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Peters et al.

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[54] LOCKING APPARATUS

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Related U.S. Patent Documents

Reissue of:

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[51] **Int. Cl.**[2] **E05B 49/00**

[52] **U.S. Cl.** **307/129;** 70/280; 361/171; 361/182

[58] **Field of Search** ..... 307/129; 317/134, 138; 70/280; 340/274 R

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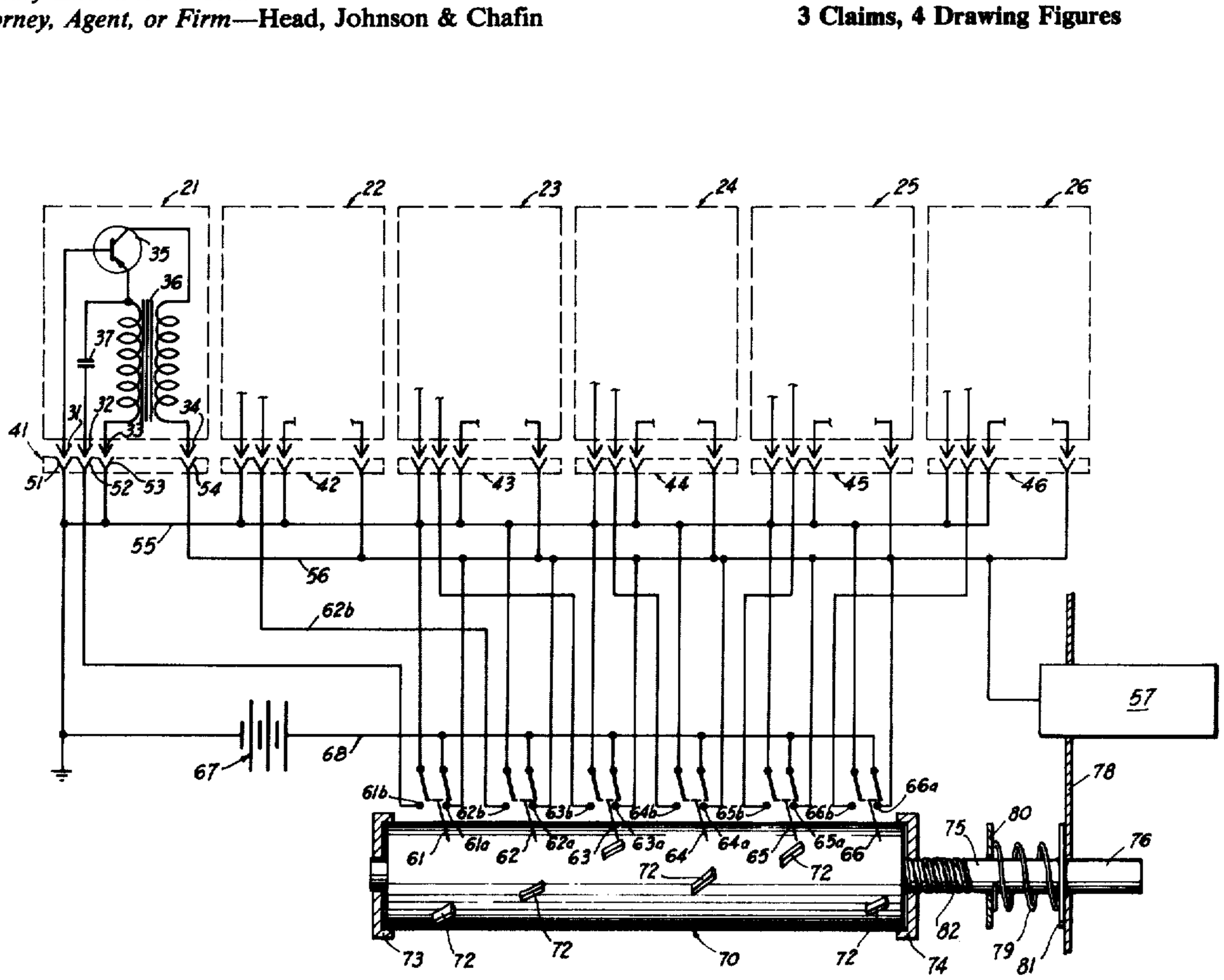
Attorney, Agent, or Firm—Head, Johnson & Chafin

[57] **ABSTRACT**

An electronic control actuating system having signal transmitting or injector means and signal receiving means. The signal transmitting means includes a plurality of self-contained oscillator circuits, each oscillator circuit capable of producing an independent radio frequency output signal and wherein the oscillating circuits are adapted to be selectively positioned relative to an actuator means capable of sequentially supplying energy to each of the oscillator circuits for effecting an output of a plurality of sequentially transmitted coded signals. The signal receiving means includes a plurality of self-contained filter circuits, each filter circuit designed for receiving one of the coded radio frequency signals produced by the signal transmitting means, with the signal receiving means including a plurality of sequentially operable switching means, and wherein the filter circuits are adapted to be selectively positioned relative to the sequentially operable switching means for effecting a sequential operation of the switching means to produce an output actuator signal in response to a complete reception of the coded signals produced by the signal transmitting means. Should any signal be received out of sequence, there will be no output signal to the actuator (unlocking-locking unit).

