

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) Publication number:

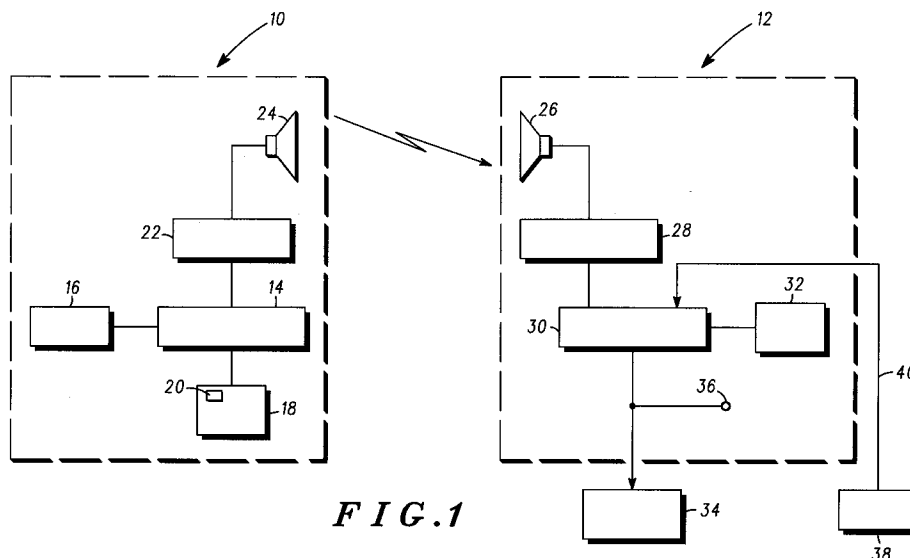
**0 535 555 A1**

(12)

**EUROPEAN PATENT APPLICATION**(21) Application number: **92116460.4**(51) Int. Cl.<sup>5</sup>: **E05B 49/00**(22) Date of filing: **25.09.92**(30) Priority: **04.10.91 US 770833**(43) Date of publication of application:  
**07.04.93 Bulletin 93/14**(84) Designated Contracting States:  
**DE FR GB**(71) Applicant: **MOTOROLA, INC.**  
**1303 East Algonquin Road**  
**Schaumburg, IL 60196(US)**(72) Inventor: **Christians, Scott T.**  
**701 Canyon Wren**  
**Buda, Texas 78610(US)**(74) Representative: **Hudson, Peter David et al**  
**MOTOROLA European Intellectual Property**  
**Operations Jays Close Viabes Industrial**  
**Estate**  
**Basingstoke, Hampshire RG22 4PD (GB)**(54) **Programming technique for vehicular remote control system.**

(57) A method of re-programming a receiver (12) which forms part of a vehicular remote control system in which the receiver (12) responds to a code sent by a handheld transmitter (10) for controlling at least one function of a vehicle. According to the re-programming technique, the vehicle's ignition (38) is first turned on. Then, a programming window is opened (i.e., the receiver is put in a programming

mode) for a time duration T1 following ignition turn-on. During the programming window, the transmitter (10) is used to transmit a code to the receiver (12), and this transmission continues for at least a predetermined time duration T2. The code thus transmitted is stored in the receiver's memory for use as a code to which the receiver (12) will be responsive for controlling at least one vehicle function.

**FIG. 1****EP 0 535 555 A1**

## Field of the Invention

This invention is directed to the field of automotive remote control systems of the type wherein a user can employ a handheld transmitter to send a signal to a receiver mounted within a vehicle to cause some function of the vehicle to be controlled remotely, such as to disarm a security device within the vehicle, or to unlock the doors of the vehicle.

## Background of the Invention

Typical remote control systems include at least one handheld transmitter (RF or infrared) that can transmit a unique code to a receiver mounted in a vehicle. In one form of remote control system (referred to as keyless entry), the receiver responds to the transmitted code by locking or unlocking the vehicle's doors. It may also turn on an interior light or perform various other functions.

It is sometimes desirable for a user to be able to re-program his receiver, as when his transmitter is lost or inoperative, and he wants to replace it with a new transmitter having a different code. Alternately, the user may want to program his receiver to be responsive to the different codes of two or more transmitters so that two or more members of his family may unlock the doors of the same vehicle, each using his/her own transmitter having its own unique code. A receiver's ability to be easily reprogrammed by the end-user is thus very desirable, but conventional systems employ programming techniques that are not totally compatible with this desired result.

