Jan. 17, 1961 V. E. CARBONARA 2,968,790

ELECTRIC LOCK

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FIG. 2

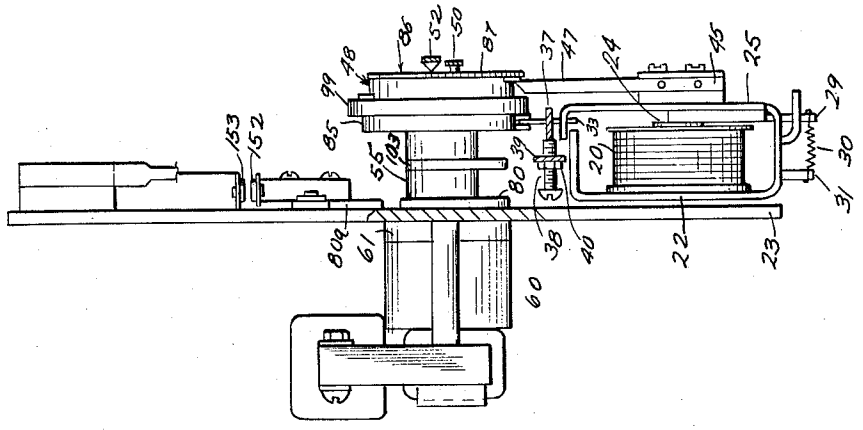
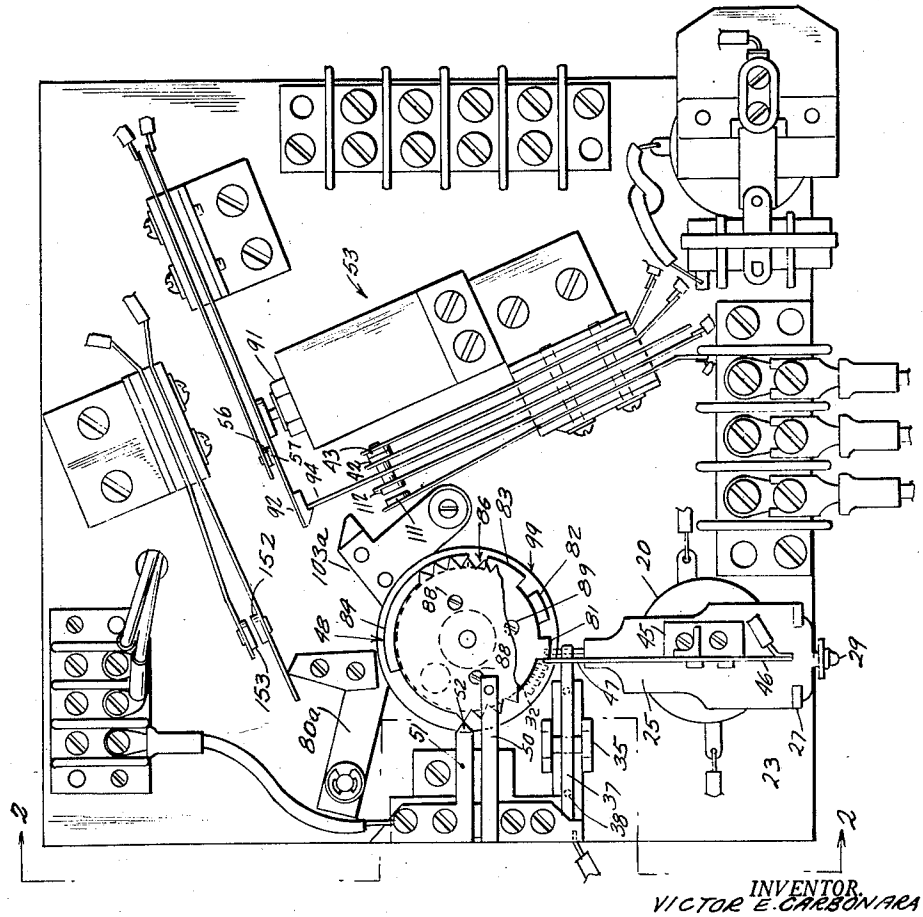