3 Claims, 4 Drawing Figures



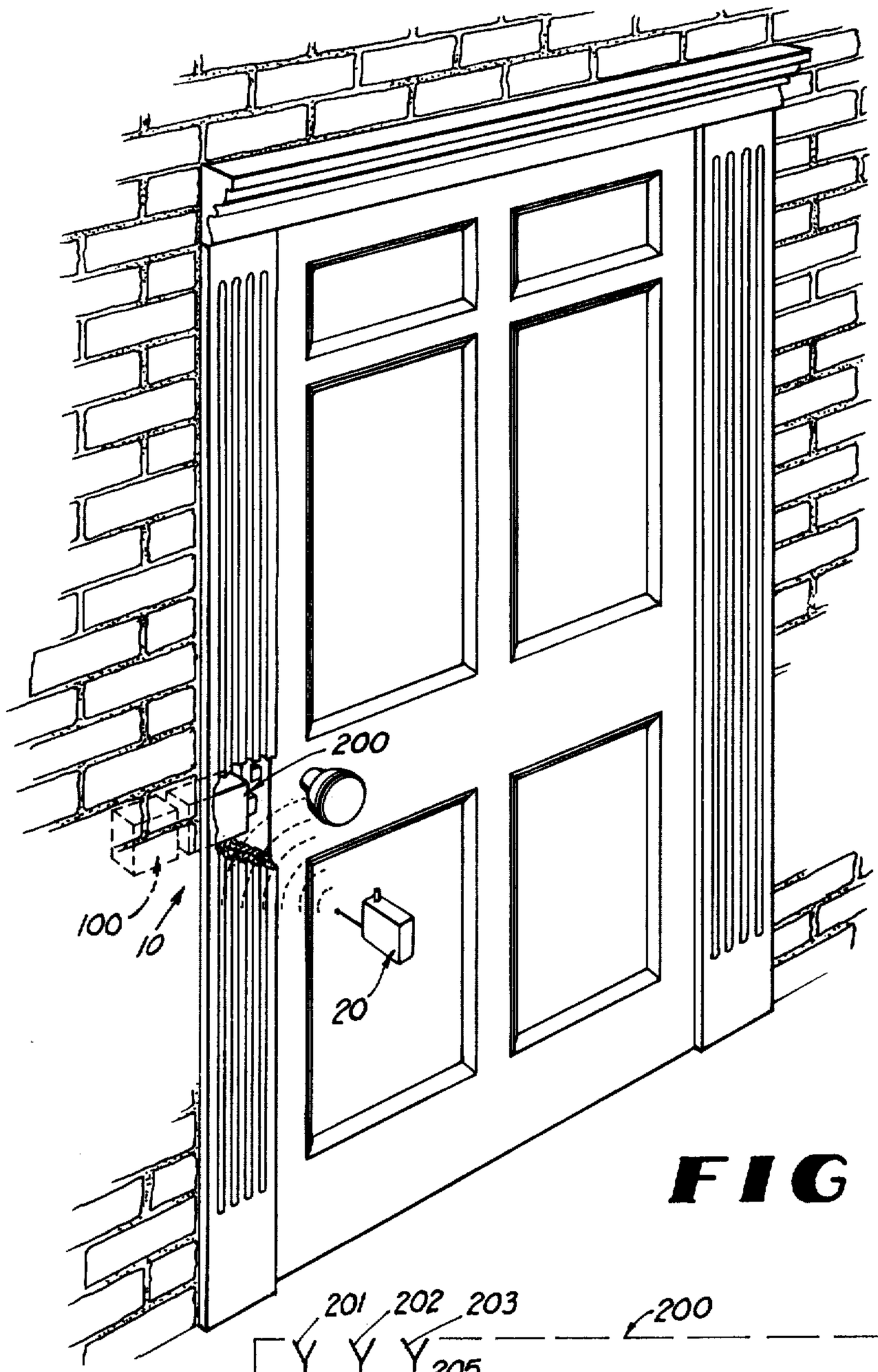

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FIG 1

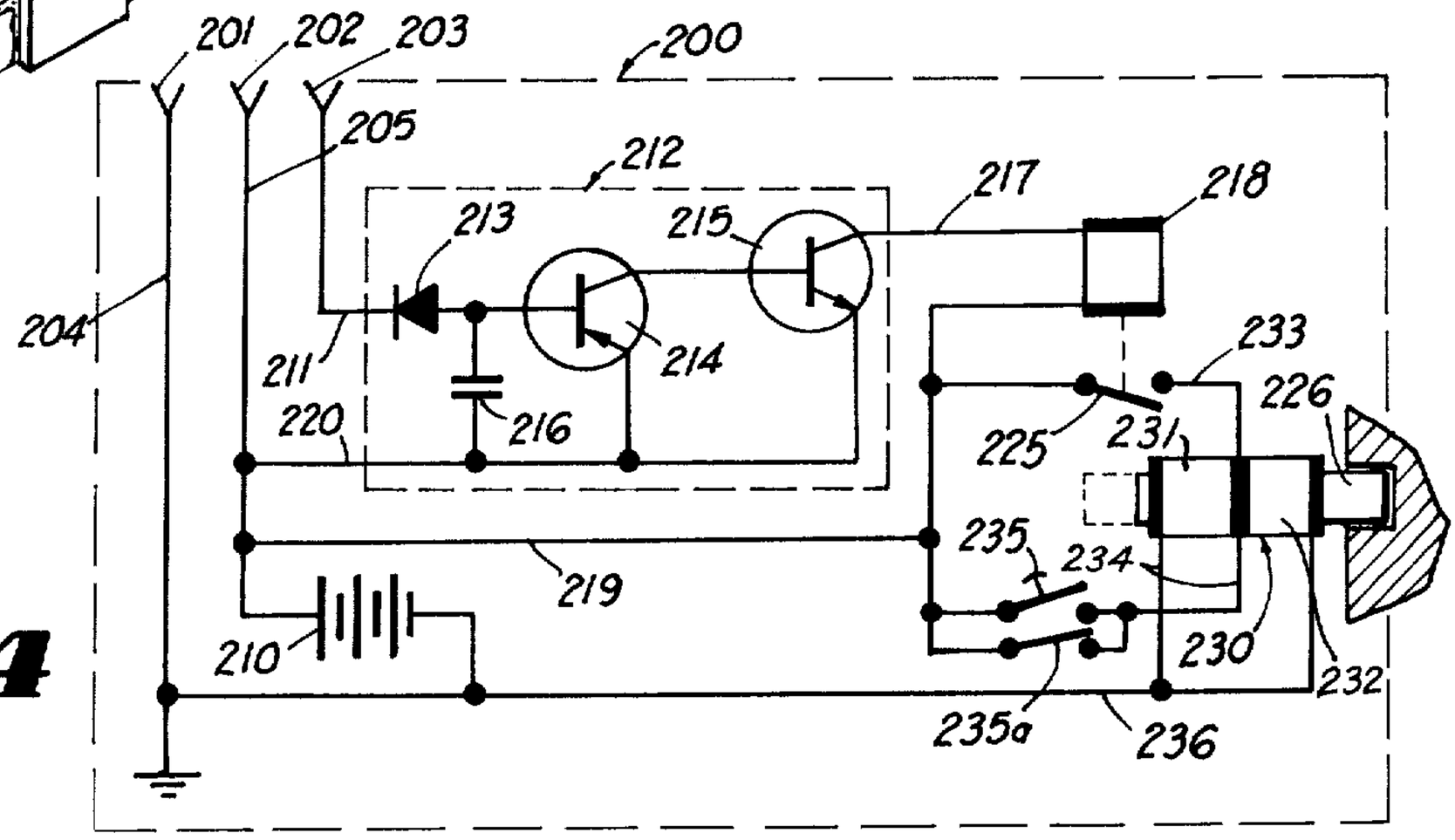
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FIG 4

