PCT

(51) International Patent Classification 5 : G05B 19/05, G08B 5/22 H04Q 5/02	A1	(11) International Publication Number: WO 92/01979
		(43) International Publication Date: 6 February 1992 (06.02.92)

(21) International Application Number: PCT/US91/04943

(22) International Filing Date: 12 July 1991 (12.07.91)

(30) Priority data:
552,769   16 July 1990 (16.07.90)   US

(71) Applicant: THE CHAMBERLAIN GROUP, INC. [US/US]; 845 Larch Avenue, Elmhurst, IL 60126 (US).

(72) Inventors: WILLMOTT, Colin, Barnes ; 917 Saybrook Lane, Buffalo Grove, IL 60089 (US). HEITSCHEL, Carl, Thomas ; 316 West 39th Street, Downers Grove, IL 60515 (US).

(74) Agents: WATT, Phillip, H. et al.; Fitch, Even, Tabin and Flannnery, Room 900, 135 South LaSalle Street, Chicago, IL 60603 (US).

(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, SD, SE, SE (European patent), SN + (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent).

Published
With international search report.

(54) Title: REMOTE ACTUATING APPARATUS

(57) Abstract

A garage door opening system comprises a receiver (73) which is responsive both to security codes in a first format (fig. 1) from existing transmitters and to security codes in a new and more secure format (fig. 2) from new transmitters (51). The old format comprises a synchronization character and ten code words and the new code format advantageously comprises twenty code words with a new synchronization character between the tenth and eleventh code words. The receiver determines (105) from the received synchronization codes the type of format being received and compares (109, 115) the received code words with stored permitted code words of the same type. When a match occurs (111, 117) an activation signal is generated (113).
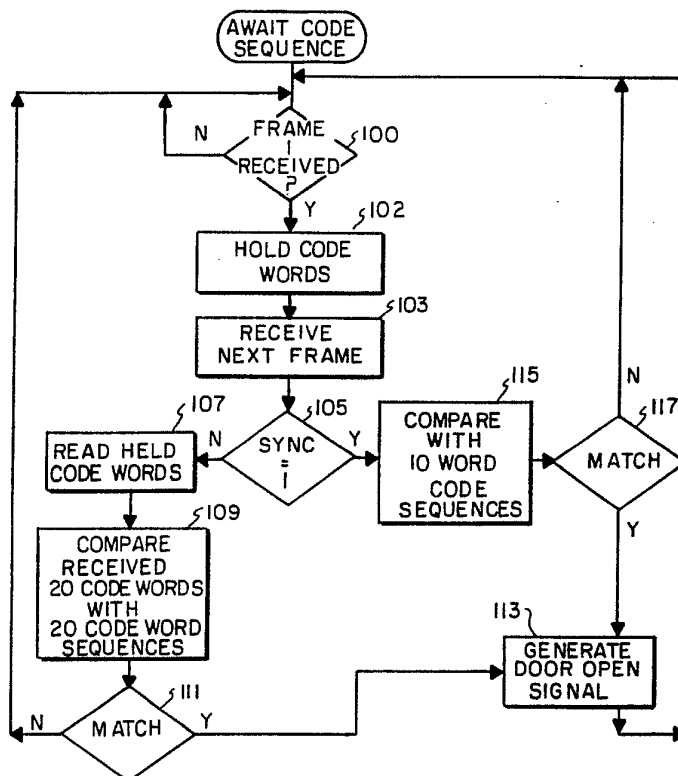
+ DESIGNATIONS OF "SU"

It is not yet known for which States of the former Soviet Union any designation of the Soviet Union has effect.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic	SE	Sweden
CH	Switzerland		of Korea	SN	Senegal
CI	Côte d'Ivoire	KR	Republic of Korea	SU+	Soviet Union
CM	Cameroon	LI	Liechtenstein	TD	Chad
CS	Czechoslovakia	LK	Sri Lanka	TG	Togo
DE	Germany	LU	Luxembourg	US	United States of America
DK	Denmark	MC	Monaco		

REMOTE ACTUATING APPARATUS

Background of the Invention:

The present invention relates to remote actuating apparatus and more particularly, to improvements in security coding provided by such apparatus.

Remote actuating apparatus such as automatic garage door openers, comprise remote transmitters and a receiver which responds to signals from the transmitters to generate actuating signals thereby opening a door. The receivers of such arrangements provide security in their operation by actuating only when a properly transmitted request is received which matches one of a small number of allowable security codes. The security codes are used to deny access by miscreants and to limit the possibility that someone with a similar transmitter will erroneously open garage doors other than his or her own.

Modern remote actuation systems provide for tens of thousands of unique security codes and the probability of a neighbor using the same code or of a potential criminal "breaking" a code are relatively small. Consumer demands for security improvements are growing, however. One possible response to such demands is to increase the number of coded characters in the security codes. This improves security, but it creates a number of additional problems. One problem comes about from the security code set up arrangements of today's door openers. Most rely on the set up by a user of a number of tiny switches in each transmitter. When the number of code characters is increased, the number of switches to be provided also increases, causing physical design problems in the transmitter and given the size of the switches makes the system more difficult to set up by the user.

An alternative to providing switched code settings in transmitters is to assign each transmitter a unique code which is unchangeably stored in the transmitter. Such a permanent code, when combined with a programmable receiver, as is disclosed in C. Heitschel, et al., United States Patent No. 4,750,118; makes set up an

-2-

easy task but it makes impossible the selective use of a
single transmitter with more than one receiver when the
receivers are physically close enough that they both
receive the same transmissions. A need exists for a remote
5   actuating system which provides set up convenience, but in
which a single transmitter can operate selectively with
multiple receivers.