FIG. 1



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ELECTRIC LOCK

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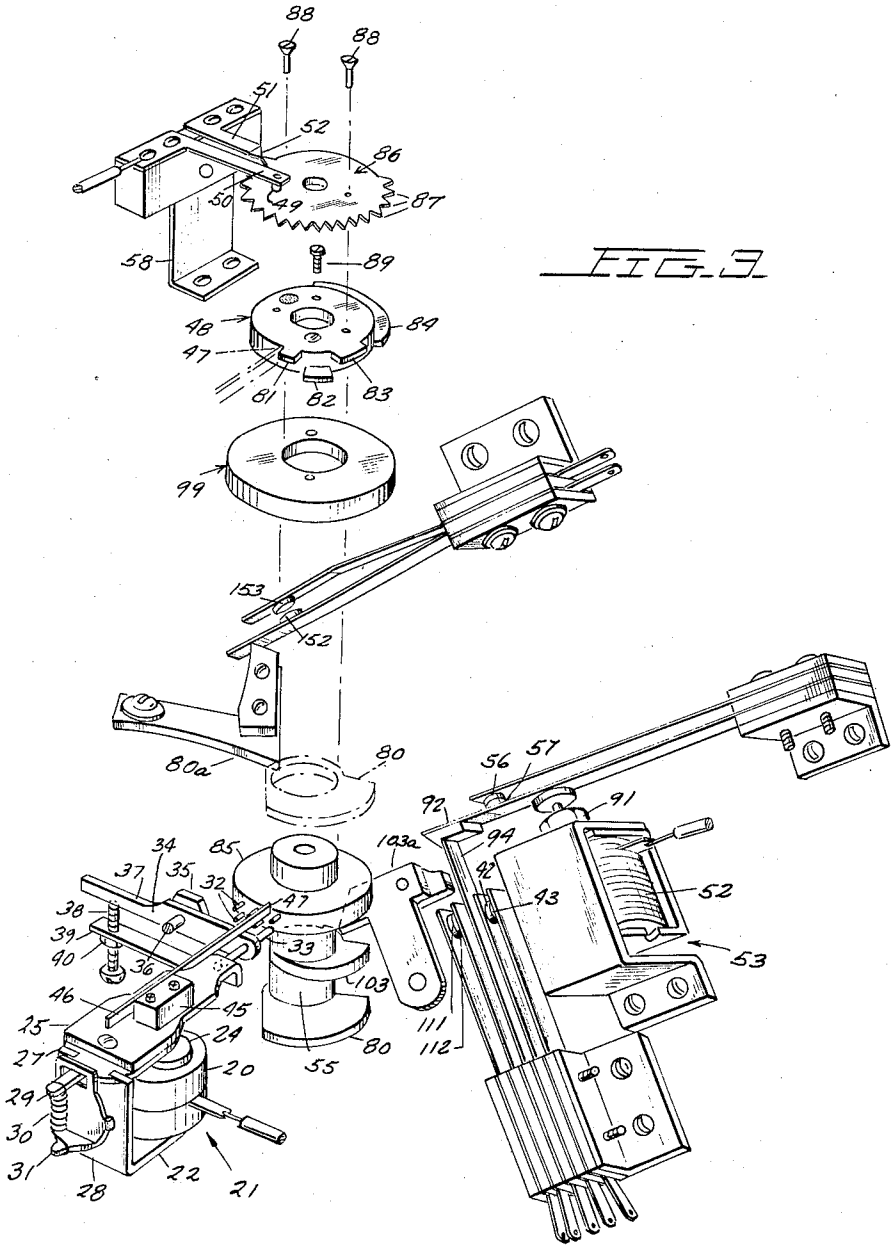

FIG. 3

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FIG. 4.

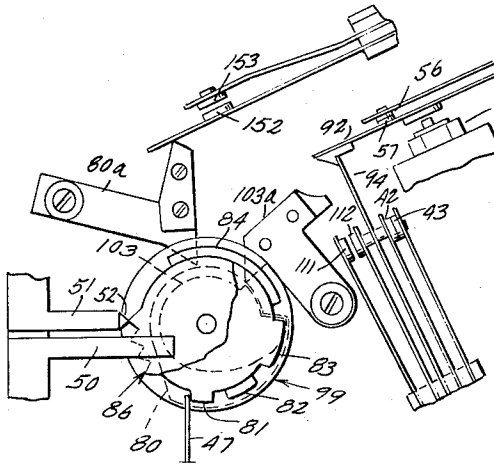


FIG. 5.

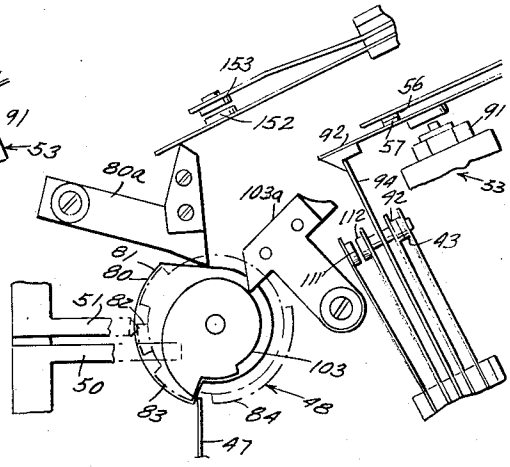


FIG. 6.

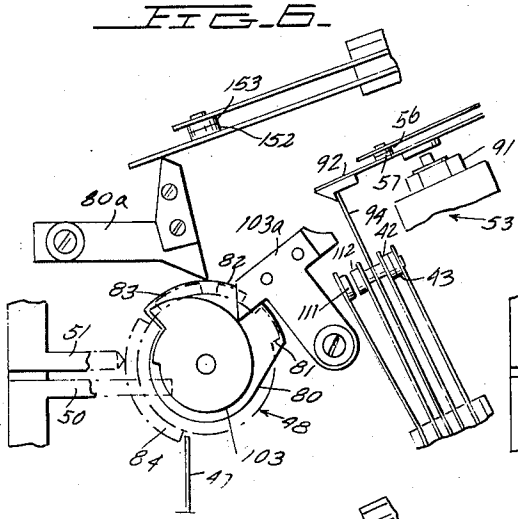
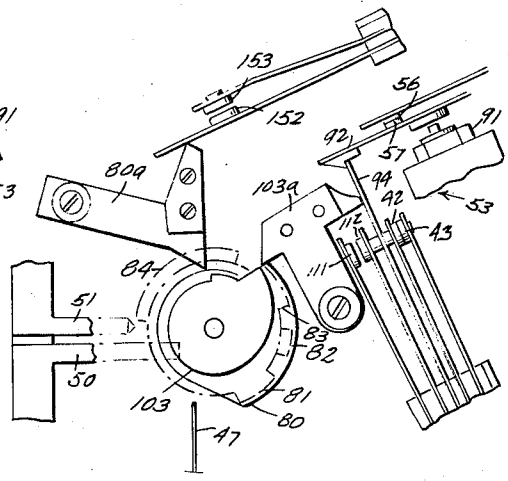


FIG. 7.



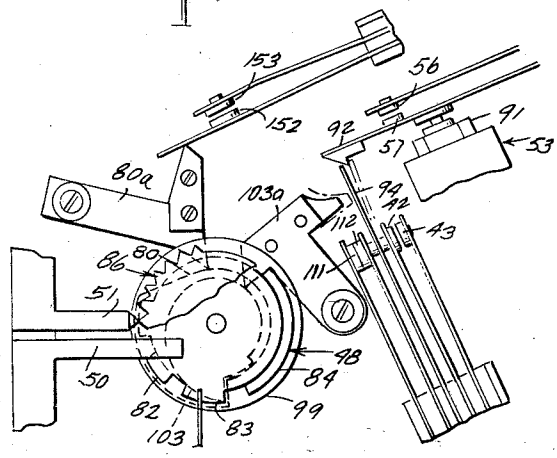


FIG. 8.

