, oversees the output of output signals dependent on the results and oversees the output of output signals is connected to the encoder / decoder unit 22. A memory unit 25 is assigned to the microprocessor 24. The memory unit contains a storage location for the storage of a serial number 16, a storage location for the storage of a device code 27, a storage location for the storage of a group number 28 and a storage location of a cryptic key code 31. The significance of the content of the memory corresponds to the significance of the same types of memory contents in the memory 15 of the base station 10 respectively. The serial number 16 is a characteristic code for the entire device consisting of base station 10 and actuating elements 20 belonging to it and is identical to the serial number contained in the memory 15 of the base station 10. The group number serves to distinguish from the remote controls 20 with the same serial number. It is established at the time of the use of the whole device by the user. The device code 27 is provided by the manufacturer of the remote control and indicates it clearly. The cryptic key code 31 is identical to the key code in the base station 10 and serves to verify its belonging to a base station 10. It is determined by the manufacturer of the technical device belonging to the base station 10.

Between the base station 10 and the remote controls 20 is a signal transmission path 30 for the transmission of contactless transmissible signals between the transmitter / receiver 21 on the remote control side and the transmitter / receiver 11 on the base station side. All signals transmitted from the transmitter / receiver 11 on the base station side reach all remote controls 20 within its range simultaneously. Signals used are preferably infrared signals or high frequency signals.

Several remote controls 20 can be assigned to one base station 10. All assigned remote controls 20 and the base station itself have in their memories 15, 25 the same serial

number 16 and use for verification an identical cryptic key code 31. The individual remote controls are distinguished by their group numbers. As a rule, they are given simply so that a remote control is clearly indicated by its group number 28. Certain group numbers can, in addition, be assigned to several remote controls 20. Remote controls with the same group number 28 differ by the device code 27.

The mode of operation of the device shown in Figure 1 will be explained on the basis of Figures 2 and 3. The procedural steps in Figure 2 are preceded by a letter B or F by which it can be seen whether the respective procedural step takes place in the base station 10: B or in the remote control 20: F.

The assignment recognition process will - usually - be triggered through the activating of a mechanical, electric or electro-optic triggering mechanism not shown by the user, Step 100. In the case of use in connection with a motor vehicle the triggering mechanism can exist, for example, in the actuating of the door handle. Due to a signal emitted after triggering, the microprocessor 13 introduces into the base station 10 the transmission of a search signal by means of the transmitter / receiver 11, Step 102. The signal contains, as indicated in Figure 4, a start frequency 35 realised as a start bit and a serial number 16 stored in the memory 15. It is preferably unencoded. The search signal is received by all remote controls within the range of the signal transmission path 30 by its transmitter / receivers 21. Their microprocessors 24 test, upon receiving a search signal, whether the serial number 16 transmitted with the search signal agrees with the serial number 16 serving as reference signal stored in the memory 25 of the remote control 20. The start bit also transmitted serves the synchronisation of the microprocessor 24 to the received search signal. If the microprocessor establishes an agreement between the received serial number and the serial number in the memory 25, it introduces the output of a response in the form of a contact signal, Step 104. A short, simply constructed signal, for example the group number of the respective remote control 20 in bit-coded form serves as contact signal. It is, like the search signal, preferably unencoded. The microprocessor 24 brings about the transmission of the search signal following a time interval characteristic for the activating element 20 and determined by the group number from the input of the search signal. It takes place in a time window of predetermined length. The emission is so measured that a definite assignment of a contact signal to a time window is possible both for the remote control 20 and for the base station.

Figure 3 illustrates the response behaviour of the remote controls 20 to a search signal. The abscissa shows an example of a time axis t subdivided into 8 time windows F0,. . . F7 which begins with the input of the search signal into the remote controls 20. The

ordinate indicates the group number 28 of the respective remote control 20. In Figure 3, eight group numbers 0 to 7 are assigned to one base station. Present are one remote control respectively with the group numbers 0 and 2 and three remote controls with the group number 7. All respond to the search signal by emitting a contact signal as per step 104. In the example, the time of emission for the contact signal, ie. the ordinal number of the time window belonging to it corresponds to the group number of the respective remote control. Therefore, the remote control with the group number 2 emits its contact signal after the waiting time T2 in the time window F2, the remote controls with the group numbers 6 sending theirs after the waiting time T6 in the time window F6. As a result, two offset contact signals appearing in the windows F2 and F6 at the transmitter / receiver 11 of the base station 10 which indicate immediately which remote controls 20 indicating through its group numbers are within the range of the signal transmission path 30.