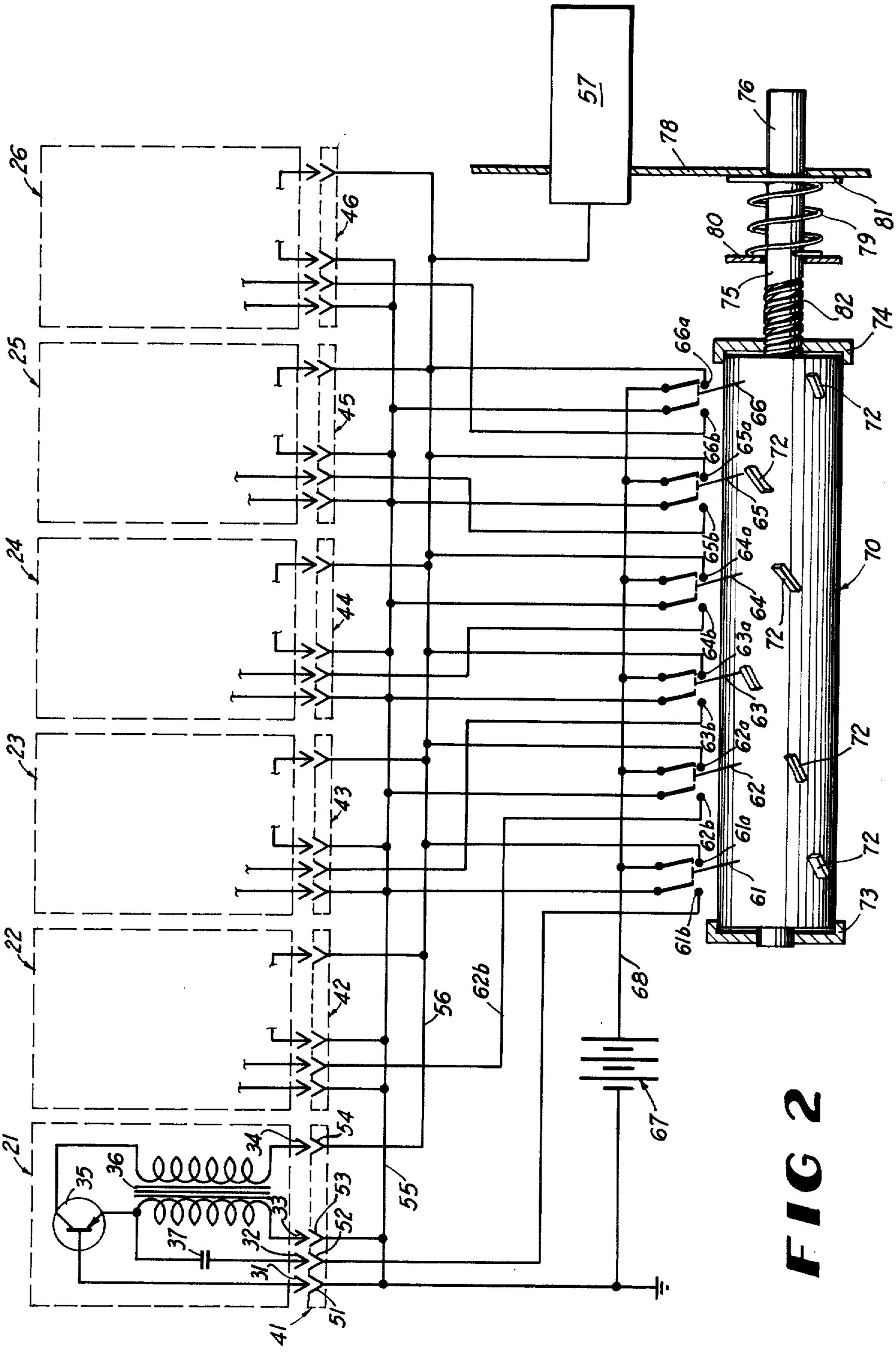
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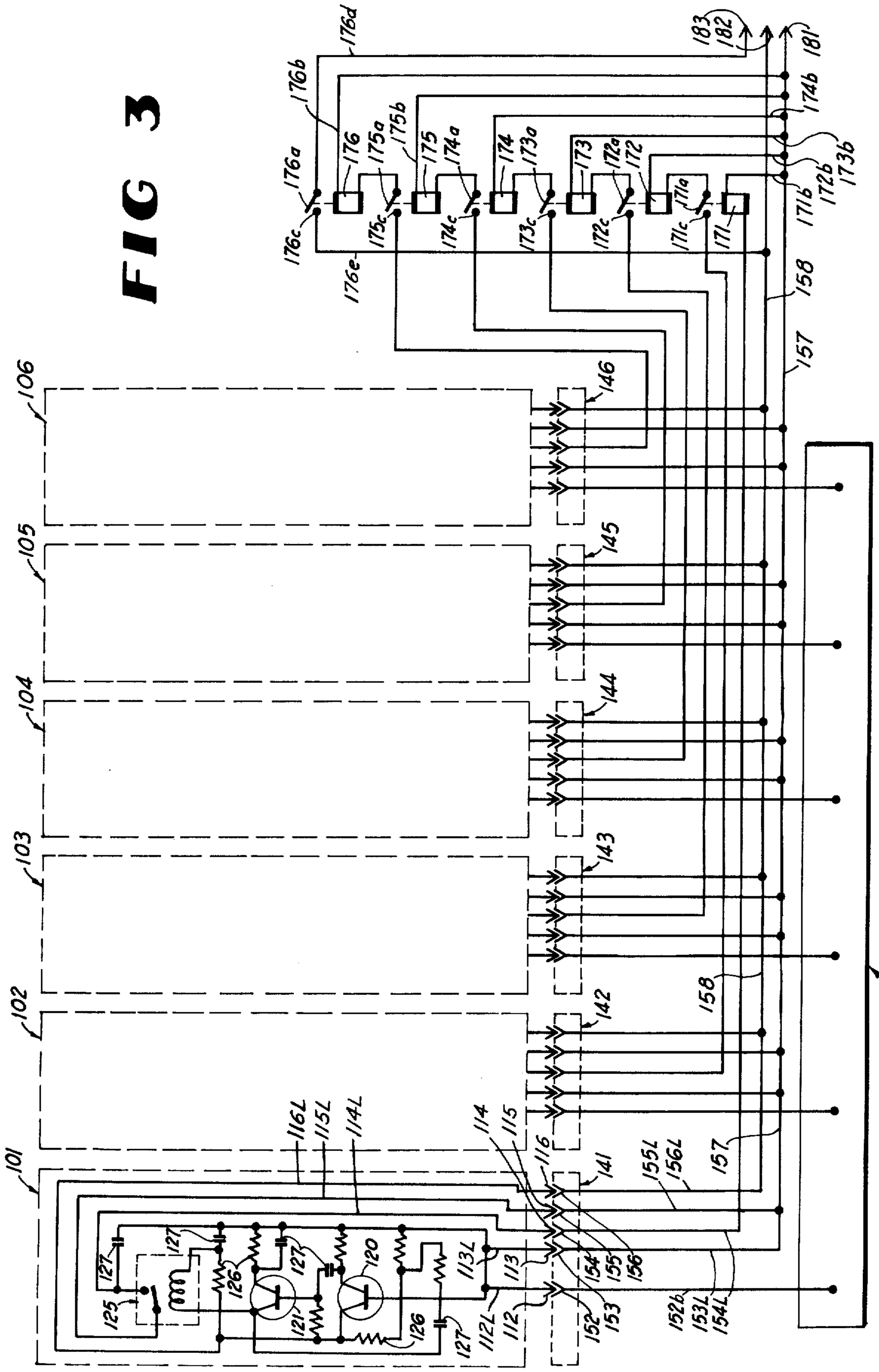
FIG 2

FIG 3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LOCKING APPARATUS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

CROSS-REFERENCE TO RELATED APPLICATION

This application is for a re-issue of our Patent No. 3,794,848, issued Feb. 26, 1974, and entitled "Locking Apparatus".