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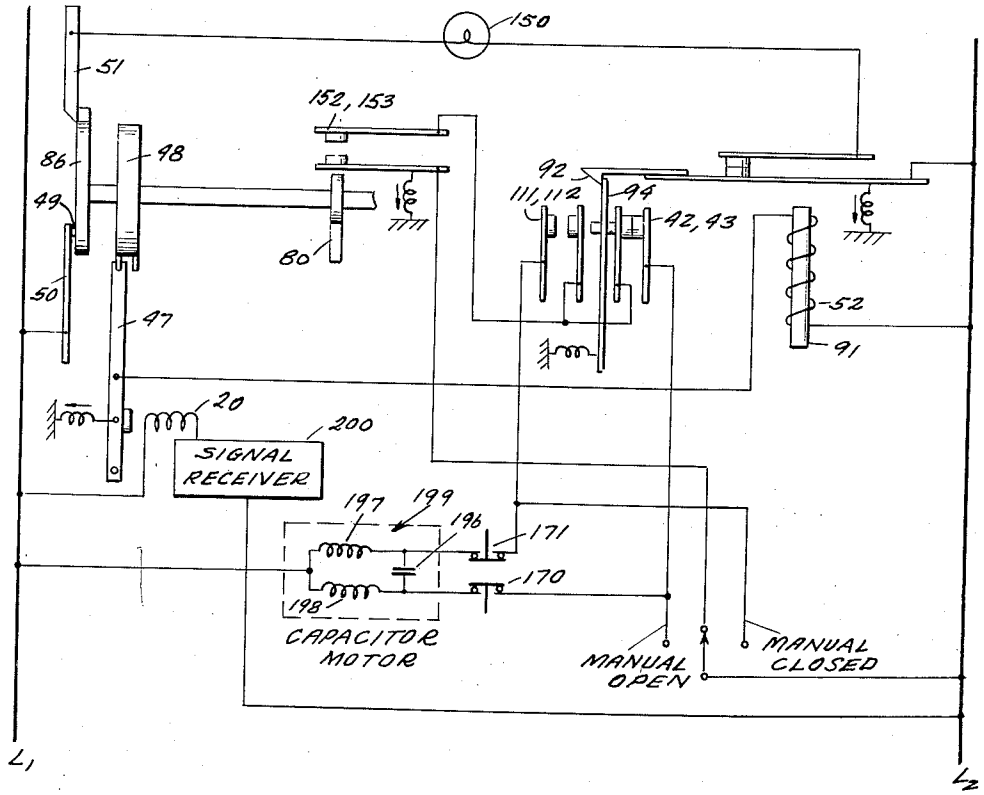
FIG. 9



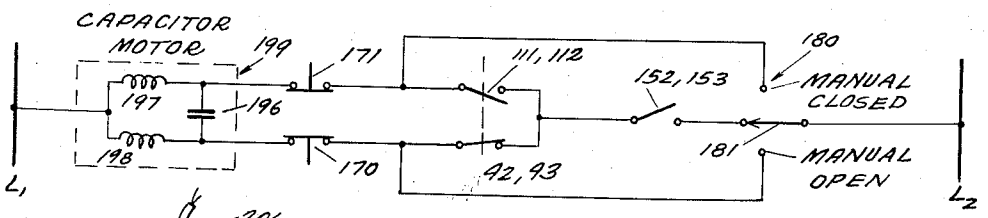


FIG. 9A

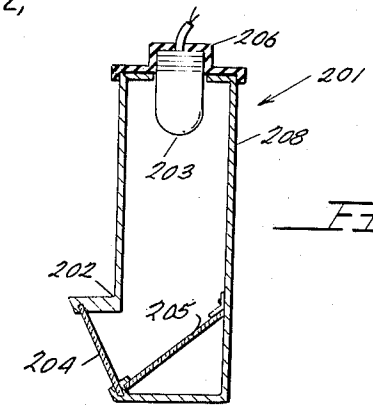


FIG. 10

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United States Patent Office

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ELECTRIC LOCK

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Filed Nov. 18, 1957, Ser. No. 697,027

9 Claims. (Cl. 340—164)

My invention relates to electric locks, and more particularly to a predetermined code receiving mechanism, hereinafter referred to as an electric lock, adapted to operate on a succession of accurately timed pulses; on the occurrence of any pulse, after the first few pulses, in the wrong time sequence, the operation of the lock will be defeated and the lock operating elements will be restored to the original condition. A full properly timed sequence is, therefore, necessary to operate the lock and any step by step attempt to defeat the lock will be frustrated.

In the operation of remote control devices, such as for instance garage door openers, it is desirable to permit the user to send a coded signal which will initiate operation while at the same time it is necessary to prevent unauthorized operation. A garage door opener consists of: a motor for operating the door, preferably through a reduction gear sufficiently large in ratio to be self-locking against any force which could lift the door when the motor has stopped; a switch for actuating the motor; means for receiving a motor actuating signal; and means (the lock) for translating the motor actuating signal into an operation of the motor switch.

Thus, the car will have some means for generating a series of timed pulses over a short space of time. This may well be a hand-wound clock-work mechanism in the car which, on a quarter turn of a handle, will unwind to create the timed sequence of pulses; any, even crude, clock-work will be accurate over the fifteen seconds or so required to generate the timed set of code pulses. These pulses may be used to operate the car headlights in cooperation with a photocell receiver at the door or may be used in connection with a transmitter on the car and a receiver at the door to generate a succession of timed pulses usable at the lock. My improved lock is then arranged to operate in response to such pulses to close the door opening circuit provided the right number of pulses is received in the right time sequence.

