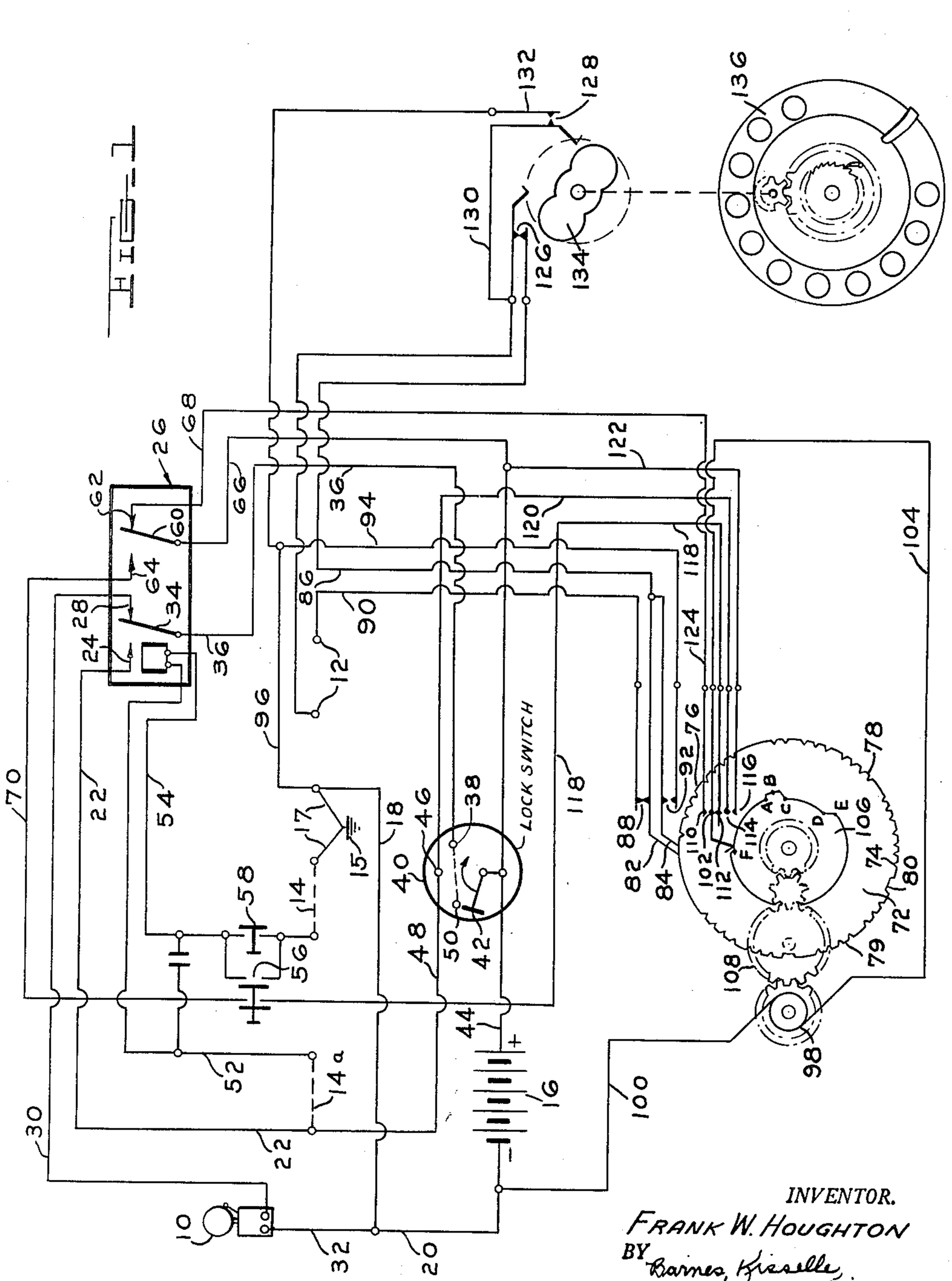
Jan. 23, 1951 F. W. HOUGHTON 2,538,968

CODE ALARM SIGNAL TRANSMITTING SYSTEM

Filed June 2, 1947 2 Sheets-Sheet 1

FIG. 1



INVENTOR.
FRANK W. HOUGHTON
BY Barnes, Kisselle, Laughlin & Raisch
ATTORNEYS

