Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2460113 A1 2004/09/05

(21) 2 460 113

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2004/03/04

(41) Mise à la disp. pub./Open to Public Insp.: 2004/09/05

(30) Priorité/Priority: 2003/03/05 (10/379,875) US

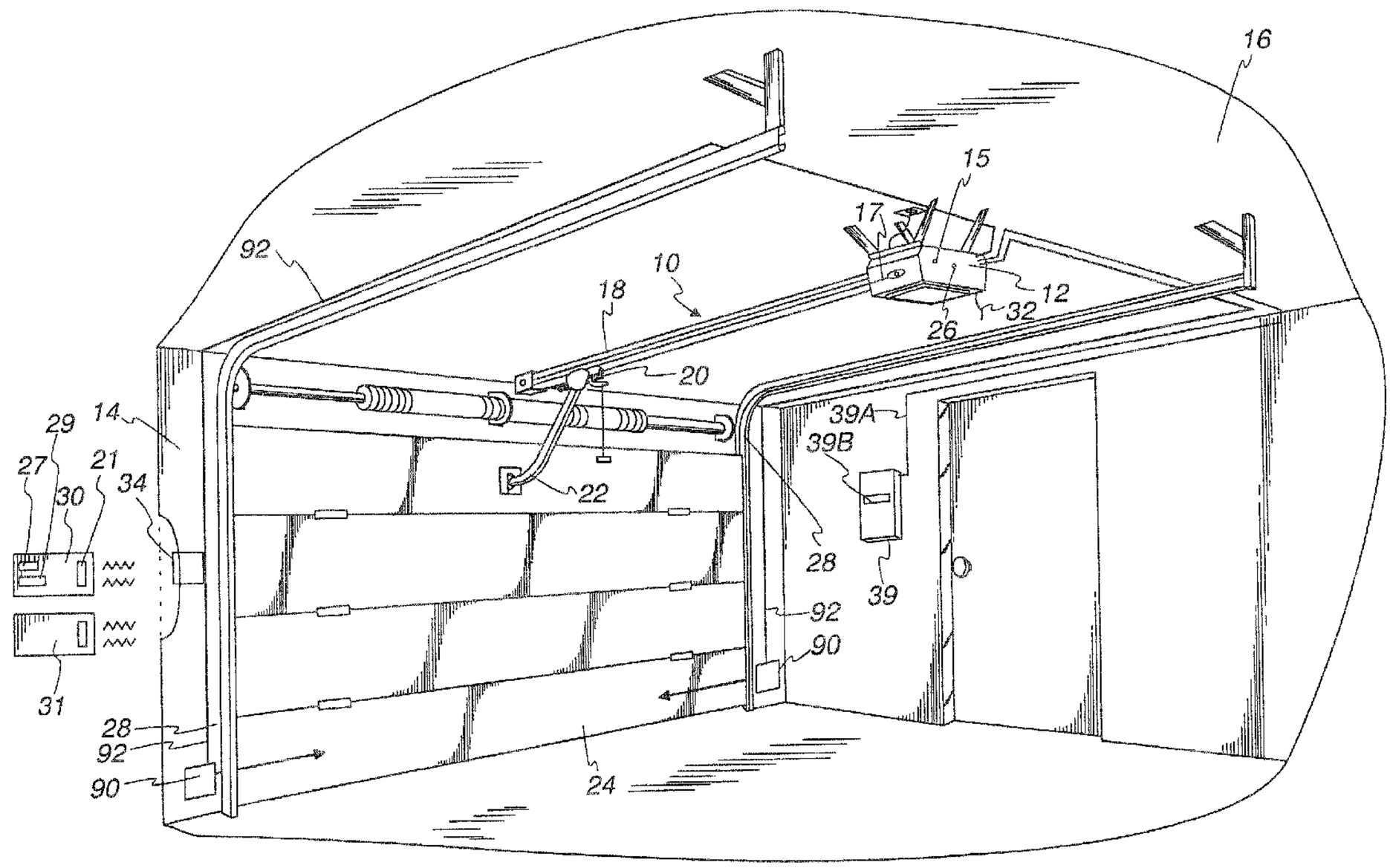
(51) Cl.Int.^{7}/Int.Cl.^{7} E05B 47/00, G06F 19/00

(71) Demandeur/Applicant:
THE CHAMBERLAIN GROUP, INC., US

(72) Inventeurs/Inventors:
DOMENZ, MERYLDINE, US;
FITZGIBBON, JAMES J., US

(74) Agent: MACRAE & CO.

(54) Titre : METHODE ET DISPOSITIF D'APPRENTISSAGE DE CODES DE SECURITE
(54) Title: SECURITY CODE LEARNING METHOD AND APPARATUS



(57) Abrégé/Abstract:
A barrier movement operator is disclosed which learns wirelessly transmitted access codes during a learn mode and subsequently in an operate mode receives wireless transmissions and determines whether action should be taken by consulting the learned access codes. Methods and apparatus are included which can be used to prohibit the learning of unauthorized access codes.

Attorney Docket No. 72098

Abstract

A barrier movement operator is disclosed which learns wirelessly transmitted access codes during a learn mode and subsequently in an operate mode receives wireless transmissions and determines whether action should be taken by consulting the learned access codes. Methods and apparatus are included which can be used to prohibit the learning of unauthorized access codes.