Typical keyless entry systems use several techniques to insure that a vehicle's transmitter and receiver operate on the same code. In one case, the receiver and its mating transmitter are programmed together at the factory with the same code. The means that both components must remain together in route to the end customer. If the end-user needs additional transmitters, they must be specially ordered to ensure that they match the receiver.

Another programming technique, used principally by automobile manufacturers, is to include a keypad on the exterior surface of a vehicle's door such that entry of a unique code by the user allows the keyless entry system to go into a programming mode in which the user can program the receiver to accept a code already programmed into the user's transmitter. A disadvantage of this technique is the requirement for a keypad mounted on the vehicle, and a relatively small number of vehicles come so equipped.

A third programming technique requires that a "programming wire" be connected to the vehicle's battery or ground system to put the receiver into

the programming mode. Since many users cannot or will not go to the trouble of finding the "programming wire" and coupling it to the appropriate electrical potential, this technique is somewhat impractical. Consequently, such users are unable to change transmitters or to add additional transmitters to their keyless entry system.

## Brief Description of the Drawings

FIG. 1 is a schematic block diagram of a remote control system that operates in accordance with a preferred embodiment of the invention; and FIGS. 2A and 2B are a flow chart that illustrates how the receiver's microcomputer (FIG. 1) is preferably programmed in accordance with the invention.

## Description of the Preferred Embodiment

Referring to FIG. 1, the illustrated remote control system includes a transmitter 10 and a receiver 12. The transmitter 10 is normally a small, handheld transmitter that can emit a coded RF (or IR) signal for causing the door of a vehicle to be locked or unlocked, or to control any other function of the vehicle. The illustrated transmitter includes conventional components such as a microcomputer 14 powered by a battery 16. Coupled to the microcomputer is a keypad 18 that is accessible to the user. A number of push-buttons are included on the keypad, including an "unlock" button 20. Other buttons (not shown) may also be included, such as a "lock" button for causing the vehicle's doors to be locked.

When an operator wishes to unlock the door or doors of his vehicle, he presses the "unlock" button 20, whereupon the microcomputer 14 outputs a coded signal that includes the operator's security code (sometimes called an "ID"), and another code representing the "unlock" command. This coded signal is received by an oscillator circuit 22 which provides a RF signal that is modulated by the coded signal from the microcomputer 14. The coded RF signal is transmitted by an output device 24 to the receiver 12 which is normally installed within the operator's vehicle.

In the receiver 12, the coded RF signal is received by an input device 26 (such as an antenna) which supplies the RF signal to a detect/decode unit 28. The unit 28 detects and decodes the codes embedded in the RF signal, and passes the decoded codes to a microcomputer 30. The latter device is powered by a power supply 32 which may be the vehicle's battery.

When the microcomputer 30 recognizes that a valid security code (ID) has been received, and that a door "unlock" code has been received, it ac-

tuates a door lock mechanism 34 for unlocking the doors off the vehicle. An output terminal 36 may be included to send a signal for controlling other vehicle functions in response to other corresponding codes having been sent by the transmitter 10. The operation described thus far is conventional.

In order to reprogram the receiver 12 to be responsive to a new or different code from the transmitter 10, the microcomputer 30 in the receiver 12 is programmed to operate in accordance with the following reprogramming technique. First, the vehicle's ignition unit 38 is turned on (as with a conventional ignition key), and that event is sensed by the microcomputer 30 via an input lead 40 which connects to the ignition unit. On sensing turn-on of the ignition unit 38, a programming window for the receiver 12 is opened. This programming window is a time period during which the microcomputer 30 allows the receiver 12 to be reprogrammed to receive a new and/or different security code, and this programming window has a time duration T1 (e.g. 15 seconds) that is measured from ignition turn-on. In other words, the receiver 12 is enabled to be reprogrammed during a time window having duration T1 immediately following ignition turn-on. Any attempt to reprogram the receiver 12 except when the programming window is open is of no avail.

During the opened programming window, a transmitter (such as transmitter 10) is used to initiate the transmission of a new code from the transmitter to the receiver, and the transmission of this code continues for at least a predetermined time duration T2 (e.g. 5 seconds). Preferably, this transmission is caused by the operator pressing the "unlock" button 20 on his transmitter's keypad and holding that button down for the duration T2. This causes the new security code to be transmitted along with an "unlock" code that continues for a duration T2.