Essentially my invention contemplates the use of a continuously operating synchronous clock mechanism connected by a clutch to a rotatable lock disc having a plurality of irregularly spaced tongues over a portion of its periphery positioned in a double tier arrangement. Normally a latch holds the lock disc stationary. The first few pulses, which may be of a random time sequence and hereinafter referred to as unlatching pulses, are transmitted to a relay which attracts its armature to disengage the latch and permits the lock disc to be driven through a full cycle of substantially 360° until the disc returns to its latched position.

When the latch is disengaged by the last unlatching pulse, a conductive extension of the armature passes below the first tongue of the upper tier and is positioned in line with the tongues of the lower tier. A pulse of proper duration will maintain the armature attracted by the relay coil for an interval of time sufficient to permit the first tongue of the upper tier to pass over the extension and thereafter release the armature before the first tongue

of the lower tier has contacted the extension. The significance of contact between the extension and a tongue will be hereinafter explained. Releasing the armature positions the extension in line with the upper tier so that a pulse of short duration will cause the extension to contact the first tongue of the upper tier. Thus the last unlatching pulse must also be a code pulse; that is, this pulse must be of a predetermined duration if the armature extension is to avoid contact with the first tongues of both the upper and lower tiers.

The tongues of one tier are arranged in vertical alignment with spaces between tongues of the other tier and each tongue is slightly narrower than the space opposite which it is aligned so that the intervals between code pulses must be of predetermined duration as determined by the spacing between the tongues of the upper tier. If the interval between pulses is too long, the extension will contact a tongue of the upper tier while if the interval is too short, the extension will contact a tongue of the lower tier.

As the lock disc rotates, a cam carried by a common shaft also rotates so that once during each lock disc revolution a pair of cooperative contacts are brought into engagement; that is, a pair of door opener contacts are closed. But closing these contacts will not necessarily energize the circuit to open the garage door. If the code pulses are incorrectly timed, either lasting too long or being incorrectly spaced, a circuit is closed to another relay which opens a set of defeater contacts in series with the opener contacts.

The lock disc then completes its cycle, with suitable cams resetting all contacts to their original positions, and the disc is then stopped by the latch. Thus any incorrect code pulse prevents the door from opening and another opening operation cannot be started until the contacts are reset toward the end of the cycle.

My invention is distinguished from prior art devices of this type in that the costly stepping relay of prior art devices has been eliminated without a sacrifice in any desirable operating features.

In order to bring costs down to a minimum and also achieve a great degree of flexibility, the device of the instant invention includes a code transmitting assist which in the embodiment to be hereinafter described is a visual means in the form of an indicator bulb whose illumination is alternately turned ON and OFF beginning with the occurrence of the last unlocking pulse and continuing to flash in a regular pattern until such time as the lock has been relatched or the defeater contacts have opened. A person knowing the proper sequence of coded signals or "combination" may readily open the lock by manipulating the headlight controls assisted by the flashing bulb, even though he might have a poor sense of timing. However, an unauthorized person, i.e., one not knowing the combination, who succeeds in unlatching the lock disc and flashing the assist indicator, will receive no aid in attempting to open the lock. Thus the need has been eliminated for providing a separate means for generating a series of timed code pulses.

When my electric lock is used to control the operation of a garage door, it is highly desirable to include a simple means whereby the door may be closed without alighting from the car to operate a manual control. For closing the door there is rarely any need to distinguish between authorized and unauthorized persons. However, a distinction must be made between intentional and accidental operation to prevent a stray source of energy from closing the door before the car has completely exited.

Accordingly, my device includes a set of closer contacts which are automatically engaged when the defeater

contacts are disengaged, thereby completing an energizing circuit to operate the motor to close the door. Thus, with the door open and the lock disc in the latched position, a plurality of unlatching pulses will permit the lock disc to rotate. Thereafter an intentional improper code pulse will cause the door closing circuit to be energized. The requirement of a plurality of unlatching pulses rather than merely one pulse acts to prevent a stray light source from defeating the lock and thereby closing the door at an inopportune moment.

Accordingly, a primary object of my invention is the provision of a novel electric lock which will operate only on an accurately timed series of code pulses to close a circuit and which will be defeated on the occurrence of any incorrectly spaced or timed pulse.

Another object is to provide a novel electric lock including means for assisting the manual control of code pulses required for opening.

Still another object of my invention is to provide a novel electric lock which does not requires the stepping relay characteristic of locks of this type but which nevertheless cannot be opened by one who does not know the proper opening sequence.

A further object of my invention is to provide a novel electric lock including provisions for automatic closing as well as opening of a garage controlled thereby.

A still further object is to provide a novel electric lock including a rotatable lock disc normally latched against rotation and means whereby a series of random pulses will unlatch the lock disc and permit it to complete a revolution back to its latched position.

Yet another object is to provide a novel electric lock including a rotatable lock disc having a plurality of spaced tongues projecting outwardly from the periphery thereof and positioned in a double tier arrangement.

The foregoing and many other objects of my invention will become apparent in the following description and drawings in which:

Figure 1 is an elevation of my novel electric lock.

Figure 2 is a cross-sectional view taken on line 2—2 of Figure 1 looking in the direction of arrows 2—2.

Figure 3 is an expanded view in perspective of my novel electric lock.

Figures 4–8 are elevations of the rotatable lock disc in different phases of its cycle of rotation, as follows:

Figure 4—imediately after unlatching, beginning of opening cycle, code assist light starts flashing.

Figure 5—shortly before opening, near end of timing sequence.

Figure 6—opening.

Figure 7—resetting defeater.

Figure 8—defeated, closing, code assist light OFF.

Figure 9 is a schematic circuit diagram showing one form which the electrical relationship among the various parts of my novel electric lock may take.

Figure 9A is a circuit diagram of selected portions of Figure 9 to simplify the understanding of the motor operating circuits.