Adding to the number of security code characters
also requires a new transmission and reception format. The
10   adoption of a new format without proper consideration for
the old format makes obsolete many old transmitters. Such
forced obsolescence is not desirable. Accordingly, a need
exists for a new coding format which permits the desired
increases in security, while at the same time is compatible
15   with equipment which is presently in the hands of
consumers.

Summary Of The Invention

20   The present invention is directed to a remote
actuating system which operates with first transmitters
repetitively transmitting a first code sequence comprising
a first frame of code words and with second transmitters
for repetitively transmitting second code word sequences
25   including both a first frame of code words and a second
frame of code words.   Each first frame of code words
includes a first identity character identifying it as a
first frame and a predetermined number of code words and
each second frame comprises a second identity character,
30   identifying a second frame, and the same predetermined
number of code words on the first frame.   A receiver for
operation with this system stores at least one first code
word sequence including the predetermined number of code
words and at least one second code word sequence storing
35   twice the predetermined number of code words.   These stored
code word sequences comprise the permitted code word

sequences. When a first frame of code words is received, it is held in storage until another frame of code words is received. When the other code word sequence is determined to be a first frame, then two first frames have been received successively, indicating that the incoming code word sequence is a first code word sequence and an actuation signal is generated when the received first frame matches a first code word sequence stored in the receiver. Alternatively, when the other frame of code words is determined to be a second frame of code words, the code words of the first and second received frames are compared with the second code word sequences stored in the receiver and an actuation signal is generated when a match occurs.

Advantageously, the identity character of each first frame is different from the identity character of each second frame and received frames of code words are distinguished by analyzing the identity characters associated therewith.

A transmitter to be used in this arrangement consists of a pre-programmed source of code words and a transmitting arrangement which transmits a first synchronizing character followed by a second predetermined number of code words. Then, after a pause in transmission, transmits a second synchronizing character followed by a third predetermined number of code words where the sum of the second and third predetermined numbers of code words equals the total number of code words to be transmitted. In an embodiment of the invention, the total number of code words transmitted is twice the number of code words in a sequence provided by the old type transmitters. Accordingly, a receiver can successively receive two old words utilizing the same circuitry as receiving a single new code word sequence. Also, in the present arrangement the first synchronizing signal is the same as the old transmitter synchronizing signal, while the second synchronizing signal is different from the first signal.

The synchronizing signals of received code word sequences are analyzed to determine whether two old type code words have been received or a single new type code word including non-identical synchronization signals has been received.

In an additional embodiment of the invention, the code word sequence transmitter includes an arrangement for permanently storing a predetermined number of code words and a plurality of operator controllable switches for controlling at least one additional code word. When a code word sequence is transmitted, it comprises both the permanently stored code words and the additional code words identified by the switches. By using a combination of pre-stored code words and switch controlled code words, this structure provides the new type of long code sequences but still permits variability in the code word sequences transmitted. When the switch controlled code words are determined by switches which can easily be accessed by the operator, this arrangement permits the use of a single transmitter to selectively actuate multiple receivers, even when those multiple receivers receive the same transmitted code word sequences from the transmitter.

Brief Description Of The Drawings

FIG. 1 is a representation of an existing garage door opener code character format;

FIG. 2 represents a new code character format in accordance with one embodiment of the present invention;

FIG. 3 is a block diagram of a transmitter of an embodiment of the invention;

FIG. 4 is a flow diagram of the transmitter of FIG. 3;

FIG. 5 is a block diagram of a code character receiver for use with the transmitter of FIG. 3;

FIG. 6 is a flow diagram of a self-programming mode of operation for the receiver of FIG. 5;

FIG. 7 is a flow diagram of the operation of receiver of FIG. 4 when a security code is received;

FIG. 8 is a block diagram of an alternative transmitter embodiment to that shown in FIG. 3; and

FIG. 9 is a block diagram of an alternative transmitter to that shown in FIG. 8.

Detailed Description Of The Preferred Embodiment

Before discussing the embodiments of the present invention which are compatible with both an "old" security code format and a "new" security code format, a discussion of the old code format is appropriate. FIG. 1 is a representation of the old coding format. With the old format, ten code words 41 make up the security code proper. Each of the code words 41 comprises 4-bits which are used to convey one of three code designations. The coding of these three designations, which are labelled A, B and C is shown in Table 1. Since each of the code words 41 indicates one of three states and ten such words exist in a code sequence, approximately 59,000 unique code word sequences can be created with the old coding format.

CODE WORD REPRESENTATIONS

TABLE 1

Code Character	Transmitted Code			
	Bit-1	Bit-2	Bit-3	Bit-4
A	0	0	0	1
B	0	0	1	1
C	0	1	1	1

The code words are transmitted from a transmitter to a receiver using RF signals and each sequence of code words begins with a single logic one synchronization pulse 42. After the transmission of a complete ten word code

sequence, a blanking interval is produced by the
transmitter of approximately 39-bit intervals, then the
entire code sequence beginning with the logic one
synchronization pulse 42, is repeated. Transmission in
this manner results in a continuing sequence of transmitted
code sequences, each separated by 39 blank bit times and
each beginning with a logic one synchronization pulse 42.
A receiver for this code format recognizes the format by
the presence of the synchronization pulse 42 following a
blanking interval and records each successive sequence of
ten code words. As is well known in the art, multiple
repetitions of the same code word sequence are received
before the code word sequence is determined to have been
received correctly.