Attorney Docket No. 72098

SECURITY CODE LEARNING METHOD AND APPARATUS

Field of the Invention

The present invention relates to code responsive barrier movement operators and more particularly to code learning methods and apparatus for such systems.

Background

Barrier movement operators are known in the art which respond to access or security codes wirelessly transmitted from hand held or mounted transmitters by controlling the position of a barrier. One common example of such a barrier movement operator is the ubiquitous automatic garage door operator, however other barrier movement operators for controlling doors, shutters, windows and gates are also known.

Some barrier movement operators store representations of one or more authorized access codes which are compared to received access codes to determine whether permission is to be given to control the barrier. During the early days of security code responsive operators, switches were set in both the transmitter and a receiver of the operator to identify the code to be transmitted and the operator code to which the received codes were compared. Product

evolution has provided an advantage whereby security codes are learned at the operator by placing the operator in a learn mode and wirelessly transmitting a security code to be learned. The operator, entered the learning mode at the press of a pushbutton and while in the learning mode, received the transmitted security codes and stored them in memory. Such a learning mode was initiated by manually pressing a learn button on a part of the operator and/or by transmitting a predetermined signal from a transmitter already learned by the operator. The learning mode then terminated for example, a predetermined period of time after its initiation. The learning mode would be entered each time the appropriate pushbutton was pressed. When not in the learning mode the operator is in an operate mode in which received wireless access codes activate the operator if they bear a known relationship to codes already learned by the operator.

The use of an automatic learn mode to learn wirelessly transmitted access codes has simplified the use of barrier operators. Since the simplification of learning access codes there has remained a possibility that an unauthorized individual could press the learn button, cause the operator to enter the learn mode and transmit an unauthorized code to the operator where it was learned. Later, the unauthorized individual could

return and transmit the unauthorized code to the operator which would respond by controlling the barrier. A need exists for a method and arrangement of controlling a barrier operator which retains the ease of security code learning and which provides resistance to the learning of unauthorized codes.

Summary

This need is met and a technical advance is achieved in accordance with the barrier movement operator methods and apparatus described and claimed herein. The barrier movement operator includes the capability of responding to a learn mode signal by learning access codes which later can be used to control the movement of the barrier. In addition, the operator detects the occurrence of a predetermined event and responds thereto by prohibiting further learn mode operations. In this way, prior to the predetermined event easy code learning is achieved, but is prohibited after the event. Such a predetermined event may be the storage of a number of security codes initially set by a user or by the manufacturer of the operator. Alternatively, the predetermined event might be the receipt of a signal from the throwing (pressing) of a switch or the receipt of a particular wireless signal. While in the prohibiting learning mode, no further access codes will be learned by the apparatus. Such

protects from unauthorized users teaching their codes to the operator. The operator may include an overriding of the learning prohibition which can be closely controlled by the individuals in control of the barrier movement operator. In one embodiment, the operator includes a key switch which can only be thrown by a person in control who is in possession of a physical key. New codes are entered into an operator in the learning prohibition mode by throwing the keyed switch which again permits use of the learn mode until the prohibition is again activated. The learning prohibition signal may be originated from a particular master transmitter which the owner keeps secure or which only the manufacturer or distributor of the barrier movement operator can use.

Brief Description of Drawings

Fig. 1 is a block diagram of a garage interior having an installed garage door opener;

Fig. 2 is a block diagram of a head end portion of the garage door opener;

Fig. 3 is a flow diagram of a function performed to prohibit further access code learning; and

Fig. 4 is a flow diagram of a function to re-activate access code learning after it has been prohibited.

Description

Fig. 1 illustrates a barrier movement operator 10 implemented as a garage door operator. It is to be understood that barrier movement operators for other types of barriers and other types of access code responsive systems are within the scope of the present invention. Barrier movement operator 10 includes a head end 12 mounted from the ceiling 16 of a garage 14. The head end 12 includes an electric motor 106 and a controller 83 for controlling the operation of the motor. A trolley rail 18 extends between the head end 12 and the garage front wall and conveys a trolley 20. A chain connects the trolley 20 to the motor 106 to move the trolley back and forth along rail 18. Trolley 20 is connected to a multi panel door 24 by a member 22 and as the trolley 20 moves back and forth the door 24 is raised and lowered on a pair of tracks 28. A wall control unit 39 is connected to the controller 83 of head end 12 so that when a button 39B is pressed a command to move or stop the door is given to the controller. Controller 83 also receives commands transmitted from two hand held transmitters 30 ad 31 and from an externally wall mounted transmitted 34.

Fig. 2 is a block diagram of head end 12 and the connections between controller 83 and external signal sources. Controller 83 includes a micro-controller 84 which includes memory to store the program and data to implement control of door movement. Micro-controller 84 is connected to additional non-volatile memory 88 which is used to store operational data such as the access codes learned by the barrier movement operator in a manner discussed below. Head end 12 includes an up limit and a down limit detector 93 which are used by the controller 83 to stop the door when open and closed. An optical transmitter and receiver pair 90 are connected to the controller 83 to indicate when an obstruction is present in the doorway. In the present embodiment transmitters 30, 31 and 34 transmit using rf which is received by a receiver 80 via an antenna 32. The receiver 80 sends the results of signal detection to the micro-controller 84 via a path 82. It should be mentioned that the transmitter of the present embodiment send signals by rf, other types of wireless signaling such as optical or acoustic may be employed.