BACKGROUND OF THE INVENTION

This invention relates to an electronic lock actuating means and is more particularly concerned with a locking means capable of being operated in response to receiving coded radio frequency signals.

Our [expending] *expanding* population and increasing crime necessitates the need for a fool-proof secure locking system.

In the past, most of our locking systems included a locking element selectively movable between a locking and unlocking position by a key. The problem with utilizing a key for operating a lock is that the lock is easily operated by a master key, a copy of the original key, operated by feeler gauging means, or present state of art, electrically actuated locks wherein present surveillance techniques exist to render them unsecure lock systems.

There have been a number of attempts to provide an electronically operable locking means operable in response to receiving an electronic actuator signal. The actuator signal is normally produced by the correct operation of a number of electronic signal actuator elements associated with the locking system. One problem with this type of electronically operable locking means is that the electronic structure and actuating mechanism utilized is often complex, expensive to manufacture and unreliable in performance.

Another problem with the prior art electronically operable locking system was that the system could not be readily programmed to vary the signals required to effect operation of the lock without the service of a skilled electronic technician.

Further, the prior art electronic lock control actuating system does not lend itself to being microminiaturized for lowering the cost and improving the reliability of the locking system.

SUMMARY OF THE INVENTION

The above disadvantages have been overcome by the present invention which basically includes an electronic lock control actuating means operable in response to receiving an actuator signal produced by a signal receiving means. The signal receiving means includes a plurality of self-contained filter circuits, with each filter circuit designed for only receiving one input signal, and wherein the self-contained filter circuits are adapted to be selectively positioned relative to a sequentially operable switching means such that the switching means would be operated in response to a signal produced in a sequential order by each of the filter circuits. The electronic control actuating system includes a signal transmitter or injector means having a plurality of self-contained independent oscillator circuits, with each oscillator circuit capable of producing a coded radio frequency output signal, and wherein the self-contained oscillator circuits are adapted to be selectively positioned relative to a sequentially operable switching means whereby energy can be sequentially transferred to the plurality of oscillating circuits for sequentially producing a plurality of coded radio frequency output signals to be received by the plurality of filter circuits to effect operation of the lock control actuating means.

One important feature of the present invention is that the self-contained independent oscillating circuits and the self-contained independent filter circuits can be selectively positioned relative to each other and relative to its associated sequentially operable switching means for varying the program of coded signals utilized in the electronic control actuating system, with only the correct sequential operation of signals developed by the oscillating circuits being received by the filter circuits for rendering the unlocking apparatus operable.

Another feature of the present invention is that the electrically movable locking element associated with the locking system includes a time control reset means for returning the locking element to an extended locking position after a predetermined period of time in response to operation of the reset means and includes selectively conditionable switch means for automatically moving the locking element to an extended locking position in response to the door being closed.

It is therefore a primary object of the present invention to provide a programmable tone sensitive lock actuating system.

A further object of the present invention is to provide [and] *an* electronic lock control actuating system which lends itself to micro-miniaturization.

An additional object of the present invention is to provide an electronic lock control actuating system which is simple in construction and use, economical to manufacture and reliable in performance.

These and other objects and advantages of the details of construction will become apparent after reading the following description of the illustrative embodiment, with reference to the attached drawings wherein like reference numerals have been used to refer to like parts throughout the several figures, and wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic block diagram illustrating the components of an electronic control actuating system embodying the principles of the present invention;

FIG. **2** is an electrical schematic diagram of a tone injector or transmitter utilized in the present invention;

FIG. **3** is an electrical schematic diagram of the filter circuits and sequentially reversible operable switching relay; and

FIG. **4** is an electrical schematic diagram showing the actuating circuit used for effecting movement of the locking element between locked and unlocked positions.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

Referring now to the drawing, an electronic control locking system embodying the principles of the present invention is shown in block diagram of FIG. **1** and generally represented by the reference numeral **10**. The electronic control locking system will be described with reference to a signal transmitting or injector means **20**,

a signal receiving means **100** and an electronic control locking apparatus **200.**

SIGNAL TRANSMITTING MEANS

As shown in FIG. **2,** the signal transmitting means includes a plurality of self-contained oscillator circuits **21, 22, 23, 24, 25,** and **26.** Each of the oscillator circuits is constructed or packaged as a self-contained unit having four releasable connector elements **31, 32, 33** and **34.** The connector elements **30–34** are adapted to be releasably connected to complementary elements provided on the transmitting device so that the oscillator circuits can be independently removed and the position thereof changed relative to each other such that the sequence of the signal produced by the oscillator circuits can be programmed. Each oscillator circuit is designed to produce a different radio output frequency and includes a transistor **35,** transformer **36** and capacitor **37.** The capacitor **37** in each of the oscillator circuits is of a different capacity which will operate to produce a different frequency radio signal output from each filter circuit.