FIG. 2 represents a new code sequence of the
present embodiment. The new sequence of FIG. 2 comprises
two frames of code words where a frame 1 consists of code
words 1 through 10 and frame 2 consists of code words 11
through 20. In FIG. 2, the code words of frame 1 are
denoted 44 and those of frame 2 are denoted 45. A code
sequence of 20 three state code words as shown in FIG. 2
permits in excess of three billion unique code
combinations. New code sequences are transmitted in a
manner different from the old code sequences. Each frame
1 is transmitted using substantially the same format as
each frame of the old system and begins with a logic one
synchronization pulse 42 and ends with a blanking interval
of approximately 39-bit times. Each frame 2, however, is
transmitted at the end of the blanking interval and begins
with a synchronization 2 signal 46 which comprises three
consecutive logic ones. At the conclusion of the
transmission of a frame 2, another blanking interval is
enforced followed by repetitive transmissions of frame 1
and frame 2, each separated by a blanking interval and each
frame 2 beginning with a 3-bit synchronization signal 46.

FIG. 3 is a block diagram representation of a

-7-

transmitter for transmitting code sequence signals of the type shown in FIG. 2. A transmit unit 51 operates in accordance with signals from a time generator 53 to read permanently stored code words from a code word source 59 and convert them into RF signal bursts which are transmitted to the receiver (FIG. 5) via an antenna 54. The transmitter of FIG. 3 is normally at rest. When an operator wishes to transmit a code, that operator presses a push-button 56 to which timing generator 53 responds by generating a continuing sequence of clock pulses at the rate of approximately one pulse per millisecond. These clock pulses are applied to transmit unit 51 via a conductor 57 and control the reading and transmission of code words. FIG. 4 is a flow diagram of the operation of the transmitter of FIG. 3 and is discussed in conjunction with the operation of the transmitter of FIG. 3.

The sequence shown in FIG. 4 begins at block 60 with the detection of the closure of push-button 56. Pressing button 56 causes time generator 53 to generate a recurring sequence of timing pulses at the rate of one per millisecond. In response to a first timing pulse, transmit unit 51 transmits via antenna 54, a logic one, synchronization 1 signal of 1-bit time duration (one millisecond). At this time, transmit unit 51 also begins to read code words from a code word source 59 over a communication path 58. In block 64, the code words read from code word source 59 are transmitted in sequence at the rate of 1 code word bit per clock time until the last bit of the tenth code word has been transmitted. At the end of transmission of the tenth code word, transmit unit 51 blanks all transmission for 39 bit times (block 66). Transmitter 51 terminat s the blanking interval by transmitting a synchronizat on 2 signal consisting of three consecutive logic ones (block 68). At the conclusion of the transmission of the synchronization 2 signal, code words 11 through 20 which are accessed from code word

source 59 are transmitted in a manner substantially identical to the transmission of code words 1 through 10. At the conclusion of the transmission of code words 11 through 20, the flow diagram proceeds to block 71 where another blank interval of 39-bit times is inserted and the flow proceeds back to block 60 where a determination is made of the state of push-button 56. If push-button 56 is still closed, the sequence 60 through 71 repeats itself. Since the time required to transmit both code word frames 1 and 2, and both blanking intervals is only 182-bit times (182 milliseconds), normal human interaction with push-button 56 results in multiple transmissions of the entire 20 code word code sequence. In order to control the minimum number of times that the code sequence is transmitted, time generator 53 may include a delay device, such a mono stable multi-vibrator (not shown) which keeps timing generator 53 operational for a predetermined period of time, regardless of the time the button 56 is actually held down. Such preset operation of timing generator 53 assures that a minimum number of code word sequences is transmitted for each push of button 56.

In the present embodiment, code word source 59 comprises a memory storing the 4-bit codes of the type shown in Table 1. This memory replaces the operator controlled switches of prior arrangements. Since twenty 3-state code words are used in the present embodiment, in excess of three billion possible codes are represented. With such a large number of possible codes, the code word sequences of all transmitters can be virtually guaranteed to be distinct.

The code word sequences transmitted from the transmitter of FIG. 3 are received the antenna 74 of the receive unit (FIG. 5) and conveyed to a receiver 73. Receiver 73 conveys the received signals to a decoder 76 which converts them to the on-off format shown in Table 1 and applies them to a control unit 78. Control unit 78

-9-

compares the received codes with permitted codes stored in a memory 79 and, when a match is found, enables door apparatus 81 via a conductor 82. The permitted codes stored in memory 79 are recorded therein during a receiver programming mode which is initiated by the press of a program switch push-button 84.

Pressing switch 84 puts control unit 78 in the programming mode shown in the flow diagram of FIG. 6. In the programming mode, the transmitter or transmitters to be used with the subject receiver are individually enabled to transmit their respective security codes to the receive unit of FIG. 5 which receives those security codes and stores them as permitted codes in memory 79. When program switch 84 is initially depressed, control unit 78 enters block 86 where it awaits the reception of a first frame 1 of code words from decoder 76. Control unit 78 determines in block 86 that a frame 1 is received by analyzing the number of bits in the received synchronization signal. It should be mentioned that either a frame one of the new coding format (FIG. 2) or any frame of the old coding format (FIG. 1) is determined in block 86 to be a frame 1. When no frame 1 is received within a period of time determined in block 88, the receive unit of FIG. 5 exits the program mode and returns to a mode of awaiting an incoming code for door actuation purposes. If 3-bits are received in block 86 as the synchronization signal, a frame 2 was actually received and the flow returns to the beginning to await a frame 1.