Controller 83 responds to the various input signals by controlling the movement or stoppage of motor 106. Accordingly, micro-controller 84 sends motor control signals via a path 102 to relay control logic 104 which sends power to the motor, to drive the motor

in one direction or the other or to stop the motor from movement. Head end 12 may also comprise a light 81 which may be controlled by the relay logic 104 in response to controller 83.

For security reasons the head end 12 should respond to signals from wireless transmitters e.g., 30, 31 and 34 only when those transmitters are authorized. For security purposes the signals from each transmitter include an access code which may be different for each transmitter. In one known arrangement the access code is twenty trinary digits in length, providing good security. The barrier movement operator of the present embodiment includes the ability to learn the access codes from various wireless transmitters by entering a learn mode and receiving a transmitted code. Head end 12 includes a learn switch 16 which is a push button switch connected to micro-controller 84. When learn switch is pressed micro-controller executes a pre-programmed sequence of instructions to learn the access code of a wireless transmitter e.g., 31 which is activated to transmit after the learn mode is entered. While in the learn mode receiver 80 receives the transmission from the sending transmitter and sends a representation to micro-controller 84 representing the received signal. Micro-controller 84 identifies the access code portion of the received signal and validates

it. The code is then stored in non-volatile memory 88 and the learn mode is terminated. When not in the learn mode the barrier movement operator is in an operate mode during which received access codes are compared with the stored representations of learned access codes and when a proper relationship is present micro-controller 84 responds to the signal by controlling the door 24. In order to prevent the learning of unauthorized transmitter access codes controller 83 includes the ability to inhibit or prohibit learning new access codes.

Fig. 3 is a flow diagram of a learn process including learn prohibit activities. Initially, a learn request is received by the apparatus and analyzed in a step 51. When step 51 determines that prohibit learn is active the process returns without implementing any learning. Alternatively, when step 51 determines that prohibit learn is not active flow proceeds to block 53 where the learn mode is entered. After the beginning of the learn mode flow proceeds to block 55 where the transmitted code is received and on to block 57 where the access code portion of the received code is stored. A check is then performed in block 59 to determine whether the event which begins the learn prohibit mode has occurred. As discussed below, such an event may be the receipt of a specified signal or the storage of a

predetermined number of access codes. When block 59 determines that the event has not occurred flow returns to await another learn mode activity. Alternatively, when block 59 determines that the event has occurred flow proceeds to block 61 where the prohibit learn is marked active and flow returns. When prohibit learn is marked active such will be detected on the next occurrence of block 51 and flow will return without learning a new access code.

Fig. 4 is a flow diagram of the process used to disable the prohibit learn function so that further performances of block 51 (Fig. 3) will allow the learning of new access codes. Periodically, the flow checks in block 63 whether the system has received a signal to re-activate the learn mode. Flow proceeds to a block 65 to determine whether the received signal is proper. If proper flow proceeds to a block 67 where learn process is again marked active and flow returns. Alternatively, when block 65 determines that the request to re-activate the learn process is not proper flow returns without marking learn active. The following embodiments illustrate the principles of the above flow diagrams.

In one embodiment the controller 83 is programmed to accept only a preset maximum number of access codes, for example 8. The installer of such an operator enters

the learn mode for each transmitter he or she wants the operator to learn and completes the above-described learn mode sequence for each. Should the installer want to teach/learn fewer than the maximum number he or she will then teach/learn the access codes of already learned transmitters until the maximum number of access codes has been learned. Although some learned access codes will be redundant the maximum number of access codes will be learned. When the maximum has been learned the controller 83 will no longer respond to the learn button 26 by entering the learn mode which may be prevented by numerous methods. When in the learn prohibitions mode the micro-controller can determine at each press of the learn button 26 that learn prohibition is active and as a result the learn access code sequence of program is skipped. Alternatively, when the learn mode prohibition is active the entire sequence of program instructions could be changed to one in which the input from the learn switch is ignored and/or which does not include the program steps performed to implement learning. Further, while in the learn prohibition mode the learn switch could be ignored by hardware or software arrangements.

In the preceding embodiment the maximum number of access codes was preset without installer intervention. In another embodiment the installer may be given control

of the maximum number. For such installer control it is necessary for the installer to accurately count the total number of transmitter access codes to be learned then enter the learn mode by pressing the learn button 26. The first time the learn mode is entered, the program allows the installer to set the maximum number of codes to be learned by repeatedly pressing the learn button 26 to represent the number of codes to be learned. The micro-controller 84 then records the maximum number and when the number of access codes learned equals the maximum number, the micro-controller 84 prohibits further learning of access codes. Optionally, the head end 12 may include a light such as an LED which the micro-controller blinks to represent the number of codes to be learned. It should be apparent that a numerical screen may be used to convey the number of access codes also.

A further embodiment allows the installer to limit the maximum number by turning on the prohibition against further learning after the access codes of all authorized transmitters have been learned. In this embodiment the head end includes an end learn switch 15 connected to micro-controller 84. An installer teaches access codes from transmitters as described above. When all transmitters to be authorized have been learned the installer presses the end learn mode button 15 in

response to which the controller enters the prohibit learn mode. The controller can alternatively be pre-programmed to respond to a press of the end learn mode button 15 followed by the receipt of an access code from a previously learned transmitter to enter the prohibit learn mode. Similarly, the use of a predetermined button on a transmitter may optionally be used to enter the prohibit learn mode.