As shown in FIG. **2,** the signal transmitting means **20** includes a plurality of connector means **41, 42, 43, 44, 45** and **46.** Each of the connector means **41–46** includes four releasable connector elements **51, 52, 53** and **54.** The releasable connector elements **51–54** are complementary to the oscillator circuit connector elements **31–34** and are adapted to readily receive the oscillator connector elements in electrical conducting relation when inserted therein. The releasable connector elements **51** and **53** are connected to a common ground line **55.** Releasable connector elements **54** of each of the oscillator circuits is connected by a common output supply line **56** to the signal transmitter injector probe **57.**

As shown in FIG. **2,** the signal transmitting means includes a plurality of selectively operable switching elements **61, 62, 63, 64, 65** and **66.** The switching elements **61–66** are operatively associated with the connector means **41–46,** respectively. Power is supplied from a battery **67** through a common power supply line **68** to each of the switch elements **61–66.** The switch elements **61–66** are a double pole switch with one pole of the switch element adapted to electrically connect power supply line **68** and with branch lines **61a, 62a, 63a, 64a, 65a** and **66a,** respectively, connected to the output supply line **56.** The other pole of the double pole switch elements **61–66** are adapted to be electrically connected to connector lines **61b, 62b, 63b, 64b, 65b** and **66b,** respectively. An opposite end of connector lines **61b–66b** are connected to the connector elements **52** in each of the connector means **41–46,** respectively.

As shown in FIG. **2,** the sequential operation of switches **61–66** is effected by a rotatable actuator drum **70.** Rotatable actuator drum **70** is provided with a plurality of camming elements **72,** one operatively associated with each of the switch elements **61–66.** The camming elements **72** are helically arranged around drum **70** whereby rotation of drum **70** will effect a sequential operation of switches **61–66.** Drum **70** is rotatable supported by a pair of support elements **73** and **74.** Drum **70** is rotated by an elongated support shaft **75** having an extended key actuating means **76** located externally of the transmitting housing **78.** Shaft **75** is spring urged outwardly by a compression spring **79** supported between housing structure **80** and tabs **81** formed on shaft **75.** As shown in FIG. **2,** shaft **75** includes a spiral groove **82** extending through drum **70.**

Drum **70** is provided with an inwardly directed projection (not shown) which is complementary to and engages groove **82.** A downward depression of key means **76** will effect a one cycle rotation of drum **70** and when the key means **76** is released, compression spring **79** will return the key and shaft outwardly to rotate the actuator drum one revolution in an opposite direction. In operation, when the key operated means **76** is depressed, drum **70** will rotate causing the camming element **72** to effect a sequential closing of switches **61–66.** When switches **61–66** are closed, power from battery **67** will be supplied through power supply line **68** through the respective switch elements **61–66** and through connector lines **61a, 61b,** respectively, to the associated oscillator circuits **21–26.** When a power pulse is transmitted to the oscillator circuits **21–26,** a radio frequency output signal will be produced and conducted through releasable connector elements **34, 54** which is transmitted along output supply lines **56** and out through the probe **57.**

It is apparent that the oscillator circuits **21–26** can be removed and the arrangement of the oscillator circuits relative to the switching elements **61–66** can be varied to change the program or sequence of signals produced by the oscillator circuits.

SIGNAL RECEIVING MEANS

As shown in FIG. **3,** the signal receiving means includes a plurality of receiving elements **101, 102, 103, 104, 105** and **106.** Each of the receiving elements includes a filter circuit constructed in a self-contained package means and is provided with a plurality of releasable connector elements **112, 113, 114, 115** and **116.** Since each of the filter circuits **101–106** are identical in construction with only the size of the resistors and capacity of the capacitors being changed, only the details of filter circuit **101** is illustrated. Each of connector elements **112–116** are connected through respective connector lines **112L, 113L, 114L, 115L** and **116L.** The connector lines **112L–116L** are operatively connected to a pair of transistors **120, 121** and to a toned resonant frequency reed relay **125.** Each circuit includes a plurality of resistors generally represented by the reference numeral **126** and a plurality of capacitors represented by the reference numeral **127.** Each filter circuit is designed to receive and be operated by only one radio tone frequency and when that tone frequency is received, the circuit is operable to develop an output signal through line **114L** for operating a sequential latching relay system to be described below.

As shown in FIG. **3,** the signal receiving means includes a plurality of connector means **141, 142, 143, 144, 145** and **146.** Each of the connector means **141–146** includes a plurality of releasable connector elements **152, 153, 154, 155** and **156.** The releasable connector elements **152–156** are complementary to releasable connector elements **112–116** and are adapted to be interconnected therewith in an assembled relationship whereby electrical current can flow through the connector elements.

The releasable connector elements **153** and **155** are connected by lines **153L, 155L,** respectively, to a common ground line **157.** Releasable connector element **152** is connected by a line **152b** to a copper bus bar **160.** The copper bus bar **160** serves as an antenna to receive signals transmitted from the transmitter **20** and the signals are transmitted through connecting lines **152b** to the releasable connector elements **152** for transmitting the

signal into the filter circuits **101–106.** Each of the connector elements **156** is connected by branch line **156L** to a common power supply line **158.**