When a frame 1 is received in block 86, the ten code words of that frame are held in storage in block 90 and the immediately subsequent frame is received in block 92. After a next frame is received in block 92, the flow proceeds to block 94 to determine if the synchronization signal received in block 92 comprises a single logic one. When the received synchronization signal comprises a single logic one, then a 10-bit code sequence (old security code)

is being received and the flow proceeds to block 97 where the ten code word sequence is stored in a location of memory 79 allocated to ten code words. After the storage of the received ten code words, receive unit exits the program mode.

When the performance of block 94 indicates that the received synchronization signal does not contain one logic one, a block 95 is performed to determine if the synchronization signal comprises three logic ones. A synchronization code of 3 logic ones indicates the reception of a frame 2 of code words 11 through 20. When the received synchronization signal does not comprise three logic ones, the program mode is exited. However, when block 95 determines that the synchronization signal comprises three logic ones the code word sequence comprising the ten code words 1 through 10 held in block 90 and the newly received ten code words 11 through 20 are stored in an area of memory 79 which is allocated to the storage of twenty code word sequences. After the storage of the two-frame code word sequence in memory 79, the program mode is again exited. Entering the program mode a number of times with different transmitters permits the storage of a number of possible code words in memory 79. The present embodiment permits the storage of one-ten code word sequence and four-twenty code word sequences.

It should be mentioned that FIG. 6 shows the receipt of the code sequences only once before they are stored in memory 79. It may be desirable to require that an incoming code sequence be received multiple times before it is stored as a permitted sequence. An arrangement for requiring multiple valid code sequences in a substantially similar environment as described in detail in the aforementioned C. Heitschel, et al., patent.

FIG. 7 is a flow diagram of the normal operation of the receive unit of FIG. 5 in which the receive unit awaits an incoming code sequence for possible door

actuation. This mode begins at block 100 where a valid
frame one is awaited. When a valid frame 1 is received in
block 100, flow proceeds to a block 102 where the 10 code
words received are temporarily stored and the flow proceeds
5   to a block 103 awaiting the next received frame. Block 105
is performed after a next frame is received to determine if
the received frame is a frame 2 or a second occurrence of
frame 1. The distinction is made by an evaluation of the
length of the synchronization signal. When the
10   synchronization signal indicates in block 105 that a frame
2 has been received the code words held in block 102 are
read in block 107 and the twenty code words comprising the
received frame 1 and frame 2 are compared (block 109) with
the permitted twenty code word sequences stored in memory
15   79. When a match is determined (block 111) between the
received 20 code word sequence and a stored 20 code word
sequence, flow proceeds to a block 113 where an actuation
signal is generated to open a door. Alternatively, when
block 111 determines that the received twenty code word
20   sequence does not match a stored permitted twenty code word
sequence, control returns to block 100 to await the
reception of a new frame 1.

    When block 105 determines that a second frame 1
has been received after a first frame 1, the ten code words
25   of the received frame 1 are compared (block 115) with the
ten code word sequences stored in memory 79. When a match
occurs, the flow proceeds from block 117 to block 113 where
an actuation signal is generated. If no match is found in
block 117, the flow of control returns to block 100 where
30   a new frame 1 is awaited.

    The transmitter as shown in FIG. 3 includes a
code word source 59 which permanently and non-changeably
stores the 20 code words to be transmitted as a code
sequence. It may be desirable to permit some limited
35   amount of user programmability of the codes being
transmitted. For example, when two actuating receivers are

employed in close proximity to one another, it may be desirable to control them independently from the same transmitter. This would be impossible when only a permanent preassigned sequence of code words could be

5   transmitted from the transmitter.

FIG. 8 is a block diagram of an alternative embodiment of the transmitter which allows user programmability. This transmitter is in large measure the same as transmitter of FIG. 4 and components given the same

10   numeral as FIG. 4 operate in substantially the same manner. The transmitter of FIG. 8 includes three switches 52 and an encoder 55 which is connected to transmitter 51 via a bus 58'. A code word source 59' permanently stores 18 code words.

15   The armatures of switches 52 are selectively and individually connectable between ground and a positive voltage and depending on operator placement apply either ground or the positive voltage to encoder 55. Encoder 55 generates two of the three state words shown in Table 1

20   with respect to each possible combination of the settings of switches 52. The two code words produced by encoder 55 are used by transmitter 51 as code words 1 and 11 of the code word sequence transmitted to the receiver via antenna 54.

25   The flow diagram of FIG. 4 represents generally the operation of the transmitter embodiment shown in FIG. 8. During step 64 of the flow diagram, word 1 is read by transmitter 51 from encoder 55 and words 2 through 10 are read by transmitter 51 from code word source 59'. In step

30   70 of the flow diagram of FIG. 4, code word 11 is read by transmitter 51 from encoder 55 and the code words 12 through 20 are successively read from code word source 59'. Thus, depending on the positions of switches 52 up to eight unique control word sequences can be transmitted by the

35   transmitter of FIG. 8.

When the transmitter of FIG. 8 is to be used with

multiple receivers. Each receiver is programmed to receive
a code transmitted with a different pattern of switch 52
positions. After the receivers have been programmed, an
operator with a transmitter of the type shown in FIG. 8 can
set the position of switches 52 to the appropriate position
for the desired receiver and then press push-button 56 to
transmit the resultant code the the receiver which will
respond by generating an activating signal. The operator
can then change the position of one or more switches 52 and
again press button 56 to cause another receiver to generate
an actuating signal. The system of the type shown in FIG.
8 would be extremely useful with a pair of separately
controlled garage doors where one of the switches 52 could
be set to one position for the left door and set to the
other position for the right door. In this way, both doors
can independently be controlled from the same transmitter.