In the case of professionally installed barrier movement operators an alternative embodiment may be used. In the alternative embodiment the professional installer has a special master transmitter, the access code of which was previously stored in the controller at the time of manufacturer and which is not used by transmitters given to routine owners or users. When a controller 83 receives a transmission from the master transmitter the prohibit learn mode could be toggled on and off.

The barrier movement operation might optionally be provided with a key switch 17 which is shown in Fig. 1 as being mounted to the cover of the head end unit 12 although other secure placements of the key switch may be used. The key switch is a normal electrical switch the position of which is only changed by the use of a physical key. The key switch is then activated to enter and leave the prohibit learn mode. In an alternative

embodiment the head end is not provided with a learn button 26 and the learn button function is replaced by the key switch 17. That is, the operator only learns an access code in a learn mode entered by activating the key switch 17.

The preceding description relates to the learn mode and how a prohibit learn mode can be activated. Further access codes cannot be learned after the prohibit learn mode is entered. Such may be too much limitation on the owner/user of the barrier movement operation. Accordingly, certain methods and apparatus may be implemented to stop the prohibit learn mode and allow the learning of access codes.

In one embodiment, when it is desired to have the operator learn one or more access codes after the prohibit learn mode is active, all previously learned access codes are erased and the learn mode is entered as before. Such a re-activation of a learn capability may be in response to a signal from a secure switch such as, key switch 17 or in response to a master transmitter held only by installers and sellers of the barrier movement operator. For added security these acts could be responded to only when accompanied by an access code from a previously learned transmitter. In embodiments for use where the maximum security is not needed the controller 83 is programmed to respond to a sequential

press of the learn button 26 and the reception of a previously learned access code. The above re-activation of learn mode includes the erasure of all previously learned access codes and the subsequent re-learning of the access codes for authorized transmitters. In alternative embodiments the re-activation of the learn mode could be done without erasure. Such would then be dependant on the security of the re-activation process.

Attorney Docket No. 72098

WHAT IS CLAIMED IS:

1. A method for operating a security code system comprising steps of:

responding to a first signal generated by user interaction by initiating a code learn mode in which access codes are received and stored;

detecting a predetermined code learn mode terminating event related to storage of the access codes by the access code system; and

prohibiting the initiation of code learn mode after the predetermined code learn mode terminating event is detected in the detecting step.

2. The method in accordance with claim 1, wherein the step of detecting the predetermined event comprises detecting a second signal identifying that no further access codes are to be learned.

3. The method in accordance with claim 1, wherein the step of detecting predetermined event comprises detecting the storage of a predetermined number of access codes.

4. The method of claim 3 comprising setting the predetermined number of access codes.

5. The method of claim 4 wherein the setting step comprises pressing a learn switch one or more times to represent the predetermined number of access codes.

6. The method in accordance with claim 2 wherein the second signal is generated in response to a user generated signal.

7. The method in accordance with claim 6 wherein the user generated signal is generated by user interaction with a access code transmitter.

8. The method in accordance with claim 6 wherein the second signal is generated by user interaction with a secure switch, access to which is limited.

9. The method in accordance with claim 6 wherein the second signal is generated by a lock protected switch.

10. The method in accordance with claim 1 comprising re-enabling the initiation of a code learn mode after the prohibiting step.

11. The method in accordance with claim 10 wherein the re-enabling step is performed in response to a master signal from a secure source.

12. The method in accordance with claim 10 wherein the re-enabling step is performed in response to a signal from transmitter which includes an access code already learned by the security code system.

13. A method for preventing unauthorized learning of security codes by a security code receiver, comprising steps of:

activating learn mode of the receiver;

storing a predetermined number of valid security codes in the receiver; and

blocking the learn mode of the receiver with a restricted access to learn mode re-activation.

14. A method of protecting a barrier movement operator from unauthorized learning of access codes, comprising steps of:

activating learn mode for the operator;

receiving and storing access codes from a predetermined number of transmitters in a memory of the operator; and

blocking the learn mode of the operator,

wherein the access to re-activation of the learn mode after blocking is restricted and allowable only under predetermined conditions.

15. The method according to claim 14, wherein the predetermined number of transmitters is set in the operator by pressing a learn button of the operator a representative number of times.

16. The method according to claim 15, comprising activating the learn mode of the operator for a learn mode term and indicating, during the learn mode term, a number of transmitters to be learned.

17. The method according to claim 14, wherein the learn mode is activated by pressing a learn button of the operator and receiving a unique signal from a transmitter previously learned by the operator.

18. The method according to claim 14, wherein the step of activating of the learn mode comprises receiving a learn mode signal from a master transmitter.

19. The method according to claim 14, wherein the learn mode is activated for a limited time.

20. The method according to claim 14, wherein the step of activating the learn mode of the operator comprises erasing all previously stored transmitter access codes from the memory of the operator.

21. The method in accordance with claim 14, wherein blocking of the learn mode of the operator comprises activating a block switch.

22. The method according to claim 18, wherein blocking of the learn mode of the operator comprises pressing a block button on the master transmitter.

23. The method according to claim 14, wherein the re-activating the learn mode includes pressing a learn button of the operator and receiving a signal from a transmitter recognized by the operator.

24. The method according to claim 14, wherein the learn mode is blocked when all the locations of the access code memory store access codes.