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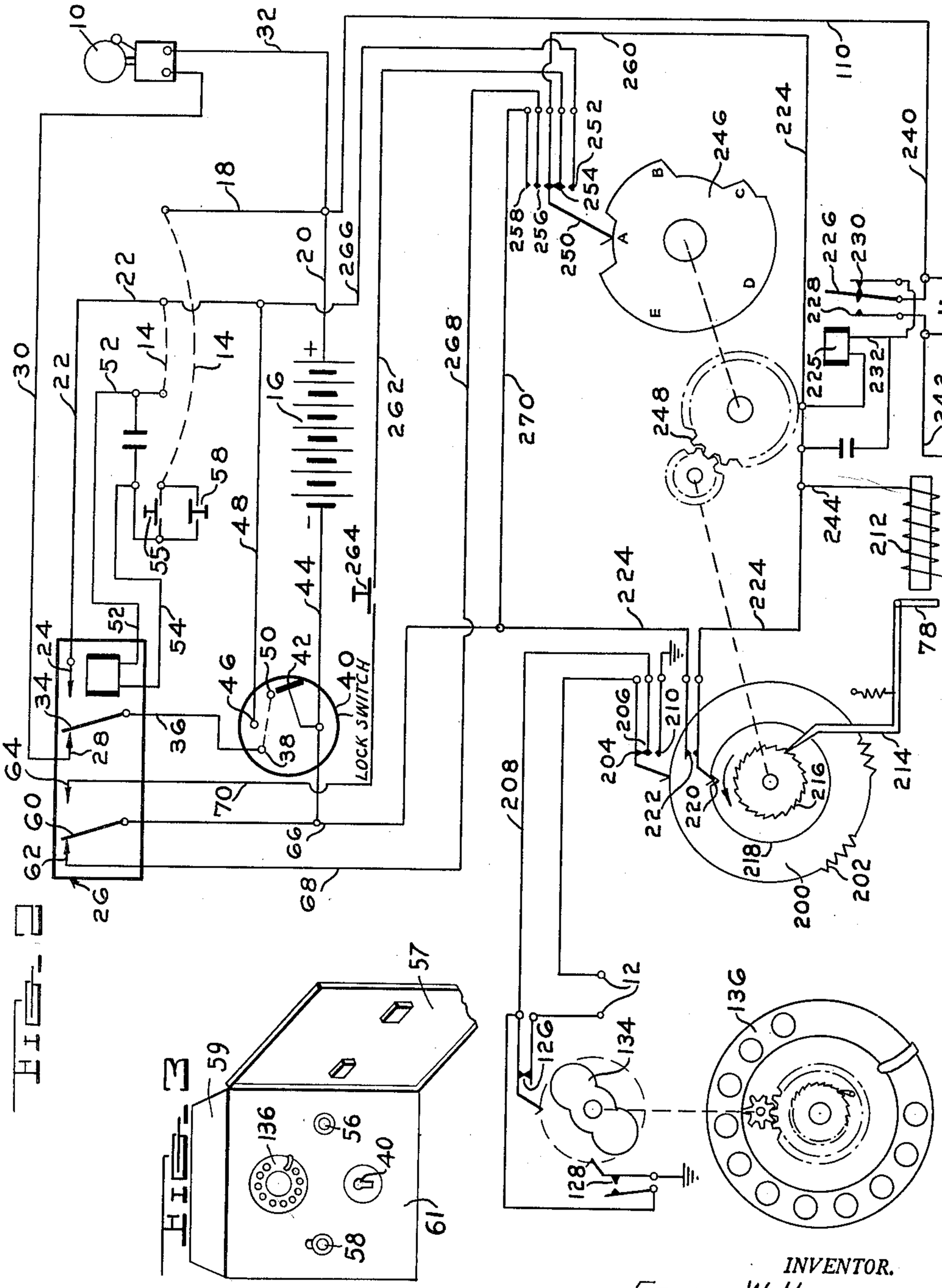

INVENTOR.
FRANK W. HOUGHTON
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CODE ALARM SIGNAL TRANSMITTING SYSTEM

Frank W. Houghton, Detroit, Mich.