        FIG. 9 represents an additional embodiment of a
code transmitter of the type shown in FIG. 8 which operates
without a separate transmit switch 56. In this embodiment
switches 52 are momentary contact push-button switches, the
armatures of which are connected to the positive voltage
when not pressed. When any of the switches 52 is pressed,
a grounded input is presented to encoder 55 and, via one of
a plurality of diodes 61, to the time generator 53. The
grounded input to time generator 53 starts the previously
described timing cycle which controls the transmission of
a code word sequence comprising 18 code words stored by
code word source 59' and two code words derived by encoder
55 from the positions of switches 52.

        While preferred embodiments of the invention have
been illustrated, it will be obvious to those skilled in
the art that various modifications and changes may be made
thereto without departing from the scope of the invention
set forth in the attached claims.

What Is Claimed Is:

     1. A transmitter for use in a remote actuating system comprising:

     a source of a first predetermined number of code words; and

     transmitting means for transmitting a code word sequence comprising a first synchronizing character followed by a second predetermined number of said code words then, after a pause in transmission, for transmitting a second synchronizing character followed by a third predetermined number of code words wherein the sum of said second and third predetermined numbers of code words equals said first predetermined number of characters.

     2. The transmitter of Claim 1 wherein said second and third predetermined numbers of code words each equal one-half of said first predetermined number of code words.

     3. The transmitter of Claim 1 wherein said second synchronizing character identifies a code word sequence comprising said first predetermined number of code words.

     4. In a transmitter for transmitting a code word sequence comprising n code words to a receiver which selectively receives code word sequences comprising m code words and code word sequences comprising n code words, where n is greater than m, a method of transmitting comprising:

     defining the n code words of a code word sequence to be transmitted;

     transmitting a first code word frame comprising a first synchronizing character followed by m of the n code words defined in said defining step;

pausing for a predetermined period of time after the preceding transmitting step; and

transmitting after the pausing step, a second code word frame comprising a second synchronizing character followed by the n minus m code words remaining untransmitted after the preceding transmitting step.

5.   The method of Claim 4 wherein said second synchronizing character transmitted in the second of said transmitting steps is different from said first synchronizing character to identify a code word sequence of n code words.

6.   In a receiver, a method for selectively generating actuating signals in response to a first code word sequence and in response to a second code word sequence, said method comprising:

storing at least one first code word sequence and at least one second code word sequence in said receiver;

receiving a code word sequence;

determining whether the received code word sequence comprises a first code word sequence or a second code word sequence;

comparing said received code word sequence with a stored first code word sequence when said received code word sequence is determined in said determining step to be a first code word sequence;

comparing said received code word sequence with a stored second code word sequence when said received code word sequence is determined in said determining step to be a second code word sequence; and

generating, responsive to said comparing steps, an actuating signal when the received code word sequence is identical to a stored code word sequence compared thereto.

7.   The method of Claim 6 wherein each of said code word sequences comprises a synchronizing character

-16-

identifying the code word sequence type; and

said determining step comprises, determining in response to the synchronizing character of a received code word sequence whether the received code sequence is a first code sequence or a second code word sequence.

8.   In a receiver, a method for selectively generating actuating signals in response to a first code word sequence comprising m code words and in response to a second code word sequence comprising 2m code words, said method comprising:

storing at least one first code word sequence of m code words and at least one second code word sequence of 2m code words in said receiver;

receiving 2m code words;

determining whether the received code words comprise two first code word sequences or one second code word sequence;

comparing m of said received code words with a stored first code word sequence when said received code words are determined in said determining step to comprise two first code word sequences;

comparing said received 2m code words with a stored second code word sequence when said received code words are determined in said determining step to comprise a second code word sequence; and

generating, responsive to said comparing steps, an actuating signal when the compared code words comprise a code word sequence identical to a stored code word sequence compared thereto.

9.   The method of Claim 8 wherein each of said code word sequences comprises a synchronizing character identifying the code word sequence type;

said receiving step comprises receiving 2m code words and at least one synchronizing character; and

said determining step comprises, determining in
response to the received synchronizing character, whether
the received code words comprise two first code word
sequences or a second code word sequence.

5

10.   In a remote actuating system comprising a
first transmitter for repetitively transmitting a first
code word sequence comprising a first frame of code words,
a second transmitter for repetitively transmitting a second
10   code word sequence comprising a first frame of code words
and a second frame of code words, wherein each of said
first frames comprises a first identity character
identifying the first frame and m code words and each of
said second frames comprises a second identity character
15   identifying the second frame and m code words, and a
remotely operated receiver, a method of operating said
receiver comprising:
storing at least one first code word sequence of
m code words in said receiver;
20   storing at least one second code word sequence of
2m code words in said receiver;
receiving a first frame of code words;
receiving another frame of code words after the
receipt of said first frame;
25   determining whether said another received frame
of code words is a first frame or a second frame;
generating an actuation signal when the
determining step determines that said another received
frame of code words is a first frame of code words and a
30   stored first code word sequence matches the code words of
the received first frame; and
generating an actuation signal when the
determining step determines that said another received
frame of code words is a second frame of code words and the
35   stored second code word sequence matches the combination of
the code words of said received first frame and said

another received frame.

11.   The method of Claim 10 wherein said determining step comprises determining from the identity character of said another received frame of code words whether said another received frame of code words is a first frame or a second frame.