25. A barrier movement operator system, comprising:

a receiver with an access code memory for receiving, learning and responding to transmitted access codes;

an activation device for enabling a learn mode of the receiver;

at least one transmitter having an access code to be trained into the access code memory of the receiver in order to operate the system;

a controller for operating during a learn mode of the receiver and evaluating availability of the access code memory for storing new access codes;

apparatus for making learn mode inactive; and

a blocking apparatus to block the learn mode of the receiver to prevent unauthorized activation of the learn mode.

26. The operator system in accordance with claim 25, further comprising an indicator for showing a number of access codes to be learned during a learn mode term.

27. The operator system according to claim 25, wherein the receiver comprises a learn switch to activate and block the learn mode.

28. The operator system according to claim 25, wherein the activation device includes a learn switch of an authorized transmitter.

29. The operator system according to claim 25, wherein the activation device comprises a master transmitter.

30. The operator system according to claim 25, comprising a plurality of additional transmitters each having an access code, wherein the access code memory of the receiver has a predetermined number of access code locations, and during the learn mode stores the access codes from the transmitters and their copies in the locations until all the access code locations are full.

31. The operator system according to claim 30, wherein, prior to storing a new access code, the controller evaluates the memory looking for a copy of a stored access code, and overwrites the copy with the new access code.

32. The operator system according to claim 25, wherein the activation device is positioned in a secure location with a restricted access.

33. The operator system according to claim 29, wherein the master transmitter is kept by a seller of the operator system.

34. A barrier movement operator for moving a barrier comprising

a motor apparatus connecting the motor to the barrier for movement thereof;

a controller, responsive to access codes from a transmitter, for controlling the motor to move and stop the barrier, the controller comprising a learn capability during which access codes from one or more transmitter can be learned; and

learn control apparatus responsive to a predetermined event for prohibiting operation of the learn capability of the controller.

35. A barrier movement operator according to claim 34 wherein the learn control apparatus comprises a key switch.

36. A barrier movement operator according to claim 34 wherein the learn control apparatus comprises a transmitter having an access code learned by the controller.

37. A barrier movement operator according to claim 34 wherein the learn control apparatus comprises a counter for counting a number of access codes learned by the controller.