Upon receipt by the receiver 12 of the coded transmission of duration T2 sent during the programming window, the received security code is at least temporarily stored in a memory (not shown) of the microcomputer 30 for use as a new code to which the receiver will be responsive for controlling at least one vehicle function (e.g. actuating the door lock mechanism 34).

In the preferred embodiment, the receiver 12 acknowledges proper receipt of the coded transmission by twice actuating the door lock mechanism 34. This gives a visual and/or audible signal to the operator that the receiver 12 acknowledges receipt of a new and/or different security code which the receiver is to be responsive to.

According to another preferred aspect of the invention, the security code received during the open programming window is stored permanently

in a memory of the microcomputer 30 only if the ignition unit 34 is turned off within another predetermined time interval T3 (e.g. 15 seconds) following receipt of the code. If the ignition unit 38 is not turned off within the time interval T3, the security code received during the open programming window is cancelled. This prevents codes that are inadvertently received from being stored in memory.

Another preferable aspect of this technique is that a security code that has been previously stored in a permanent memory is cancelled in response to at least one newly received security code being permanently stored. This allows an operator to make the receiver responsive only to a new or different security code and to prevent a previously stored code from being used by another operator. This might arise, for example, in the case where the operator's original transmitter has been lost and he wishes to reprogram the receiver to be responsive to the security code of a replacement transmitter, and to be unresponsive to the security code associated with the lost transmitter.

It is also possible to store more than one security code with this technique. If an additional code is transmitted to the receiver, and this transmission continues for at least the predetermined time duration T2, (e.g. 5 seconds), and the additional security code is transmitted to the receiver within an additional period T1 following the storage of a previously transmitted security code, then the additional security code will also be stored. In a preferred embodiment, up to four security codes may be stored in this manner, but any attempt to store more than four (or more than any other predetermined number) results in all received codes being cancelled.

All security codes received during the open programming window(s) will be permanently retained in the receiver's memory only if the ignition is turned off within the time period T3 after the receiver receives the transmitted code(s). At the conclusion of a successful programming session, all security codes stored during any previous programming session are erased from memory.

The way in which the above described technique is preferably implemented will now be described with reference to the flow chart shown in FIGs. 2A and 2B. This flow chart represents a preferred technique for programming the receiver's microcomputer 30.

Referring first to FIG. 2A, the block indicated as "main process" is the part of the program in the microcomputer 30 that processes incoming code, determines whether the received security code is valid, and otherwise controls all non-programming functions of the receiver 12. It will be assumed that the receiver has already received a security code

that matches a stored code, thus determining that the received security code is valid.

Immediately after the "main process" block, the reprogramming part of the microcomputer's program begins with an instruction 42 which asks if the ignition unit 38 has just been turned on. If the answer to this inquiry is "yes", the program proceeds to instruction 44 for causing a timer T1 to start. This timer begins timing the period immediately following ignition turn-on and signifies the opening of the programming window. As will be shown in the program below, the timer T1 terminates 15 seconds after having been started, thereby providing a 15 second window in which the operator may reprogram the receiver.

The next instruction 46 asks whether a transmission has been received from the transmitter. If the answer is "no", the program proceeds to instruction 48 so that the microcomputer 30 can continue the main process, following which the program can proceed again to instruction 42 to once again look for ignition turn-on.

Referring to instruction 42 again, when it results in answer of "no", the program proceeds to instruction 50 to determine whether the ignition has just been turned off. If the answer to this inquiry is "no", the program proceeds back to instruction 46 and then to instruction 48 to loop through the program again to look for ignition turn-on and the receipt of a transmission.

Referring again to instruction 46, it will be assumed that ignition turn-on has occurred (per instruction 42), that timer T1 has been started (per instruction 44), and that a transmission has been received. This indicates that the operator has pressed one of the buttons on the keypad of the transmitter 10, such as the "unlock" button 20. In this event, the program proceeds to instruction 52 (FIG. 2B) to determine whether the received transmission was initiated by the "unlock" button 20, and whether such transmission lasted for longer than 5 seconds (T2 equals 5 seconds in this example). If the answer to this question is "yes", this indicates that the operator desires to reprogram the receiver, and the program then proceeds directly to the next instruction 54.