Figure 10 is a side elevation of a signal pickup device which may be used as part of my novel electric lock.

Referring first to Figures 1–4, I have shown my novel device at its unlatched position preparatory to receipt of the code signals required for unlocking.

As previously pointed out, a local source of energy is controlled from a remote point to provide a plurality of appropriately spaced and timed signals. This source for the unlocking signals is connected to the coil 20 of the operating relay 21 which is supported by bracket 22 on the chassis 23 of my improved electric lock. The coil 20 is provided with a suitable core 24 arranged to attract the armature 25 when the coil 20 is energized. The armature 25 is hingedly mounted at 27 on the lower leg 28 of bracket 22, and an extension 29 of the armature 25 has connected thereto one end of tension spring 30, the other end of which is connected to the stationary lug 31 on the lower leg 28 of the bracket. The armature 25 is thereby spring biased away from the core 24 of relay coil 20.

When the car initially approaches the garage door, shaft 55 is prevented from turning because latch rod 33 extending from armature 25 engages the first of the five radial latch pins 32 of wheel 85, rigidly fastened to rotatable shaft 55.

Through a timed drive means, such as friction clutch 61 and motor 60, rotating at a constant sped, is continuously urging shaft 55 to rotate in a clockwise direction with respect to Figure 1. Shaft 55 will not turn, however, as long as inflexible latch rod 33 engages one of the five radial latch pins 32. The operator then sends three impulses, as by turning his headlights on and off three times. Each impulse causes a signal receiver 200 (Figure 9) to transmit a current, energizing coil 20 of operating relay 21 for the duration of the impulse. Each energization of coil 20 causes armature 25 to rotate about hinge 27, moving down to touch core 24 of coil 20, extending tension spring 30 between lug 29 of armature 25 and stationary lug 31. Each cessation of the outside impulse allows the signal receiver 200 to terminate the energization of coil 20, allowing tension spring 30 to bias armature 25 back to its initial position.

The five latch pins 32 extend radially from wheel 85, and are arranged so that the first, third and fifth pins can engage latch rod 33 only when armature 25 is in the up, or solenoid de-energized, position. The first unlatching impulse causes latch rod 33, carried by armature 25, to drop under the first pin 32, which then rotates past latch rod 33 until the second pin 32 engages rod 33, and the cessation of the first impulse causes latch rod 33 to rise over the second pin 32, which also rotates past under the influence of the constant angular force exerted by motor 60 on shaft 55 through friction clutch 61. The second unlatching impulse takes care of the third and fourth pins 32 in similar fashion. The third unlatching impulse eludes the fifth and last pin 32, and shaft 55 will thereafter rotate through an entire cycle uninterrupted. The lock phase shown in Figures 1–4 corresponds to the lock position immediately after the most counterclockwise latch pin 32 has just passed latch rod 33.

The travel of armature 25 must be limited so that latch rod 33 engages the lower latch pin when armature 25 is in the down position, and the upper latch pins when armature 25 is in the up posistion. Downward travel of armature 25 is limited by solenoid core 24 of relay 21. Upward travel is limited by adjustable limiting screw 38 threaded into nut 40, which is in turn rigidly fastened to strip 39. Strip 39 is rigidly fastened to bracket 35 mounted on chassis 23. Pin 36 projects from bracket 35 and supports rocker arm 34 which is free to rotate about an axis coincident with the axis of pin 36. Latch rod 33 passes through one end of rocker arm 34, and moves that end of rocker arm 34 up and down with it. The other end of rocker arm 34 terminates in heel 37, which bears against adjustable limiting screw 38 to limit the upward travel of armature 25. This upward limiting position can be changed by adjusting the adjustable limiting screw 38.

Five latch pins 32 are employed instead of just one in order that the shaft 55 will not turn a full cycle in response to every spurious signal, as from the headlights of a stranger turning around in the driveway. This will become particularly important when we come to consider closing of the door by means of this electric lock. It is highly unlikely that there will be three closely spaced stray impulses cooperating to unlatch the device shortly after it has been latched, yet when the operator intends to unlatch it he can do so by the simple expedient of flashing his lights three times.

Occasionally, however, stray impulses will have rotated the wheel 85 so that the third or perhaps even the fifth latch pin 32 is in engagement with latch rod 33. In such a case the operator will need warning that the unlatched position shown in Figures 1–4 has been reached after only 1 or 2 flashes instead of the usual three. This warning is provided by the code assist light 150 outside the garage door (not shown), visible to the operator, which lights up as soon as the last latch pin 32 passes by latch rod 33. The circuit for the code assist light 150 runs from a source of power, through normally closed assist contacts 56, 57, through contact tip 52 of arm 51, into the toothed wheel 86, and through arm 50 by way of brush contact 49, which constantly touches toothed wheel 86. Toothed wheel 86 is rigidly fastened by means of screws 88 to lock disc 48, which in turn is rigidly fastened by means of screws 89 to insulating wheel 99 keyed to shaft 55.

Thus, code assist light 150 flashes whenever one of the teeth 87 of toothed wheel 86 is touched by contact tip 52, as toothed wheel 86 rotates with shaft 55 during the opening cycle. As seen in Figures 1–4, the first such contact between teeth 87 and tip 52 is made as soon as the last latch pin 32 has passed latch rod 33, whereupon the first flash of code assist light 150 announces the beginning of an opening cycle.

The unlatching operation need not be done at any particular speed or in any particular rhythm. The operator can slowly and deliberately slip the latch rod 33 over and under as many latch pins 32 as may remain, watching for the first flash of code assist light 150. Then he begins the timed opening sequence when code assist light 150 announces that the cycle has begun and thereafter shaft 55 will run at synchronous speed. In the event that three stray impulses cooperate to unlatch the device, shaft 55 will turn through one full cycle, until it relatches itself. But, as hereinafter described, this will not cause the door to open.