12.   A code word sequence transmitter for use in a remote actuating system, said transmitter comprising:
a source of code words comprising a storage means for permanently storing a predetermined number of code words and operator controllable means for selectively defining at least one code word in addition to said permanently stored code words;
a transmit enable switch for generating transmit enable signals; and
means responsive to said transmit enable signals for transmitting a code word sequence comprising said permanently stored code words and said at least one additional code word, to a remote actuating receiver.

13.   The transmitter of Claim 12 wherein said storage means comprises an integrated circuit permanent storage means and said operator controllable means comprises at least one switch having a plurality of positions.

14.   A remote actuating receiver to be used with the transmitter of Claim 12, said receiver comprising:
means operative in a programming mode of said receiver for receiving a code word sequence from said transmitter and for storing said received code word sequence in a memory of said receiver; and
means operative in an actuation mode of said receiver and responsive to code word sequences transmitted

-19-

from said transmitter for selectively generating an actuation signal.

15. A code word sequence transmitter for use in a remote actuating system, said transmitter comprising:
a source of code words comprising a storage means for permanently storing a predetermined number of code words;
a plurality of operator controllable switch means, each having at least two switch positions;
means responsive to said switch means for selectively defining at least one code word in addition to said permanently stored code words;
means responsive to change in switch positions of at least one of said switch means for generating transmit enable signals; and
means responsive to said transmit enable signals for transmitting a code word sequence comprising said permanently stored code words and said at least one additional code word, to a remote actuating receiver.

16. A remote actuating receiver to be used with the transmitter of Claim 15, said receiver comprising:
means operative in a programming mode of said receiver for receiving a code word sequence from said transmitter and for storing said received code word sequence in a memory of said receiver; and
means operative in a actuation mode of said receiver and responsive to code word sequences transmitted from said transmitter for selectively generating an actuation signal.
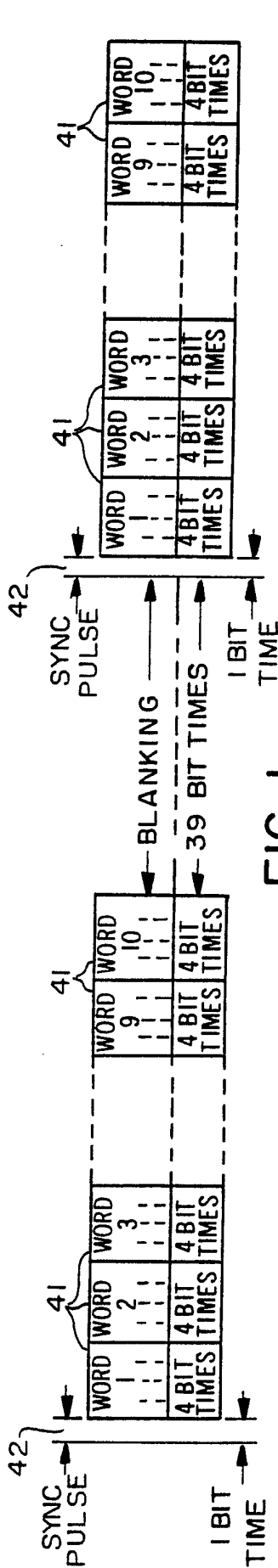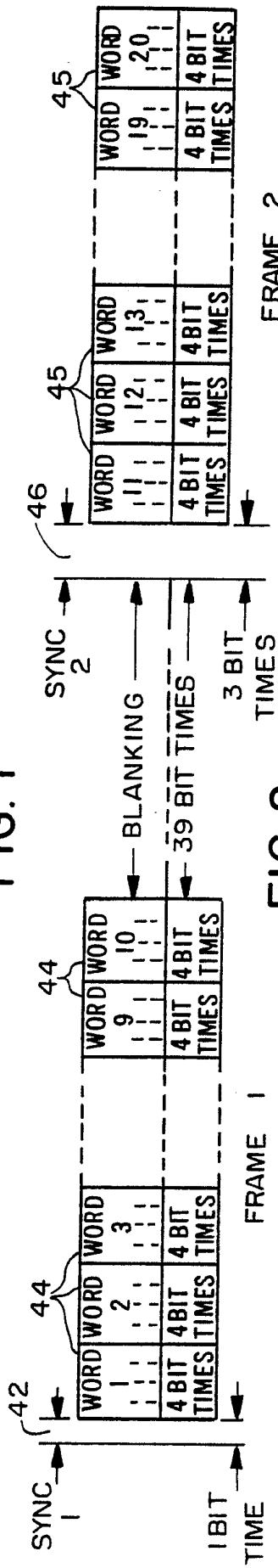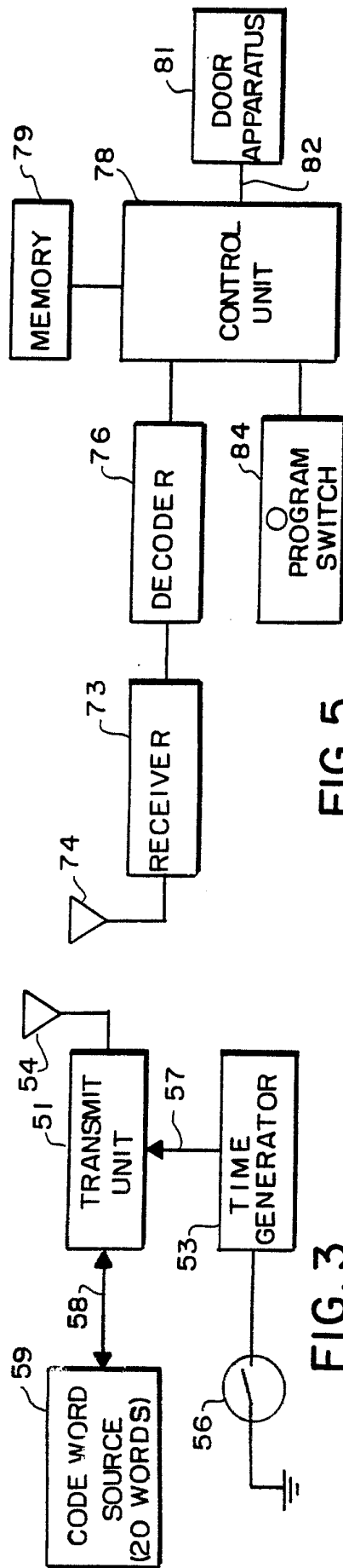
WORD 1	WORD 2	WORD 3		WORD 9	WORD 10
4 BIT TIMES	4 BIT TIMES	4 BIT TIMES		4 BIT TIMES	4 BIT TIMES