Instruction 54 asks whether the time period T1 is greater than 15 seconds. In other words, "has the reprogramming window expired?" If the answer is "no", this indicates that reprogramming is still possible and the program proceeds to the next instruction 56. If the answer to the question posed by instruction 54 had been "yes", meaning that the reprogramming window had expired, then the program would have proceeded to instruction 58 which causes the microcomputer 30 to set a timer T3 for greater than 15 seconds. As will be shown, this has the effect of rejecting the last-received security

code.

Referring back again to instruction 54, and assuming that the timer T1 does not exceed 15 seconds, the program will continue with instruction 56 which asks if more than four programming codes (i.e., security codes) have been received. The point of this instruction is to ensure that no more than four (or any other predetermined number of codes) can be programmed into the receiver. If more than four codes have been received, the program proceeds to instruction 58 to again set the timer T3 to more than 15 seconds and thereby reject all the received security codes.

If less than four codes have been received, the program proceeds from instruction 56 to instruction 60 to start the timer T3 (which is used to determine how much time has passed since receipt of the last transmitted code) and to restart the timer T1 (to open another 15 second programming window). From there the program proceeds to instruction 62 which causes the door locks to be cycled twice by actuating the door lock mechanism 34 (FIG. 1). This provides an audible and/or visual acknowledgement of the fact that the receiver has been properly programmed with the security code that has just been sent by the operator. The next instruction 64 causes this security code to be placed in temporary memory.

The program then continues back through instruction 48 (FIG. 2A) and then to instruction 42. Assuming that the ignition has not been just turned on, the program will proceed then to instruction 50 to determine whether the ignition has just been turned off. If it has been just turned off, the next instruction 66 asks whether the timer T3 is greater than 15 seconds. If the answer is "no" this indicates that ignition turn-off occurred within 15 seconds following receipt of the last code, and that the operator desires the receiver to be responsive to this new security code (recall that the timer T3 was started by instruction 60). Then the program proceeds to instruction 68 which causes the received code to be moved into a permanent memory from the microcomputer's temporary memory. The codes previously stored in the permanent memory are cancelled. Thus, the microcomputer 30 has been reprogrammed with a new security code.

In the event that the time T3 has expired per instruction 66, instruction 68 will be skipped, meaning that the received security code will not be placed in permanent memory. Rather, the program proceeds from instruction 66 to instruction 46 and from there it loops through the program again, ignoring the received security code.

It will be recalled that the time T3 was set to exceed 15 seconds per instruction 58 (FIG. 2B). This occurred when 1) the timer T1 exceeded 15 seconds, meaning that the programming window

had expired, or 2) more than four codes were received. Setting the timer T3 to a time greater than 15 seconds ensures that any security code(s) received under conditions 1) or 2) above gets rejected when the program reaches instruction 66.

Another event that is handled by the program is the receipt of an "unlock" signal that is intended only to unlock the doors (not to reprogram the receiver). This event is handled by instructions 52, 70 and 72 (FIG. 2B). If the execution of instruction 52 results in determining that the transmission of the "unlock" code lasted less than 5 seconds, then the program proceeds to instruction 70 to determine whether the received security code matches a stored security code. If no match is detected, the program ignores the code and returns to instruction 48 to loop through the program. If a match is detected, the program proceeds to instruction 72 to perform the function associated with the received "unlock" code, or to perform the function associated with any other non-security code that was received.

It can be seen, therefore, that the present technique for reprogramming the receiver is operator-friendly, while also avoiding the problem of unintentionally making the receiver responsive to an undesired code. This technique also provides an easily implemented technique (cycling the door locks) for telling the operator that a transmitted code has been properly received and stored.

## Claims

1. For use with a vehicle having an ignition, and having a remote control system comprising a handheld transmitter and a receiver that is responsive to receipt of a code from the transmitter for controlling at least one function of the vehicle, a method of re-programming the receiver, comprising:
  - (a) turning on the vehicle's ignition;
  - (b) opening a programming window for the receiver, the programming window having a time duration T1 following ignition turn-on;
  - (c) initiating transmission of a code from the transmitter to the receiver, the transmission continuing for at least a predetermined time duration T2; and
  - (d) upon receipt by the receiver of the transmission of duration T2 sent during the programming window, at least temporarily storing the received code for use as a code to which the receiver will be responsive for controlling at least the one vehicle function.
2. A method as set forth in claim 1 wherein the transmitter includes an "unlock" button, where wherein the transmission recited in step (c) is

initiated by actuating the "unlock" button for the time duration T2.