Contact arm 46 is rigidly fastened to electrically insulative block 45, which in turn is rigidly fastened to armature 25. Contact arm 46 is spaced from armature 25 so that no current can pass from one to the other.

Just as shaft 55 rotates to the point where the last latch pin 32 has passed the latch rod 33, and the code assist light 150 has been turned on, contact tip 47 of flexible contact arm 46 comes abreast of tongue 81 of lock disc 48, which is rigidly mounted on rotating shaft 55 and rotating therewith. But contact tip 47 of contact arm 46 will not initially touch tongue 81 of the upper tier since armature 25 is at this point in the cycle in the down, or solenoid energized, position in line with tongues 82, 84 of the lower tier. Contact tip 47 of contact arm 46 is thus also carried down so that contact tip 47 can pass under the leading edge of tongue 81 of lock disc 48.

At this point the operator must generate the properly timed sequence of impulses which will hold contact tip 47 down to miss tongues 81 and 83, and let it up to pass tongues 82 and 84 of lock disc 48. To do this he must know the "combination" peculiar to the particular lock disc 48 in use; i.e., a timed sequence of impulses corresponding to the spacing of the tongues 81–84 around the periphery of the particular lock disc 48 in use. One who does not properly execute the timed sequence of code pulses will allow contact tip 47 to touch one of the tongues 81–84 of lock disc 48 either by energizing coil 20 when contact tip 47 is above one of lower tongues 82 or 84, or by failing to energize coil 20 when contact tip 47 is abreast of one of the upper tongues 81 or 83 of lock disc 48. The distance between these upper and lower sets of tongues is such that contact tip 47 is in line with the tongues 81, 83 when coil 20 is de-energized and contact tip 47 is in line with tongues 82, 84 when coil 20 is energized as determined by the limiting members solenoid core 24 and adjustable limiting screw 38. If this distance were greater, contact tip 47 might miss some of the tongues 81–84 even though the impulses to operating relay 21 departed from the proper timing sequence.

Figure 5 shows a stage in the opening cycle before the garage door has been opened. Once in every revolution of shaft 55, after contact tip 47 has passed the leading edge of tongue 84 of lock disc 48, cam 80 rigidly fastened to shaft 55 and rotating therewith will displace cam follower 80*a* so that cam follower 80*a* closes door opener contacts 152, 153, which are normally leaf spring biased open, and holds contacts 152, 153 closed for a period long enough to allow the garage door motor 199 to open the garage door. This door opener operation is shown in Figure 6. At the end of the door opening period, cam 80 will release cam follower 80*a* which is spring biased back to its initial position, thus allowing opener contacts 152, 153 to reopen.

Figure 7 shows this stage in the opening cycle. With defeater contacts 42, 43 engaged, opener contacts 152, 153 connect garage door motor 199 across through lines L_1, L_2 (Figures 9 and 9A) to a source of A.C. power with motor winding 198 in parallel with the series combination of winding 197 and capacitor 196 causing rotation in a forward direction which opens the garage door.

Whenever the operator fails to execute the proper timing sequence, or three consecutive stray impulses have cooperated to unlatch the device, i.e., whenever contact tip 47 touches one of the tongues 81—84 of lock disc 48, a circuit is established and current passes through contact arm 50, brush contact 49, toothed wheel 86, lock disc 48, contact tip 47, contact arm 46, and appropriate wiring through coil 52 of defeater relay 53. Energization of coil 52 raises armature 91, which in turn raises latch arm 92. This releases leaf spring arm 94, which then biases defeater contacts 42, 43 open. Defeater contacts 42, 43 are in series with opener contacts 152, 153 and connect the garage door motor 199 for rotation in the forward direction. Once the defeater relay 53 has been tripped by a departure from the timing sequence, closing of opener contacts 152, 153 cannot energize the garage door motor 199 for rotation in the forward direction. This defeater operation is shown in Figure 8. Note that latch rod 33 must be electrically insulated from contact arm 46, otherwise a defeating current would pass through the latch pins 32 before the beginning of each opening cycle.

After the defeater relay 53 has been tripped, it must be reset so that defeater contacts 42, 43 will be closed in expectation of proper execution of the timing sequence on the next try. Once during each revolution, or cycle, of shaft 55, after cam follower 80*a* has been allowed to return to its initial position by cam 80, and opener contacts 152, 153 have thus been allowed to open, so that it is therefore too late in the cycle to energize garage door motor 199 for rotation in a forward direction, cam 103 keyed to shaft 55 will displace cam follower 103*a* so that leaf spring arm 94 is relatched against latch arm 92 thus reclosing defeater contacts 42, 43 and resetting the defeater means. After this operation is performed, cam 103 will release cam follower 103*a* which is spring biased back to its initial position. If on a given cycle, defeater relay 53 has not been tripped, cam 103 and cam follower 103*a* merely perform an empty act. This defeater resetting operation is shown in Figure 7.

In order to make opening the lock easier for one who knows the proper timing sequence but has a poor sense of timing and thereby eliminate the need for a separate code transmitter, code assist light 150 flashes regularly On and Off to set the beat during the entire opening cycle. An authorized operator thus can count beats, and flash his lights accurately on, e.g. the seventh beat, but an unauthorized operator will get no help from

knowing which is the seventh beat if he does not know what needs to be done on that beat. He may make a lucky guess on a few beats, but the statistical probability of correct guesses on all beats is negligibly small. The circuit of code assist light **150** runs through code assist contacts **56**, **57**, contact arm **50**, brush contact **49**, toothed wheel **86**, contact tip **52**, and contact arm **51**. Therefore code assist light **150** will flash On whenever contact tip **52** engages one of the teeth **87** of toothed wheel **87**, and will go Off whenever contact tip **52** is between teeth **87**. Since toothed wheel **86** rotates at a constant speed with shaft **55** during the opening cycle, the code assist light **150** will flash in a regular pattern.