By means of checking whether and into which time windows F0 to F7 contact signals have entered, the microprocessor establishes the remote controls present, Step 106. Present remote controls 20 are noted by means of appropriate entries in the memory 15. If no present remote control 20 is determined, a truncation signal is issued, Step 108. with which the recognition attempt is ended.

After determining the remote controls 20 present, the microprocessor 13 makes a selection with which a verification of the assignment should then take place, Step 112. It firstly checks whether clearly indicated remote controls 20 are present through group numbers given only once. If this is the case, it selects one for the following verification communication. The basis for the choice can, for example, be a graduation of rank for the remote control 20 on the basis of which the remote controls are given differing ranges of function.

The selected remote control 20 subjects the base station 10 to an assignment correctness check. It takes place by way of the customary challenge / response method. The base station send, in this step, a random number generated for this purpose as a challenge to the remote control 20, Step 130. At the same time, the microprocessor 13 forms a desired response signal according to a pregiven algorithm from the device code 28 stored in the directory 18 of the respective remote control 20, the cryptographic key code 31 and the random number. The challenge signal transmitted to the remote control 20 is received, in the meantime, by its transmitter / receiver 21 and passed on to the microprocessor 24. It transmits a response signal from the received challenge signal in the same way as the microprocessor 13 of the base station 10 and transmits it back to the base station 10, Step 132. After reception, the microprocessor 13 compares the

returned response signal with the previously determined desired response signal and, on agreeing, emits an enable signal, on non-agreement, an inhibiting signal. An inhibiting signal is issued particularly when the device code 27 contained in the response signal belongs to a blocked remote control 20 (blocked as the result of loss or theft).

If the evaluation of the present remote controls 20 in Step 112 results in only remote controls 20 with multiple group numbers 28 being present, the microprocessor 13 effects the issuing of an identification signal via the transmitter / receiver 11, Step 114. It causes the microprocessors 24 of the remote controls 20 present to respond by transmitting back the device codes 27 in the memories 25. All present remote controls 27 respond simultaneously, Step 116. The microprocessor 13 of the base station 10 checks, upon the transmission of an isolating signal of a returned device code whether the signal received has the form of a device code and is identifiable with a device code stored in the memory, Step 118. If so, then there is only one single remote control 20 with multiple group numbers present. The microprocessor then continues to carry out a simplified verification communication. In doing so, it sends the remote control 20 a challenge signal consisting of a random number, Step 134, at the same time generating from the random number in connection with the cryptic key code 31 a desired response signal. In the same way, the remote control 20 proceeds during this process, with the transmitted challenge signal. It sends the encoded signal back to the base station 10, Step 136. Its microprocessor 13 compares the response signal received back with the previously detected desired response signal and, if agreement takes place, emits an enable signal, if non-agreement, an inhibiting signal.

If checking of the signal received in Step 118 reveals that it cannot be interpreted as a clearly identifiable device code, the microprocessor 13 causes the transmission of an isolating signal, Step 120. It is received by the remote controls 20 and directed to their respective microprocessors 24. The isolating signal causes it to leave a contact signal in a randomly selected time window not connects with the group number 28. The microprocessors 24 of the remote controls 20 cause, correspondingly after reception of an isolating signal, the randomly controlled selection of a time window, Step 122. For this, they connect the device code 27 present in the memory 25 with a random number generated by the microprocessor or previously sent by the base station. It then prepares the sending back of the contact signal for the randomly selected time window.