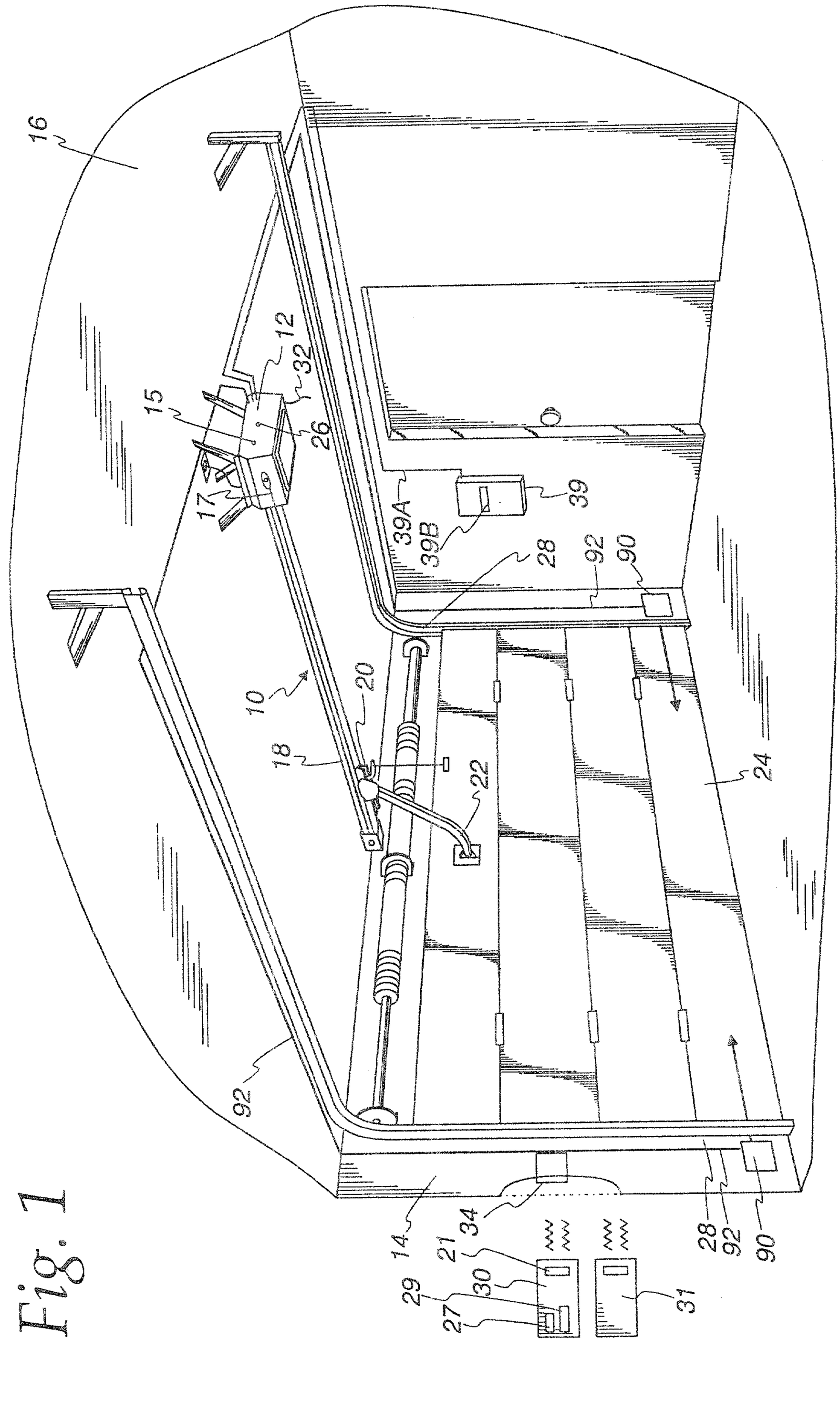

16
12
32
15
26
17
39A
39B
39
28
92
90
10
20
18
22
24
14
21
34
29
30
27
31

Fig. 1

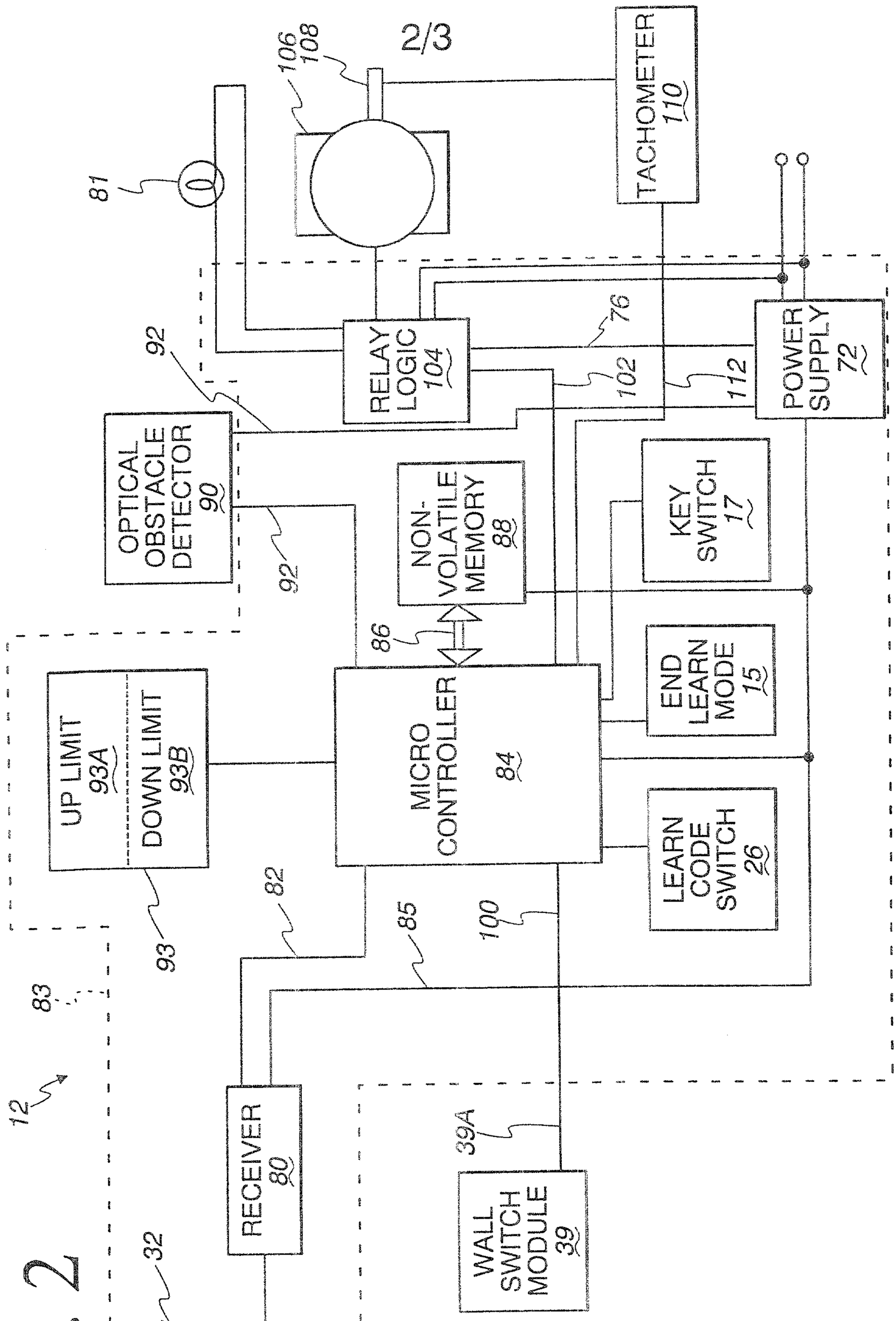

2/3
106
108
81
TACHOMETER
110
RELAY
LOGIC
104
76
102
112
POWER
SUPPLY
72
92
OPTICAL
OBSTACLE
DETECTOR
90
92
NON-
VOLATILE
MEMORY
88
86
KEY
SWITCH
17
END
LEARN
MODE
15
UP LIMIT
93A
DOWN LIMIT
93B
MICRO
CONTROLLER
84
LEARN
CODE
SWITCH
26
82
85
100
93
83
RECEIVER
80
32
12
39A
WALL
SWITCH
MODULE
39