SYNC
PULSE   BLANKING   39 BIT TIMES   1 BIT
TIME

FIG. 1

WORD 11	WORD 12	WORD 13		WORD 19	WORD 20
4 BIT TIMES	4 BIT TIMES	4 BIT TIMES		4 BIT TIMES	4 BIT TIMES

SYNC
2   BLANKING   39 BIT TIMES   3 BIT
TIMES

FRAME 2

FIG. 2

WORD 1	WORD 2	WORD 3		WORD 9	WORD 10
4 BIT TIMES	4 BIT TIMES	4 BIT TIMES		4 BIT TIMES	4 BIT TIMES

SYNC
PULSE   4 BIT
TIMES   1 BIT
TIME

WORD 1	WORD 2	WORD 3		WORD 9	WORD 10
4 BIT TIMES	4 BIT TIMES	4 BIT TIMES		4 BIT TIMES	4 BIT TIMES

SYNC
1   FRAME 1   1 BIT
TIME

FIG. 5

MEMORY — CONTROL UNIT — DOOR APPARATUS

DECODER — RECEIVER

PROGRAM SWITCH

FIG. 3

TRANSMIT UNIT — TIME GENERATOR

CODE WORD SOURCE (20 WORDS)

2 / 3

FIG.6

PROGRAM MODE

FRAME 1 RECEIVED ? — 86

N → TIME OUT — 88
  Y → EXIT
  N → (back to FRAME 1 RECEIVED)

Y → HOLD 10 CODE WORDS — 90

RECEIVE NEXT FRAME — 92

SYNC = 1 — 94
  Y → STORE HELD CODE WORDS 10 CODE WORD LOCATION — 97
  N → SYNC = 3 — 95
      Y → STORE HELD CODE WORDS AND FRAME 2 CODE WORDS IN 20 CODE WORD LOCATION — 99
      N → EXIT