3. A method as set forth in claim 1 including permanently storing the received code if the ignition is turned off within a predetermined time interval T3 following receipt of the code.
4. A method as set forth in claim 3 wherein the received code is cancelled if the ignition is not turned off within the time interval T3.
5. A method as set forth in claim 1 wherein all codes received for storage are cancelled in response to an attempt to store more than a predetermined number of codes.
6. For use with a vehicle having an ignition, and having a remote control system comprising a handheld transmitter and a receiver that is responsive to receipt of a code from the transmitter for controlling at least one function of the vehicle, a method of re-programming the receiver, comprising:
  - (a) turning on the vehicle's ignition;
  - (b) opening a programming window for the receiver, the programming window having a time duration T1 following ignition turn-on;
  - (c) initiating transmission of a code from the transmitter to the receiver, the transmission continuing for at least a predetermined time duration T2;
  - (d) upon receipt by the receiver of the transmission of duration T2 sent during the programming window, temporarily storing the received code as a code to which the receiver will be responsive for controlling at least the one vehicle function;
  - (e) repeating step (c) with an additional code transmitted within a time period of duration T1 following the temporary storage of the previously transmitted code;
  - (f) upon receipt by the receiver of the code transmitted in step (e), temporarily storing that code as another code to which the receiver will be responsive for controlling at least the one vehicle function;
  - (g) turning off the ignition; and
  - (h) in response to ignition turn-off occurring within a predetermined interval T3 following receipt of the last transmitted code, permanently storing the codes that were stored temporarily per steps (d) and (f).
7. A method as set forth in claim 6 further including rejecting all received codes if an attempt is made to store more than a predetermined number (N) of codes.

8. For use with a vehicle having an ignition and a door locking mechanism, and having a remote control system comprising a handheld transmitter with an "unlock" button and a receiver that is responsive to receipt of a code from the transmitter for controlling at least the vehicle's door locking mechanism, a method of reprogramming the receiver, comprising:
- (a) turning on the vehicle's ignition;
  - (b) opening a programming window for the receiver, the programming window having a time duration T1 following ignition turn-on;
  - (c) pressing the "unlock" button to transmit a code from the transmitter to the receiver, the transmission continuing for at least a predetermined time duration T2;
  - (d) upon receipt by the receiver of the transmission of duration T2 sent during the programming window, temporarily storing the received code as a code to which the receiver will be responsive for controlling at least the door locking mechanism, and acknowledging such receipt by twice actuating the door locking mechanism;
  - (e) repeating step (c) with a different transmitter to send an additional code transmitted within a time period of duration T1 following the temporary storage of the previously transmitted code;
  - (f) upon receipt by the receiver of the code transmitted in step (e), temporarily storing that code as another code to which the receiver will be responsive for controlling at least the one vehicle function;
  - (g) turning off the ignition;
  - (h) in response to ignition turn-off occurring within a predetermined interval T3 following receipt of the last transmitted code, permanently storing the codes that were stored temporarily per steps (d) and (f); and
  - (i) in response to ignition turn-off occurring after the predetermined interval T3, cancelling all codes received after the opening of the programming window.