As shown in FIG. **3,** the signal receiving means includes a plurality of relay elements **171, 172, 173, 174, 175** and **176.** Each relay element **171–176** is operatively associated with a switch **171a–176a,** respectively. Each of the relay elements **171–176** are connected by branch connecting lines **171b–176b,** respectively, to the common ground line **157.** An input pulse is transmitted to relay **171** through a branch connecting line **154L.** Branch connecting line **154L** is operatively connected through releasable connector elements **114** and **154** to the power output line **114L** of filter circuit **101.** The power output lines **114L** associated with filter circuits **102–106** are connected through branch connecting lines **154L** to switch terminals **171c, 172c, 173c, 174c, 175c** and **176c.** When a power pulse is transmitted from filter **101,** relay **171** will be energized thereby closing switch element **171a.** When switch element **171a** is closed, a power pulse received from filter **102** will be transmitted through the terminal **171c** and switch **171a** to relay **172,** thereby energizing relay **172.** When relay **172** is energized, a power pulse transmitted from filter circuit **103** will be transmitted through switch terminal **172c,** switch **172a** to relay **173** thereby energizing relay **173.** When relay **173** is energized, a power pulse transmitted from filter circuit **104** will be transmitted through terminal **173c,** switch **173a** to relay **174** to thereby energize relay **174.** When relay **174** is energized, a power pulse transmitted from filter circuit **105** will be transmitted through terminal **174c,** switch **174a** to energize relay **175.** When relay **175** is energized, a power output signal from filter circuit **106** will be transmitted through terminal **175c,** switch **175a** to energize relay **176.**

Switching terminal **176c** operatively associated with switch **176a** is operatively connected by a connecting line **176e** to the power supply line **158.** Therefore, when the relays **171–176** are closed in sequence as described above, a pulse will be transmitted through power supply line **158,** branch connecting line **176e,** terminal **176c,** switch element **176a** and out through an output line **176d.** As shown in FIG. **3,** the common ground line **157** is connected to a releasable connector element **181,** power supply line **158** is connected to a releasable connector element **182** and signal output line **176d** is connected to a releasable connector element **183.**

In operation, the filter circuits **101–106** are programmed in connected relationsip relative to the switching relay elements **171–176** such that the sequential signals transmitted from the signal transmitter will effect a sequential closing of switches **171a–176a** as described above. When the switches are sequentially closed by receiving a correct sequence of tones transmitted from the transmitter **20,** switch **176a** will close thereby conducting an actuator signal out through line **176d** and releasable connector element **183.** The copper bus bar **160** is common to each of the filter circuits and will serve as an antenna to pick up the tone transmitted from the transmitter and for transmitting the tone through branch connecting lines **152L** for input into the filter circuits **101–106.**

ELECTRONIC CONTROL LOCKING APPARATUS

The signal receiving releasable connector elements **181–183** are adapted to be releasable connected with complementary connector elements **201, 202, 203,** respectively provided on the electronic control locking apparatus **200,** as shown in FIG. **4.** Releasable connector element **201** is connected to a common ground line **204.** Releasable connector element **202** is connected by line **205** to the positive terminal of a battery supply means **210.** Releasable connector element **203** is connected by a signal transmitting line **211** to a transistorized amplifying circuit means **212.** The transistorized amplifying circuit includes a diode **213,** transistor **214,** transistor **215** and capacitor **216.** The transistorized circuit **212** is connected by a signal supply line **217** to a relay **218.** Relay **218** is connected by line **219** to the positive terminal of battery **210.** An output from the transistorized circuit **212** is connected by line **220** to the line **204.** Relay **218** is operable when energized for closing switch **225.**

As shown in FIG. **4,** the locking apparatus includes a dead bolt locking element **226** which is slidably supported by a double-coil polarized solenoid **230.** Solenoid **230** includes first and second coils **231, 232.** Coil **231** is connected by line **233** through switch means **225** to the power supply line **219.** Coil **232** is connected by connecting line **234** to the common ground line **204.** An actuator signal from signal receiving means **100** is transmitted through the transistorized circuit **212** and amplified to effect energization of relay **218** to close switch **225** thereby allowing power to be conducted through coil **231.** When coil **231** is energized, the dead bolt latch **226** will be retracted to an unlocked position, as shown in dash line of FIG. **4.**

The second coil **232** of the double coil solenoid **230** is operable for returning the dead bolt latch outwardly to a locked position and is operatively connected through a timing reset switch **235** to the positive power line **219.** Coil **232** is connected by line **236** to the common ground line **204.** Switch **235** is time controlled and is operable when manually moved to a closed position for closing and conducting a current to solenoid **232** after being closed for a predetermined period of time, which time would be sufficient to permit an individual located within the house to press the reset switch **235,** move to a location outside of the house and pull the door to a closed position, after which the timing switch would operate to energize solenoid **232** for moving dead bolt latch **226** outwardly to a locked position.

A by-pass switch **235a** is connected around timing reset switch **235** so that solenoid **232** can be immediately energized for moving the locking element to an extended locked position.

Additional by-pass switch means (not shown) could be operatively associated with the door so that the locking element would be immediately moved to the locking position in response to closing the door.