The microprocessor 13 of the base station 10 awaits, in the meantime, the input of the first contact signal, Step 124. As soon as it has established the entry of the first contact signal, it accepts no further contact signals. At the same time, it causes the setting

down of a control signal, Step 126, blocking the sending out of other prepared contact signals by the remote controls 20 in later time windows. The remote controls 20 hindered from transmission do not take part again in subsequent communication. Thereupon, the microprocessor 13 again prompts the sending out of an identification signal, Step 114, to the remote controls 20 still involved in the communication. They respond again by sending back their device code, Step 116, which the microprocessor 13 on the base station side evaluates again for clear interpretability. If it establishes that the response signal received on the transmission of the isolation signal is interpretable and can be assigned to a device code 17 stored in a memory 15, the microprocessor 3 continues with the implementing of the assignment correctness test according to Step 130. If there is no clear interpretability in the test of Step 118, the microprocessor 13 repeats the steps 114 to 126 until the check results in a clearly identifiable device code. If the microprocessor 13 determines on running through the loop defined by the steps 114 to 126 that no response contact signal goes on an identifying signal, it aborts the assignment communication, Step 138 and/or prompts further appropriate measures.

While maintaining the basic idea of allowing multiple assignment of individual time windows based on an assignment on the time window principle and an identifying of a remote control belonging to a multiple-assigned time window by means of the evaluation of a simultaneously emitted signal from all present remote controls in response to intelligibility, the prescribed method and the prescribe device can be expanded upon and modified. For example, that applies for the structure of the base stations of the remote controls or for the number and sequence of the procedural steps. After the detecting of the present remote controls, it can, for example, be planned to very all recognised as present.

The claims defining the invention are as follows:

1. A method for the assignment of a remote control to a base station, the base station emitting a search signal, the remote control receiving a search signal, comparing said search signal with a reference signal and, if agreement occurs, after a time period from the input of the search signal characteristic for the remote control determined by a group number emitting a contact signal,

said method further including the steps of:

the transmission of an identification signal by the base station after receiving a contact signal;

the reception of an identification signal by the remote control; and

the return of a device code clearly indicating the remote control by the remote control, wherein said remote controls with the same group number are distinguished from the rest by their respective device codes.

2. A base station for the implementation of the method of Claim 1, said base station including a transmitter / receiver which is constructed for the transmission of a search signal and an identification signal and for the reception of contact signals and device codes of a remote control

and which has other means for the prompting / evaluation of signals transmitted / received via the transmitter / receiver.

3. A base station as claimed in Claim 2 wherein said transmitter / receiver is designed in such a way that it emits an identification signal when contact signals belonging to certain remote controls are input; the identification signal causes all remote controls receiving the identification signal to send back their respective device codes.

4. The base station as claimed in Claim 2 further including a microprocessor designed in such a way that it checks a device code signal received from a remote control for clear interpretability.

5. The base station as claimed in Claim 4 wherein said transmitter / receiver is designed in such a way that it is also constructed for the emission of an isolating signal and emits an isolation signal when a device code signal is not interpretable.

6. The base station as claimed in Claim 5 wherein said transmitter / receiver is designed in such a way that when the first contact signal is input, said transmitter / receiver emits an inhibit command upon receiving an isolating signal, preventing the transmission of subsequent contact signals by other remote controls.

7. A base station as claimed in Claim 4 wherein the microprocessor is designed in such a way that it evaluates contact signals received at the time of their entry with reference to the emission of a search signal for the identification of an activating element.

8. A remote control for the implementation of the method as claimed in Claim 1, said remote control including a transmitter / receiver,

which is designed for the reception of search and identification signals, and

is designed for the emission of contact and device code signals, the contact signal being emitted following a time period characteristic for the remote control and determined by a group number from the input of the search signal from a transmitter / receiver of a base station, and

means for the evaluation / prompting of signals to be transmitted / received.

9. The remote control as claimed in Claim 8, wherein when receiving an identification signal, said remote control emits a device code signal.

10. The remote control as claimed in Claim 8, wherein said remote control is further constructed for the reception of isolating signals and when an isolating signal is received, prepares the emission of a contact signal in a randomly selected time window.