Fig. 2

Fig. 3

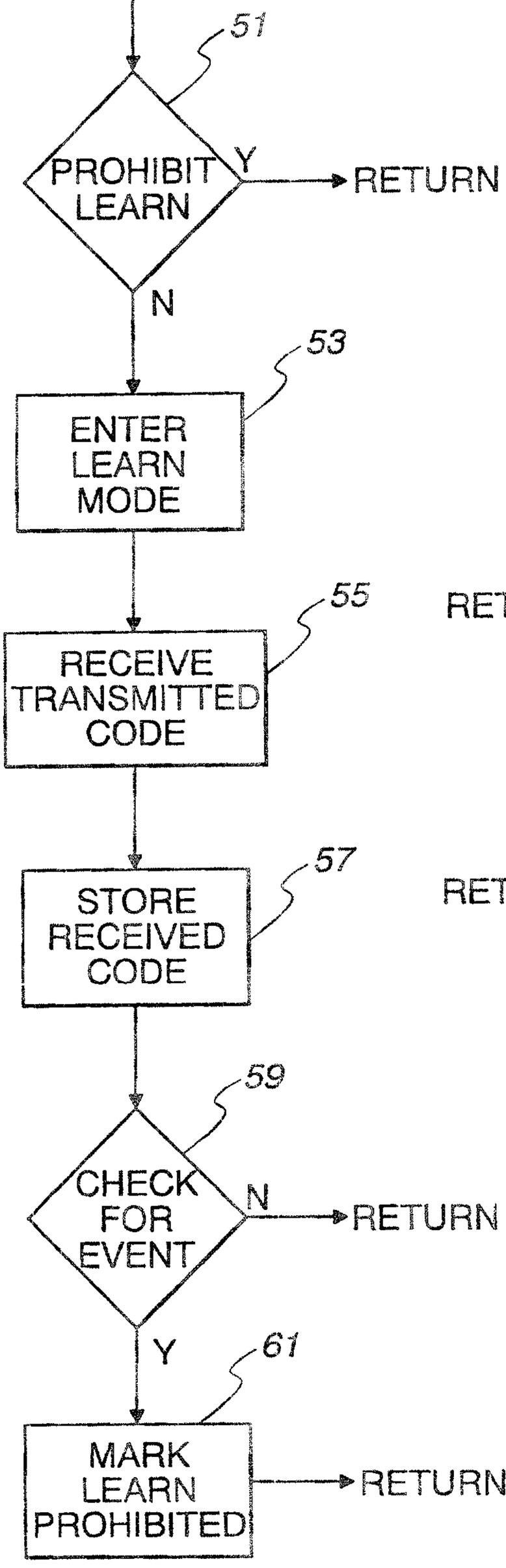
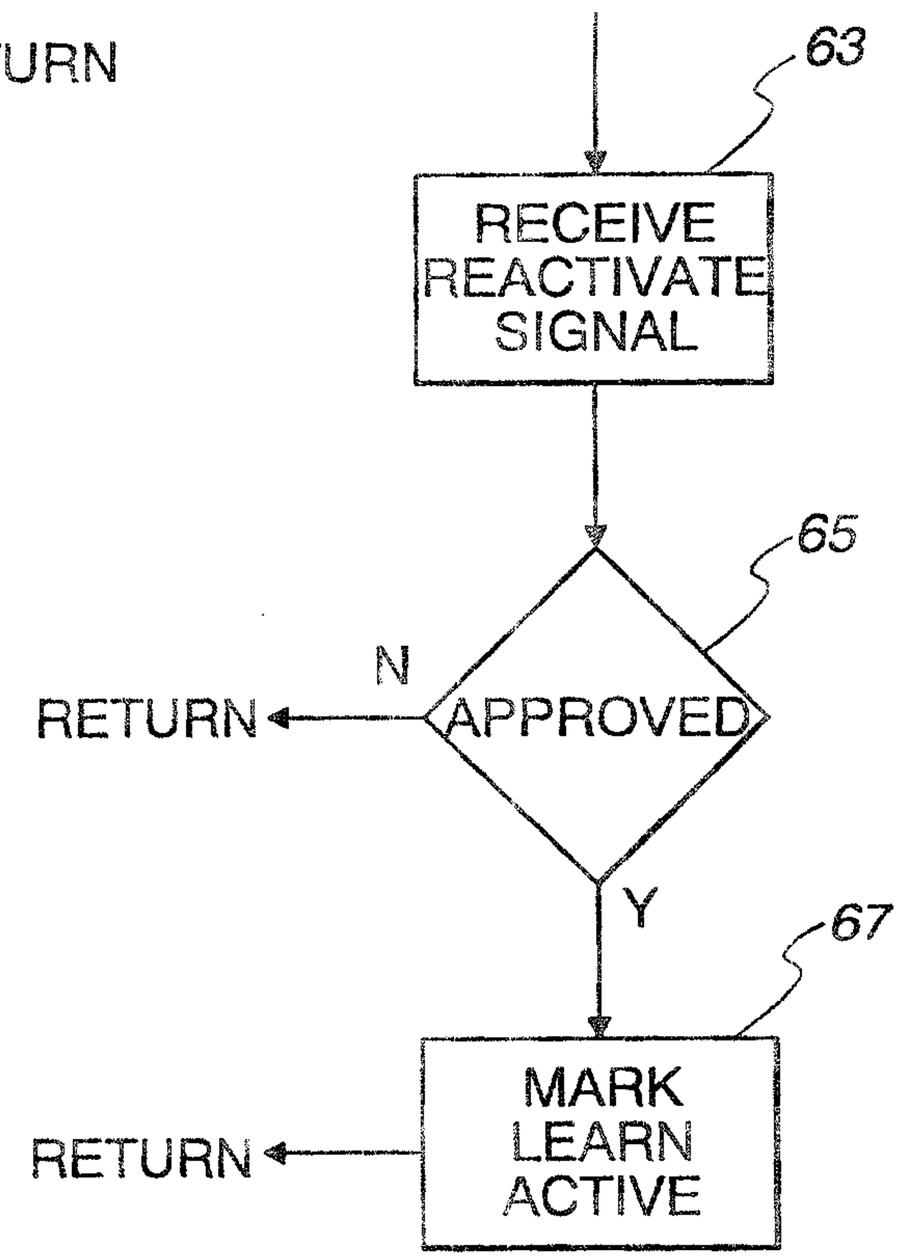
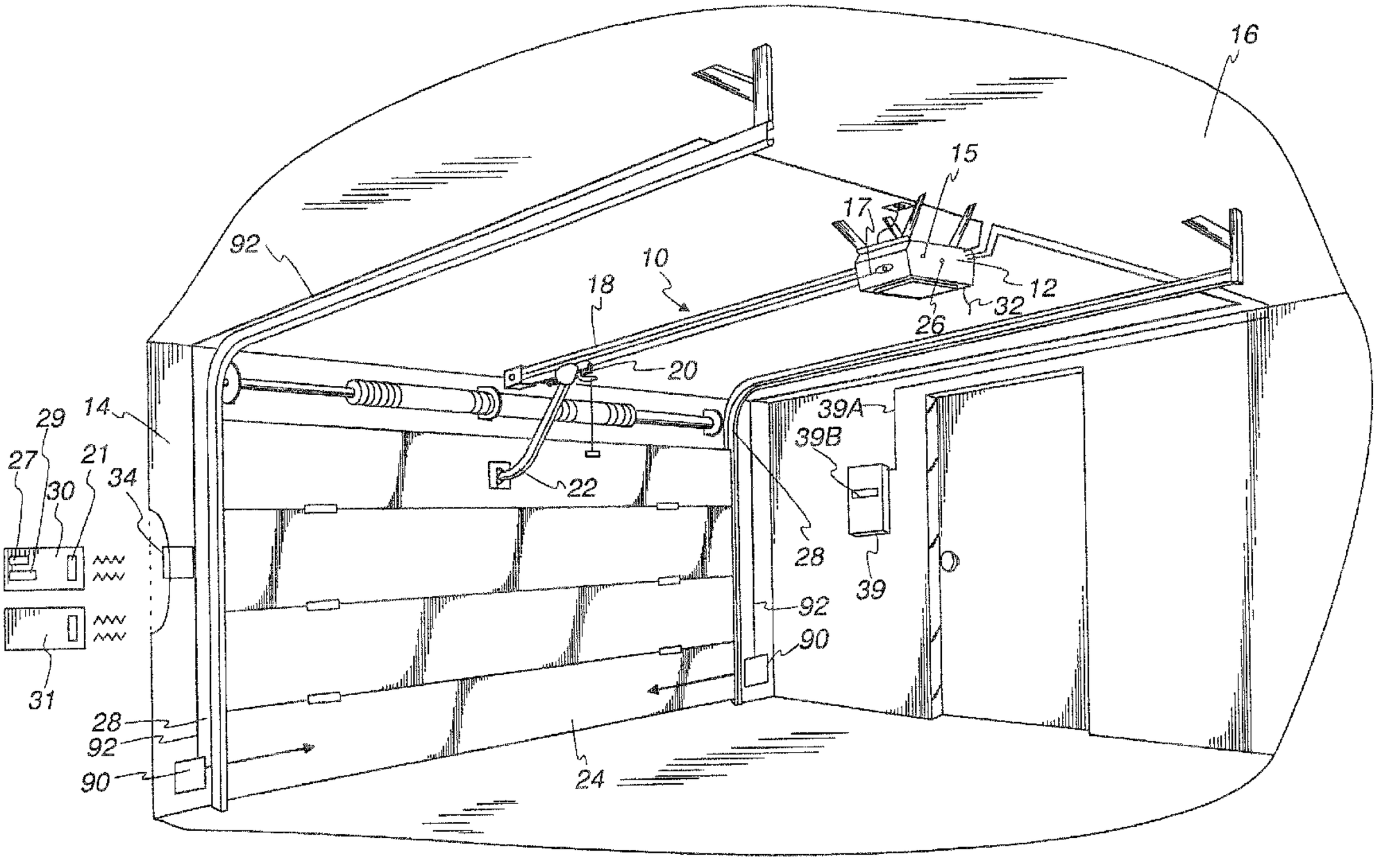

51
PROHIBIT LEARN
Y
RETURN
N
53
ENTER LEARN MODE
55
RECEIVE TRANSMITTED CODE
57
STORE RECEIVED CODE
59
CHECK FOR EVENT
N
RETURN
Y
61
MARK LEARN PROHIBITED
RETURN

Fig. 4


63
RECEIVE REACTIVATE SIGNAL
65
APPROVED
N
RETURN
Y
67
MARK LEARN ACTIVE
RETURN


16
15
17
92
10
18
12
32
26
20
39A
39B
29
14
27
21
30
34
22
28
39
92
90
31
28
92
90
24