45

50

55

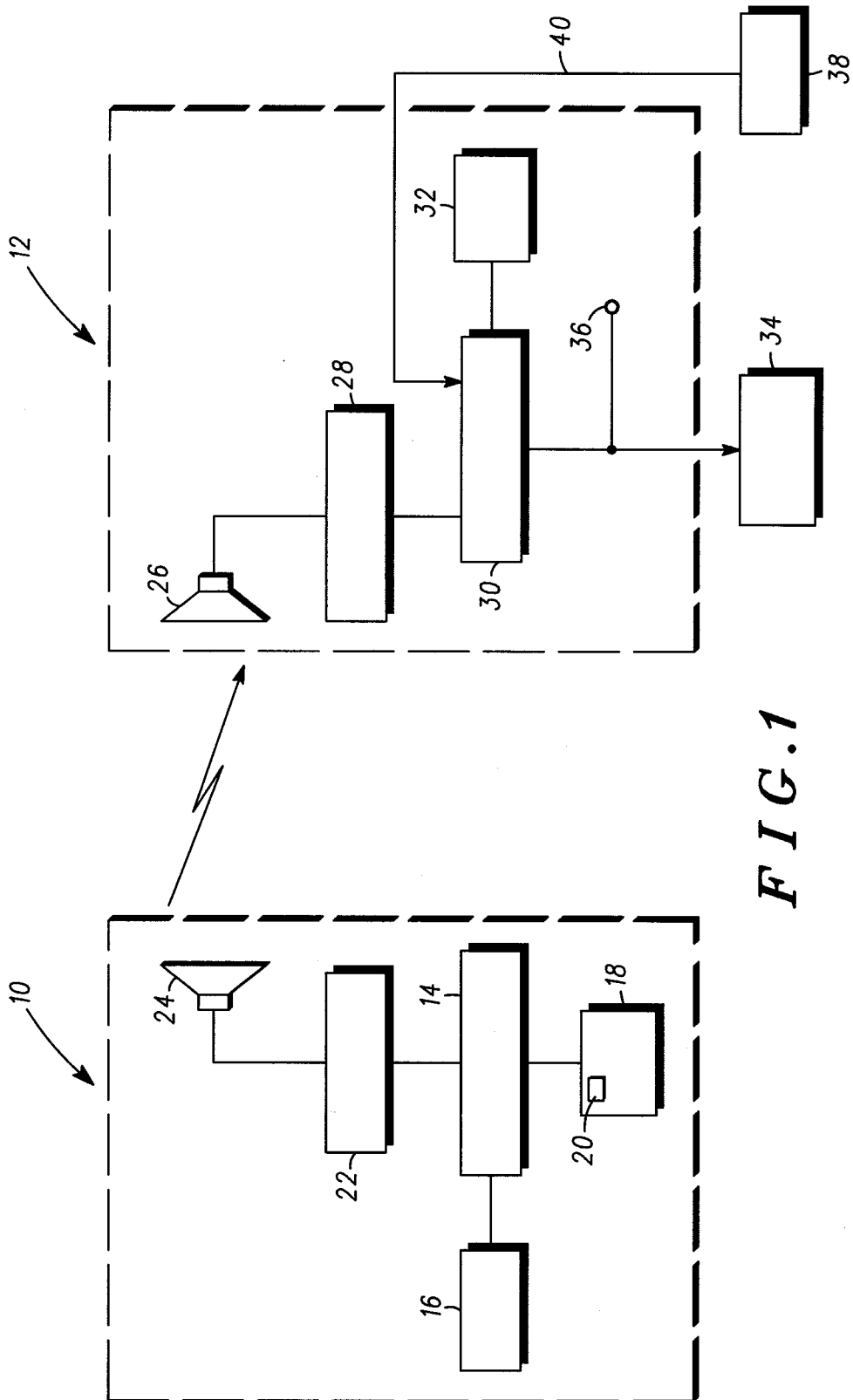