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5 Claims. (Cl. 177—314)

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This invention relates to an automatic electric transmitter system, and particularly to systems commonly used for burglar alarm protection, fire alarm, sprinkler supervisory, temperature control and other types of alarm systems. In systems of this character as heretofore constructed, it is common to provide a code signal transmitter in the protected premises which is under the control of a detection circuit so as to operate whenever the detection circuit is interfered with by the occurrence of attempted burglaries, the existence of a fire, operation of sprinklers or whatever the condition may be that the detection responds to. The transmitter in turn then sends a predetermined sequence of code signals over a transmission circuit to a central station for the attention of an operator there. Various local warning signals may also be set off at the protected premises.

In the case of a burglar alarm system, it is necessary to provide some way by which the system may be placed in the alert condition at the time the authorized personnel leave the premises and this must be done before leaving the premises. When the system is properly set and the authorized personnel leave the premises, this will operate the detection circuit causing the transmitter to send in a code signal which serves the purpose of notifying the central station operator that the premises are alerted and leaving the transmitter in condition to send further code signals upon any subsequent interference with the detection circuit.

With systems of this character as heretofore constructed, the transmitter is usually operated by a spring motor which is released electrically by the detection circuit. Should the authorized personnel forget to wind the transmitter or wind it insufficiently, it is possible to leave the premises in an unguarded condition or to give the central station operator incorrect code signals when the premises are opened by an unauthorized person.

It is an object of the present invention to provide an improved automatic transmitter system in which an electrically operated transmitter is used which eliminates the necessity of winding the same and which at the same time can be operated with the same or less battery drain than the conventional spring operated electrically released transmitter.

It is also an object to provide in a system of this character a transmitter so connected and coordinated with the detection circuit as to make the system more foolproof in operation when the authorized personnel leave the premises.

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Another object of the present invention is to provide in a system of this character a second manually operated code transmitter which is so coordinated with the automatic transmitter that it may be used to signal the central station operator when the premises are re-entered by an authorized person and which will be effective independently of the condition of the transmission circuit; that is, even though this circuit be open or grounded.

It is also an object to provide a manual transmitter which is convenient to operate requiring no special skill to transmit uniform signals of a predetermined coded arrangement.

In the drawings:

Figure 1 is a diagrammatic view of an alarm system embodying the preferred form of the present invention.

Figure 2 is a diagrammatic view illustrating a modified arrangement of the system shown in Figure 1.

Figure 3 is a perspective view of the control cabinet with the door open.

The invention may be applied to various types of code transmission systems and for the purpose of illustration I have shown in Figure 1 my invention embodied in a burglar alarm system located in a structure to be protected such as a store or like. The system includes a local alarm signal such as a bell 10 and a transmission circuit comprising conductors 12 which extend to a central station not shown. The upper portion of the diagram represents the local detection circuit while the lower portion represents a circuit including an automatic and a manual transmitter.

In the detection circuit there is provided the usual protective wiring 14 and 14*a* which extends across the doors and windows in the protected structure so as to open the protective wiring circuit when a window or door is opened or otherwise tampered with. One end of conductor 14 is connected to the battery 16 through conductors 17, 18 and 20 and the other end of conductor 14 connects with the operating coil of a relay 26 through a conductor 54, the latter having a normally open switch 56 which is adapted to be closed by the door 57 of the usual control cabinet 59 in which the operating mechanism of the system is housed, and a second switch 58 in parallel therewith. Conductor 14*a* is connected at one end to the opposite side of battery 16 through conductor 48 and 44 across switch lock 40. The other end of conductor 14*a* is connected to the operating coil of relay 26 by means of a conductor 52. The movable contact 34 of relay 26 connects

by a conductor 36 to contact 38 of the three-point manually operated lock switch 40. The movable contact 42 of switch 40 connects to the battery by the conductor 44. Switch 40 has contact 46 connected to conductor 22 by conductor 48 and a contact 50 which is connected to contact 38.