FIG.4

DETECT BUTTON 56 PUSHED — 60

TRANSMIT LOGIC 1 SYNC 1 — 62

TRANSMIT BITS OF CODE WORDS 1-10 IN SEQUENCE — 64

BLANK FOR 39 BIT TIMES — 66

TRANSMIT 3 BIT LOGIC 1 SYNC 2 — 68

TRANSMIT BITS OF CODE WORDS 11-20 IN SEQUENCE — 70
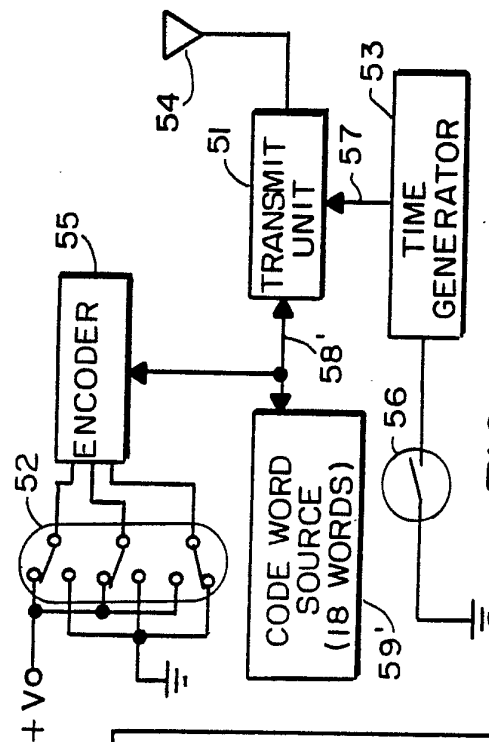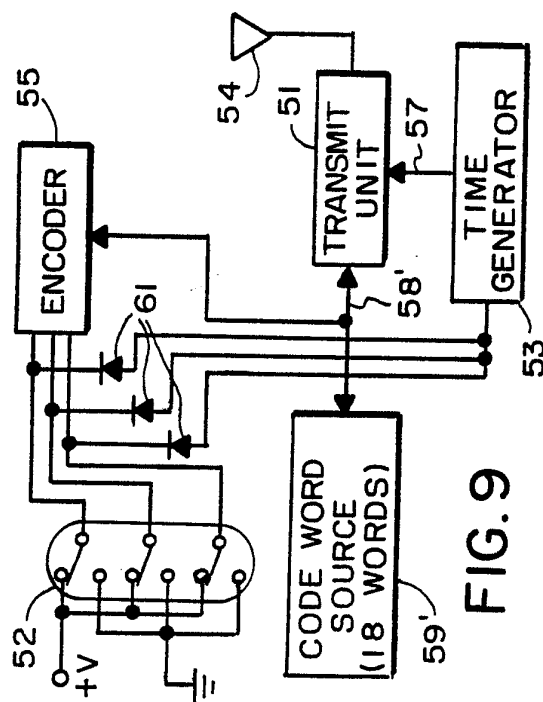
BLANK FOR 39 BIT TIMES — 71
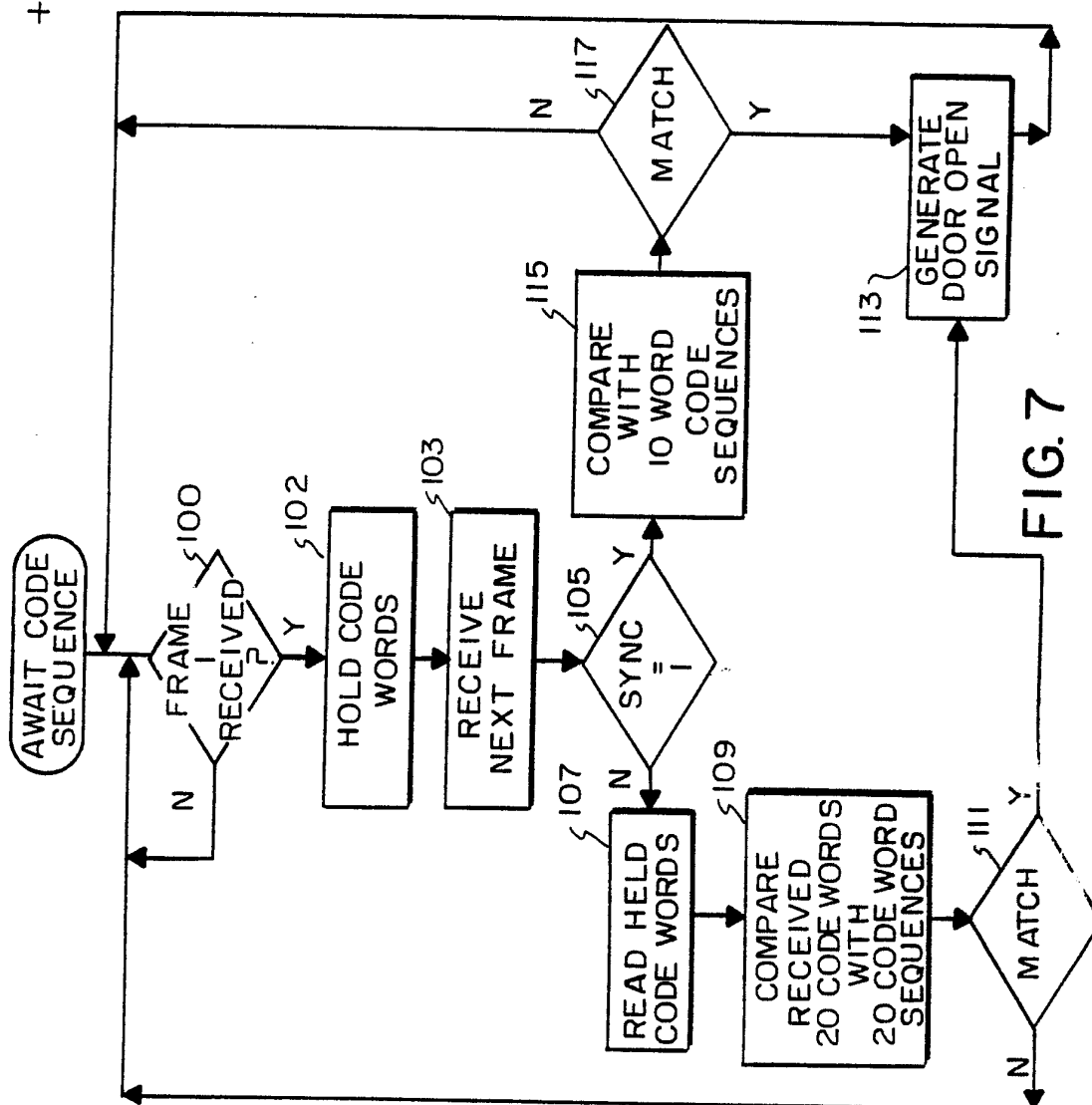
3/3

FIG.8

FIG.9

FIG.7

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/04943

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC CLS. (5) G05B 19/05, G08B 5/22, H04Q 5/02
U.S. CLS.: 340/825.22, 825.06, 825.07, 925.53, 825.44

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
US/CLS	340/310A, 825.22, 825.06, 825.07, 825.53, 825.44

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [*]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	US, A, 4,755,792 (PEZZOLO et al) 05 July 1988	10,11,12,14
Y	See col. 6 lines 18-36, col. 9 lines 8-32	1-9,13,15,16
Y	US, A, 4,454,509 (BUENNAGAL et al) 12 June 1984 See col. 8 line 57 - col. 10 line 30	1-9,13,15,16
A	US, A, 4,418,333 (SCHWARZBACH et al) 29 November 1983, See fig. 7 & Abstract	
A	US, A, 4,750,118 (HEITSCHEL et al) 07 June 1988 See col. 3 line 31 - col. 4 line 14	

* Special categories of cited documents: [10]

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

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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

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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
08 August 1991	11 SEP 1991
International Searching Authority	Signature of Authorized Officer
ISA/US	Donald J. Yusko

Form PCT/ISA/210 (second sheet) (Rev. 11-87)