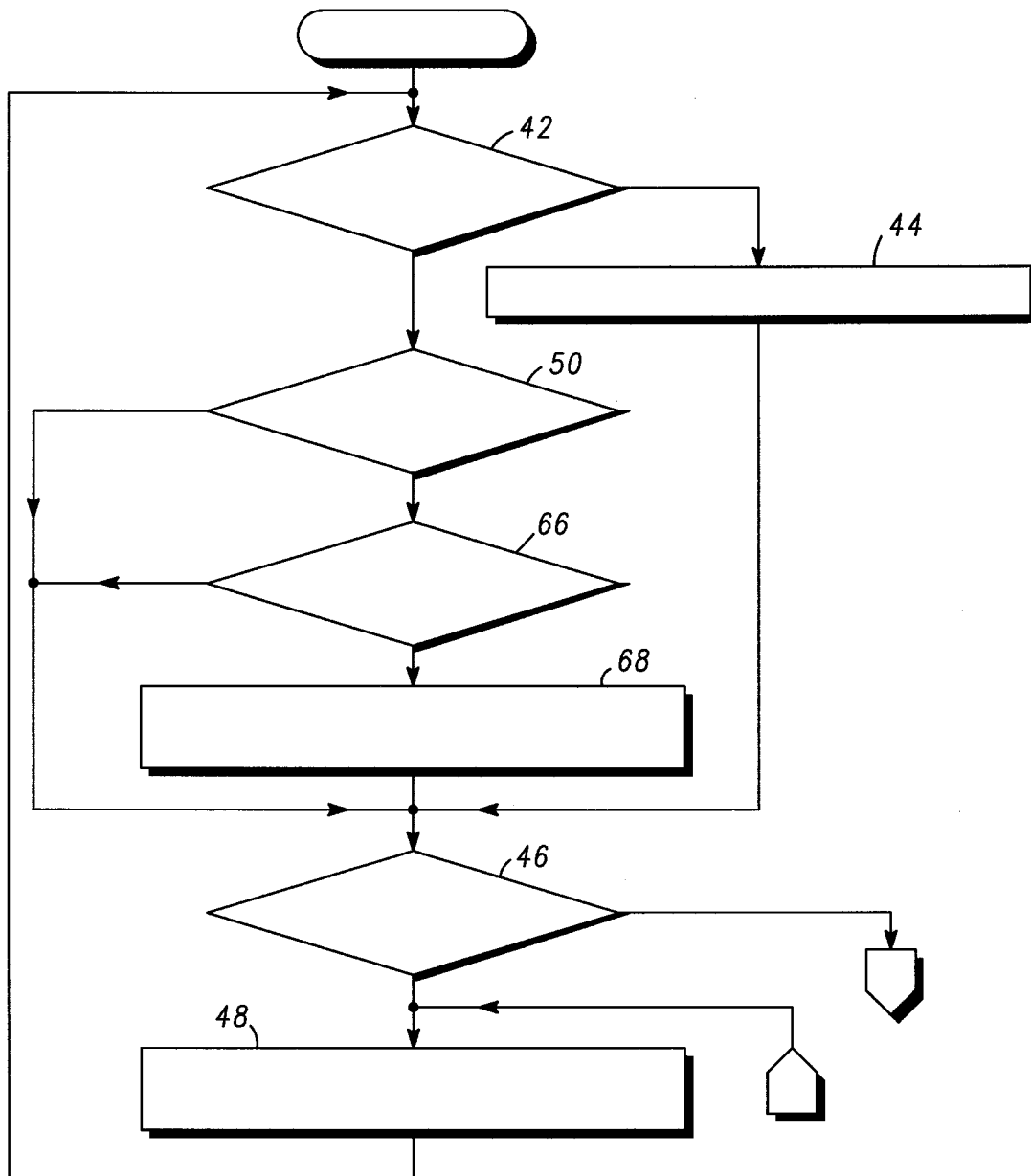
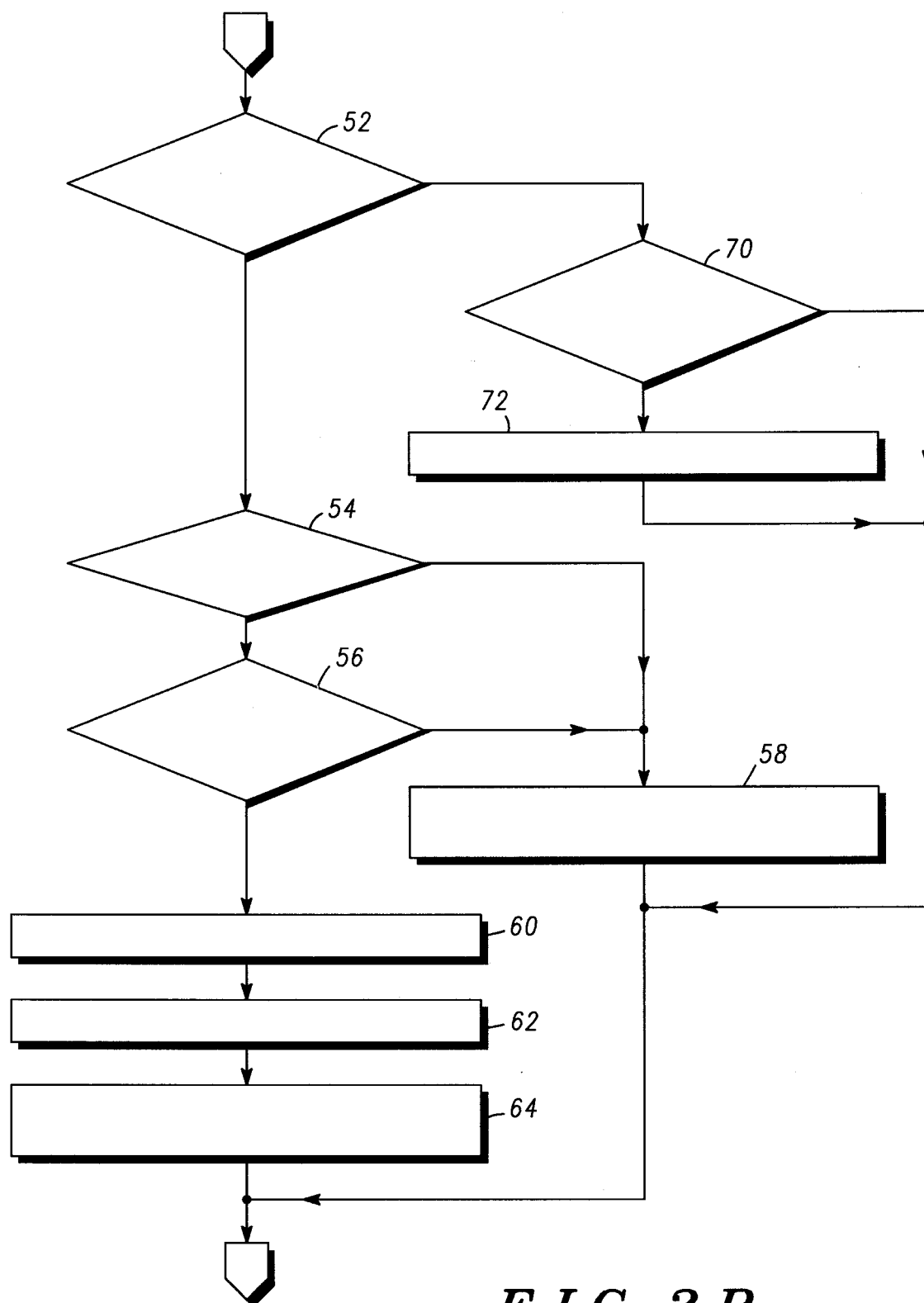