When the defeater means has been tripped, latch arm **92** biased toward core **91** and no longer held away by leaf spring arm **94** will move toward coil **52** since deenergization of coil **52** of relay **53** allows armature **91** to return to its initial position within coil **52**, thus separating code assist contacts **56**, **57**. This interrupts the circuit to the code assist light **150** and it ceases to flash, thus indicating to an operator who knows the combination but has unknowingly generated an accidental false impulse, that he has defeated the lock and should not expect it to open on this cycle. The beginning of the next cycle and the next attempt will be announced by the first flash of the code assist light **150** after the operator performs the unlatching operation. Code assist contacts **56**, **57** will by that time have been reclosed in the resetting of the defeater by cam **103** and cam follower **103***a*, thus once again allowing code assist light **150** to be controlled by toothed wheel **86**.

Figure 10 illustrates a signal pickup device **201** which may be utilized to receive the light pulses from the car headlights. Pickup device **201** is comprised of an L-shaped housing **202** having an elongated vertical arm with a photoelectric cell **203** disposed therein at the top free end of the vertical arm. Window **204** is located at the free end of the horizontal leg.

Mirror **205** is positioned at the juncture between the arm and leg of housing **202** and is inclined to reflect light rays passing through window **204** substantially parallel to the leg, upward to cell **203**. Window **204** is oppositely inclined with respect to mirror **205** for purposes of drainage as well as to admit more light coming from below than above the leg. A water-tight covering **206** is placed at the free end of the vertical leg with cable **207** projecting through covering **206** and extending to the other circuitry of signal receiver **200**.

Pickup device **201** is mounted externally of the garage with surface **208** positioned against the garage door frame with the housing leg projecting toward the driveway. Window **204** is so positioned that spurious light signals which may impinge upon cell **203** are kept to a minimum.

The door-opening operation of my novel electric lock has now been described. But this improved device will also close the garage door automatically, thus making it unnecessary for the operator to alight from the car. All the operator need do is perform the unlatching operation, and then when code assist light **150** announces the beginning of an opening cycle, intentionally defeat the lock, tripping the defeater relay **53** by simply shutting off his headlights preferably before the trailing edge of tongue **81** of lock disc **48** has had time to rotate past contact tip **47**. Contact arm **46** is flexible enough not to be damaged when bent by the passing tongues **81**—**84**. When defeater relay **53** is tripped, leaf spring arm **94** is released by latch arm **92**, and is free to bias closer contacts **111**, **112** closed.

Closer contacts **111**, **112** are in series with opener contacts **152**, **153** and connect motor **199** across lines L_1, L_2 with winding **197** paralleling the series combination of winding **198** and capacitor **196** so that motor **199** will rotate in a reverse direction to close the garage door. Closer contacts **111**, **112** and opener contacts **152**, **153** will remain closed for a long enough time to close the garage door completely if the defeater relay **53** is tripped reasonably early in the opening cycle. With this combination defeating and closing action, note that the requirement of three unlatching impulses instead of merely one helps to insure that not enough stray impulses can occur during the short time required to drive into or out of the garage. Closer contacts **111**, **112** will be reopened when cam **103** and cam follower **103***a* reset the defeater.

Normally closed limit switches **170**, **171** (Figures 9 and 9A) are connected in electrical series with defeater **42**, **43** and closer contacts **111**, **112**, respectively, on the motor side of each. Limit switches **170**, **171** are preferably mounted to the garage door frame (not shown) near the top and bottom respectively thereof, and operatively positioned for engagement by a lug (not shown) carried by the garage door. When the lug engages a limit switch **170**, **171**, the switch so engaged is caused to open.

Limit switch **170** is opened when the garage door is open thereby interrupting the motor energizing path through defeater contacts **42**, **43** so that motor **199** cannot be rotated in the forward direction. Similarly, limit switch **171** is opened when the garage door is closed thereby interrupting the motor energizing path through closer contacts **111**, **112** so that motor **199** cannot be rotated in the reverse direction. Thus limit switches **170**, **171** prevent energization of motor **199** for rotation of the garage door when it is fully opened and close the garage door when it is fully closed.

A typical arrangement for manual operation of motor **199** is also illustrated in Figures 9 and 9A. Manually operated switch **180** is a single pole three position switch. Movable contact arm **181** is biased to a center position where motor **199** is controlled by the operation of my novel electric lock by connecting one of the opener contacts **152**, **153** to line L_2. Counterclockwise rotation of contact arm **181** interrupts the circuit between opener contacts **152**, **153** through switch **180** to line L_2 and connects motor **199** to line L_2 for forward rotation provided limit switch **170** is closed. Similarly, clockwise rotation of contact arm **81** connects motor **199** to line L_2 for reverse rotation provided limit switch **171** is closed. Thus, manual control of motor **199** by means of switch **180** takes over even after an automatic control by means of the electric lock has initiated rotation of motor **199**.

In operation, therefore, an appropriate means for transmitting signals of coded sequence and duration is used in connection with a means for receiving the signals and impressing them on the coil **20** of operating relay **21**. After the timed and spaced coded signals are received, they are utilized to prevent opening of defeater contacts **42**, **43**, rather than to close opener contacts **152**, **153** as in previous locks, and it is this prevention of defeating which allows the opener windings of the garage door motor **199** to be energized for rotation in a forward direction by the closing of opener contacts **152**, **153** when defeater contacts **42**, **43** are also closed.

Assuming that it takes approximately ten seconds for garage door motor **199** to operate a garage door from the closed to the open position, the cycle of operation of the code disc **48** may be arranged to occur in thirty seconds. The first ten to twelve seconds may be used for the reception of the code signals to operate contact tip **47** so that it will avoid contact with tongues **81**—**84**. The second ten to twelve seconds of the cycle of the disc **48** may be used to maintain the opener contacts **152**, **153** closed so that garage door motor **199** may operate the garage door to the open position, and the last few seconds of the cycle of operation may then be used for operation of cam **103** to reset defeater relay **53**.