11. A remote control for the allocation of a remote control to a base station with

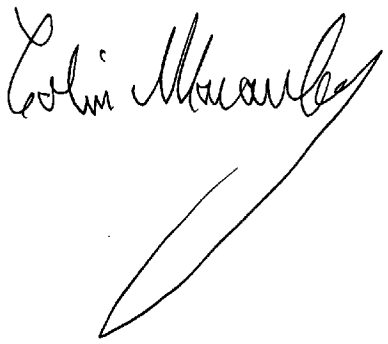
a base station as claimed in Claim 2 and

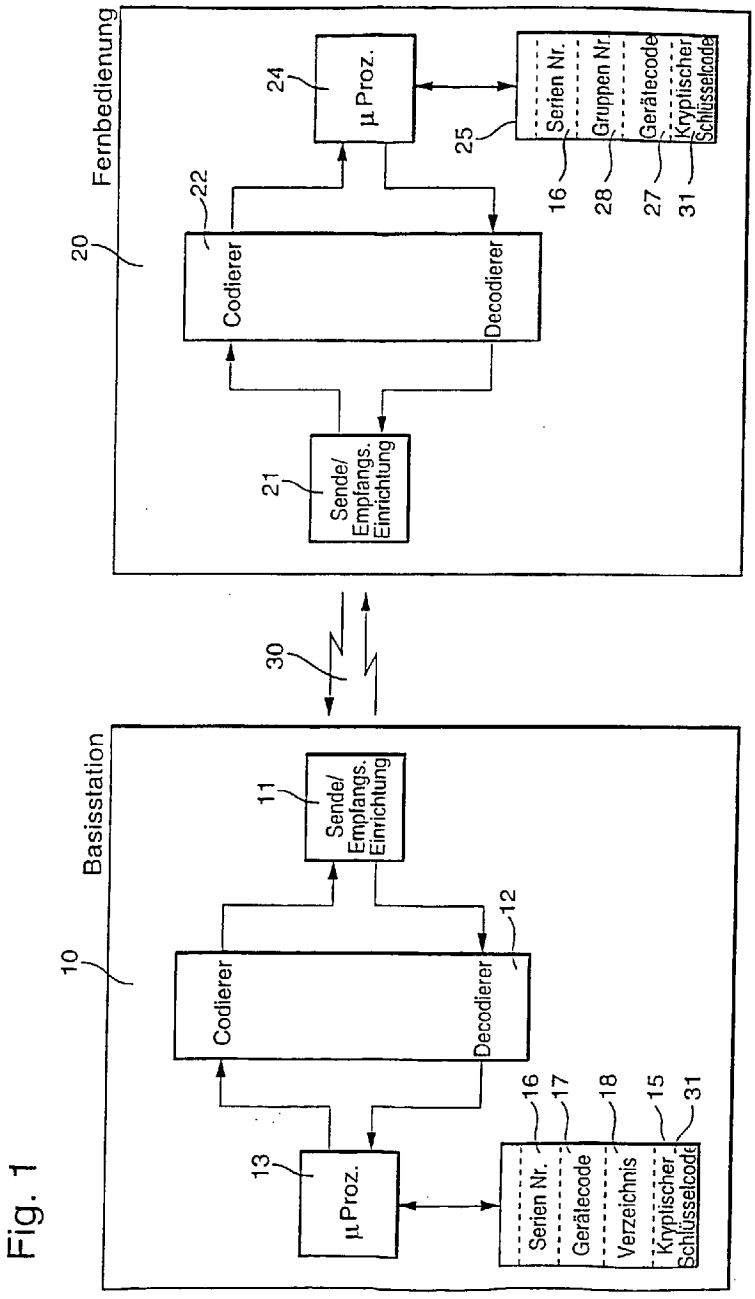
a plurality of remote controls as claimed in Claim 8, identifiable by group numbers,

wherein at least one group number is allocated to several remote controls simultaneously.

Dated this 6th day of March, 2001.