FIG. 1



**FIG. 2 A**



**FIG. 2B**



European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number

EP 92 11 6460

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                     |                                                                                                   |                                                                                                                                                                                                                                                                                       |                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Category                                                                                                                                                                                                                | Citation of document with indication, where appropriate, of relevant passages                     | Relevant to claim                                                                                                                                                                                                                                                                     | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
| Y                                                                                                                                                                                                                       | EP-A-0 385 070 (DIMLER-BENZ)<br>* column 5, line 12 - column 7, line 30;<br>figure 1 *            | 1-3,6,8                                                                                                                                                                                                                                                                               | E05B49/00                                     |
| Y                                                                                                                                                                                                                       | EP-A-0 212 050 (AUDI AG)<br>* column 2, line 13 - line 52; figure 1 *                             | 1-3,6,8                                                                                                                                                                                                                                                                               |                                               |
| A                                                                                                                                                                                                                       | FR-A-2 580 128 (TURATTI M.)<br>* page 5, line 18 - page 6, line 8; figure 1 *                     | 1,6,8                                                                                                                                                                                                                                                                                 |                                               |
| A                                                                                                                                                                                                                       | DE-A-3 625 555 (CHAMBERLAIN MFG. CORP.)<br>* column 3, line 40 - column 4, line 41;<br>figure 2 * | 1,6,8                                                                                                                                                                                                                                                                                 |                                               |
|                                                                                                                                                                                                                         |                                                                                                   |                                                                                                                                                                                                                                                                                       | TECHNICAL FIELDS SEARCHED (Int. Cl.5)         |
|                                                                                                                                                                                                                         |                                                                                                   |                                                                                                                                                                                                                                                                                       | E05B                                          |
| The present search report has been drawn up for all claims                                                                                                                                                              |                                                                                                   |                                                                                                                                                                                                                                                                                       |                                               |
| Place of search<br>THE HAGUE                                                                                                                                                                                            |                                                                                                   | Date of completion of the search<br>11 JANUARY 1993                                                                                                                                                                                                                                   | Examiner<br>SGURA S.                          |
| <b>CATEGORY OF CITED DOCUMENTS</b>                                                                                                                                                                                      |                                                                                                   |                                                                                                                                                                                                                                                                                       |                                               |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                   | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                               |