OPERATION

In utilizing the electronic control locking apparatus of the present invention, the oscillator circuits **21–26** and filter circuits **101–106** are programmed so that the sequence of tone signals generated by the oscillating circuits **21–26** will be sequentially received in order by the filter circuits **101–106.** With a person located externally of a house, the signal transmitter is operated to permit a sequence of tone signals to effect operation of the lock by depressing the key means **76,** thereby rotating actuator drum **70.** When actuator drum **70** is rotated, switches **61–66** will be sequentially closed, thereby sequentially transmitting power pulses to each of the oscillator circuits **21–26.** As each of the oscillator

circuits **21–26** receives a power pulse, the power pulse will develop an output radio frequency tone signal which is transmitted through line **56** and out through transmitting probe **57.** The sequential tone signals transmitted through tone probe **57** will then be sequentially picked up by the common bus bar antenna **160,** with the signals being transmitted sequentially to the respective filter elements **101–106.** As the filter elements **101–106** sequentially receive the generated tones, an output signal will be supplied from each of the filter circuits through branch connecting lines **154L** to the switching relay means **171–176** to effect a sequential closing of switches **171a–176a.** After a sequential closing of switches **171a–176a,** an actuator pulse is then transferred from the power supply line **158** through switch **176a** and out through signal actuator line **176d.** The pulse transmitted through signal actuator line **176d** will then be transferred through line **211** of the locking apparatus and into the transistorized circuit **212.** The signal will be amplified in the transistorized circuit **212** and will effect operation of relay **218.** When relay **218** is energized to close switch **225,** a pulse will be transmitted through coil **231** to cause the dead bolt latch to be withdrawn to a retracted, unlocked position, thus permitting the door or other associated structure to be readily opened. When it is desired to move the dead bolt latch **226** to an extended locking position, the manually controlled reset timing switch **235** is operated and a predetermined period of time after switch **235** is operated, a reset pulse will be transmitted to coil **232** to cause the latching element to be moved outwardy to an extended locked position and/or for instant locking operation to by-pass the time delay switch **235** or **235a** or by a door operated by-pass switch.

It is apparent that a number of solid state circuit systems and/or integrated circuit systems can be substituted for the above described oscillator filter circuits and can be operated sequentially in a manner as described above to effect a locking and unlocking operation of an electronic controlled locking apparatus.

It now becomes apparent that the above described illustrative embodiment of an electronic control locking apparatus is capable of obtaining the above stated objects and advantages. It is obvious that those skilled in the art may make modification in the details of construction without departing from the spirit of the invention which is to be limited only by the scope of the appended claims.

What is claimed is:

1. An electronic control actuating system comprising in combination:

a. signal transmitting means including

(1) a plurality of signal transmitting elements comprising self-contained oscillator circuits with each signal transmitting oscillator circuit operable for producing a different radio frequency output signal [;],

(2) actuator means operable for sequentially supplying energy to each of said oscillator circuits for sequentially producing a plurality of coded radio frequency output signals [and with said actuator means comprising a rotatable drum having a set of camming elements;], [and]

(3) means for selectively relocating said signal transmitting elements relative to said actuator means including a plurality of sets of releasable connectors with the relative spacing and orientation of the releasable connection of each set being substantially identical,

(4) a plurality of switches located adjacent said [rotatable drum in operative association with said camming means,] *actuator means* and

(5) a plurality of [conductor] *conductors* coupling said switches with said releasable connectors whereby said coded output signal produced by said signal transmitting means can be selectively [programmed] *reprogrammed* for changing the sequence of said coded output signals; and

b. signal receiving means operatively associated with said signal transmitting means for sequentially receiving only said plurality of coded output signals produced by said signal transmitting means and including

(1) a plurality of signal receiving elements, each signal receiving element operable for receiving one of said plurality of coded output signals and wherein said signal receiving elements are selectively [programmable] *reprogrammable to respond to* [so that said signal receiving elements can be altered in response to changing of said] *a programmed sequence* coded output signal *of said transmitter,* and

(2) means for producing an actuator signal in response to and only when a complete reception of said coded signals are received *from said transmitter* in a programmed sequential manner.

2. An electronic control actuating system as defined in claim **1** further characterized in that said signal receiving means includes a plurality of self-contained filter circuits, each filter circuit being operable for receiving one of said coded radio frequency output signals produced by said signal transmitting means, and wherein said signal receiving means includes a plurality of sequentially operable switching means capable of producing an actuator signal when sequentially operated, and wherein said self-contained filter circuits are adapted to be selectively positioned relative to said sequentially operable switching means for effecting operation of said switching means in response to sequentially receiving said plurality of coded sequentially produced radio frequency output signals produced by said signal transmitting means.

3. An electronic actuated lock, comprising:

a portable transmitter having an energy source therein, the transmitter having a plurality of oscillator positions;

a plurality of self-contained oscillator circuits each providing, when energized, a different selected frequency output, each oscillator circuit being connectable into a said oscillator position;

means in said transmitter for sequentially energizing said oscillator circuits, each oscillator circuit being energized for a preselected time for providing an output signal, the transmitter output thereby being in the form of a series of different signals, the sequence of signals being selectable by positioning of said oscillator circuits;

a lock operable when electrically energized;

a receiver having a plurality of receiver output positions and having a receiver relay connected to each of said positions;

a plurality of self-contained receiver circuits, each receiver circuit being responsive to the output frequency of one of said oscillator circuits, each receiver circuit being connectable into a receiver position;

circuit means connecting said receiver relays in series arrangement whereby the actuation of said receiver relays in series connects said voltage source to said lock to operate the same, whereby said lock is operated only when said oscillator circuit positions and said receiver circuit positions are preselectedly arranged in a corresponding sequence.

* * * * *