The operation of my novel predetermined code receiving mechanism, or lock, is summarized as follows:

(1) The energization and deenergization of operating relay **21** is determined by the presence and absence, respectively, of light at photo-electric cell **203**.

(2) Lock disk **48** is unlatched when latch rod **33**, secured to relay armature **25**, has cleared all of the latch rods **33**.

(3) After disk **48** is unlatched relay **21** must be alternately energized and deenergized for predetermined time intervals determined by the speed of disk **48** and the location of tongues **81—84**.

(4) If tip **47** of contact arm **46**, which is carried by armature **25**, does not contact any of the tongues **81—84** opener contacts **152, 153** will thereafter close the energizing circuit for opener winding **198** of garage door motor **199** which will then operate to open the garage door.

(5) If relay **21** is energized or deenergized for an incorrect interval of time, contact arm tip **47** will engage one of the tongues **81—84** thereby energizing defeater relay **52**. This causes contacts **42, 43** in the opener winding energizing circuit for motor **199** to be open even when opener contacts **152, 153** thereafter close so that the garage door will not be opened.

(6) After a complete revolution the rotation of lock disk **48** is arrested by the engagement of latch rod **33** with the first lock pin **32**.

While I have illustrated my invention in connection with four spaced tongues **81** to **84**, it is obvious that any number of spaced tongues may be used for this purpose. By merely varying the spacing between the tongues and the width, or distance, along the periphery of the tongues, the combination thereof can be conveniently changed. The essence of my invention is the varying of the spacing between the tongues in each tier in some way which will be random for any particular lock, in a series, but will be specific for the particular lock and unlocking signal transmitting device and individual or as far as possible unique to that particular pair of lock and unlocking signal generator.

In the foregoing I have described my invention solely in connection with a specific illustrative embodiment thereof. Since many variations and modifications of the invention will now be obvious to those skilled in the art, I prefer to be bound not by the specific disclosure herein contained but only by the appended claims.

I claim:

1. In a system for effecting control of a load device in response to a series of time spaced signals, a signal responsive code following means for testing the timing of a series of signals, motivation means for effecting a complete cyclic movement of said code following means as signals are fed thereto, control means actuatable at termination of a cycle of said code following means for effecting control of said load device, said code following means comprising a defeater device actuatable during the course of a cycle of movement in response to an incorrectly timed signal for preventing the energization of said load device at the end of said cycle in the event that an incorrectly timed signal has been received during said cycle, and latch means normally latching said code following means and being unlatched by a plurality of spaced electrical impulses for effecting the start of movement of said code following means at the beginning of a cycle and effecting latching of movement of said code following means at the end of a cycle.

2. In a system as set forth in claim 1 wherein said plurality of electrical impulses are randomly spaced.

3. In a system as set forth in claim 1, wherein said code following means comprises a rotary element having an array of spaced tongues extending therefrom, a contact arm, means for moving said contact arm in response to signals as said rotary element rotates, wherein said contact arm is positioned to engage one of said tongues in the event an incorrectly timed signal is received but wherein said contact arm is moved so as to avoid engagement with said tongues in accordance with a series of correctly timed signals, and electrical circuit means responsive to engagement of said contact arm with any of said tongues to effect actuation of said defeater device.

4. In a system as set forth in claim 1, said latch means comprising an element movable with said code following means and having a plurality of projections in spaced array and an arm mounted for movement and disposed to engage said projections one at a time so as to prevent movement of said code following means, and signal receiving means for actuating said arm responsive to random signals for engaging and disengaging said projections whereat disengagement from a final projection effects the commencement of the cycle of the movement of said code following means.

5. In a system as set forth in claim 1, said code following means comprising a rotary element and an arm adjacent thereto including projections on said rotary element engageable by said arm to effect actuation of said defeater device, said latch means comprising a rotary element and an arm adjacent thereto and engageable with projections thereon to prevent rotation thereof, said rotary elements being integrally movable in unison on a common axis, relay means for effecting motion of said arms in response to signals received, the projections of said latch means being phased ahead of the projections of said code following means in the direction of rotation, whereat random signals fed to said relay means effects ultimate disengagement of said latch means arm from the last projection of said latch means to bring the arm of said code following means into position to engage the projections of said code following means, wherein a series of correctly timed signals fed to said relay means effects movement of said code following means arm to avoid engagement with any of said projections of said code following means as it rotates, electrical circuit means actuatable in response to engagement of said code following means arm with any of the projections of said code following means to effect actuation of said defeater device while said rotary elements continue to rotate, and circuit closing means for effecting energization of said load device comprising an element carried rotatably with the rotary elements of said code following means and said latch means and operative to effect said energization at the end of a cycle.

6. In a system for achieving a control effect in response to a series of time coded signals, the combination of a manually operated transmitting means and a preset code receiving means, said receiving means comprising a timed drive means and having a sensing device driven thereby for detecting an error in the timing of transmitted signals and means to defeat said control effect upon receipt of an incorrectly timed signal, said receiving means having a timing assist device with means producing a series of time spaced assist signals receivable by an operator at said transmitting means, wherein said assist signals are timed to coordinate with the timing of the coded signals so as to apprise the operator of the times at which coded signals are to be transmitted or withheld, according to the preset code of the receiver.

7. In a system as set forth in claim 6, said sensing device comprising a cyclically moving member, the signal producing means of said timing assist device comprising an element movable with said cyclically moving member and said element having spaced signal control means thereon, and additional signal control means co-acting therewith for effecting said assist signals.

8. In a system as set forth in claim 7, cycle initiating

means responsive to a series of random signals at the beginning of a cycle for a predetermined portion thereof prior to said sensing device becoming effective, said timing assist device becoming effective when said sensing device becomes effective.

9. In a system as set forth in claim 8, said cycle initiating device comprising a member also movable with said element of said timing assist device.

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