ROBERT BOSCH GMBH
By their Patent Attorneys:
CALLINAN LAWRIE

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Gerätecode
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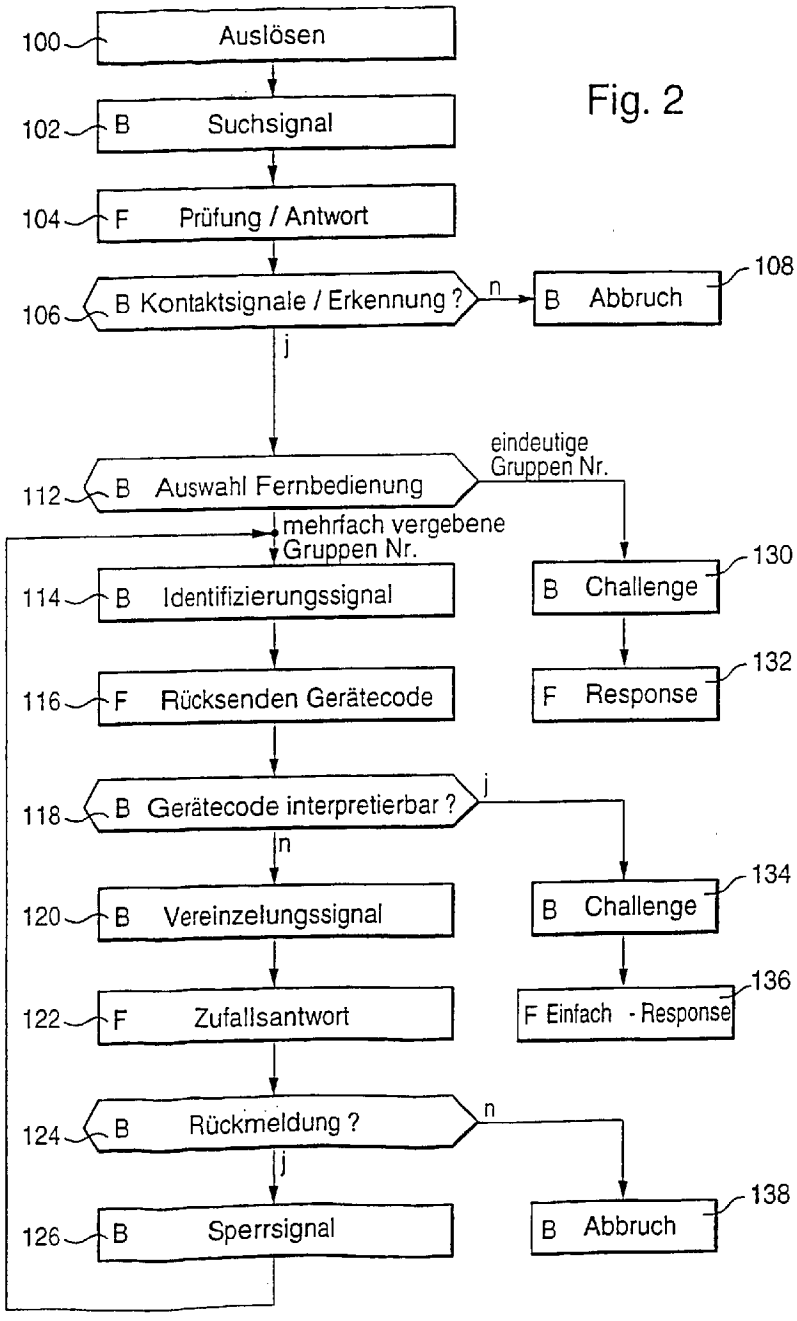
Fig. 1


100
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B Suchsignal
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B Kontaktsignale / Erkennung ?
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108
j
112
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eindeutige Gruppen Nr.
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B Challenge
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B Challenge
134
122
F Zufallsantwort
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Fig. 2

Fig. 3

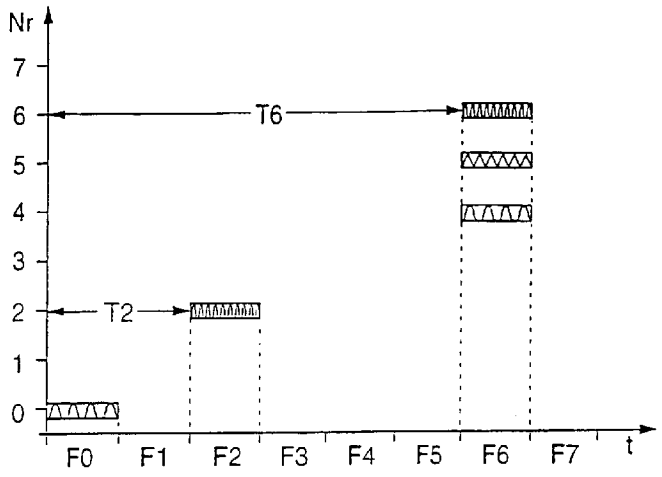

Fig. 4