Relay 26 is of the type having two movable contacts actuated by a single armature. One movable contact 34 is arranged to contact either with a front contact 24 or a back contact 28. Front contact 24 is a holding contact and is connected by a conductor 22 to the coil of the relay through protective wiring 14*a*. Back contact 28 is connected by a conductor 30 to the alarm bell 10, the other side of which is connected by a conductor 32 to battery conductor 20. The relay 26 has a second movable contact 60 with front and back contacts 64 and 62 respectively. Contacts 62 and 64 are connected with the transmitter mechanism by conductors 68 and 70.

The switch 58 is a push-pull type switch which, with the cabinet door open, may be retained in either position, being open when pushed in and closed when pulled out. When in closed position switch 53 projects outwardly of panel 61 of cabinet 59 such that it is pushed in automatically to open when the door 57 is closed. Switch 56 is a push button switch normally biased to open. Like switch 58, switch 56 is also controlled by door 57. When door 57 is opened switch 56 is automatically opened and when the cabinet door is closed switch 56 is closed and switch 58 opened. Switch 56 is a double pole switch and is arranged to open and close circuits through conductor 14 and the operating coil of relay 26 on the one hand and the circuit through conductors 70 and 118 on the other.

The mechanism above described with the exception of the protective wiring and, if desired, the alarm bell 10 may all be located within control cabinet 59 located inside the protected structure.

Also located in this same control box is the transmitter mechanism which consists of two parts, namely; an automatic code signal transmitter and a manual code signal transmitter. The automatic transmitter comprises a cam or break wheel 72 which is provided, around its periphery, with five sets of interruptor teeth 74, the teeth in each set being arranged to transmit a particular code number. In the break wheel shown, the number transmitted to the central station is 34. The first set of teeth 76 is preceded by a single notch. The second set 78 is preceded by a double notch and between the last three sets 79 are located long notches 80. These notches are provided for to differentiate each progressive signal from the local transmitter. The interrupter teeth actuate two movable contacts 82 and 84. Contact 82 is connected with one side of the transmission circuit 12 by means of a conductor 86 and the manual code transmitter and is normally closed with contact 88 which is connected to the other side of the transmission circuit 12 by the conductor 90. Contact 84 is connected to conductor 86 and is normally open with respect to the ground contact 92. Contact 92 is connected with the ground 15 by conductors 94 and 96.

The break wheel is adapted to be actuated by a low amperage motor 98 which is connected to the battery on one side by conductor 100 and to a spring contact 102 on the other side by a conductor 104. On the same shaft on which the break wheel 72 is mounted there is also mounted

a supervisory wheel 106. Both wheels are driven at the same speed by a motor 98 through a gear arrangement 108. The supervisory wheel 106 has cam portions arranged at three different levels to control the movement of movable contactor 102 with respect to spring contacts 110, 112, 114 and 116. Contact 102 is normally closed with contactor 112 which is connected through switch 56 with relay conductor 70 by a conductor 118. Contact 114 is a holding contact for relay 26 and connects with the alarm circuit by a conductor 120 while contact 116 connects with conductor 66 by a conductor 122 and contact 110 connects with conductor 68 by means of conductor 124. The cam portions of supervisory wheel 106 are arranged so that in the normal starting position contact 102 is closed with contact 112 along the surface FA which is equivalent to 1/5 of the circumference of the wheel. Along the surface B contact 102 breaks with contact 112, closes with contact 110 and then drops down to the surface CD where it closes contact with 112, 114 and 116 which is the second 1/5 of the circumference of the wheel. Along the final 3/5 of the circumference, that is, along surface EF, contactor 102 is raised and closes with contact 110.

Referring now to the manual code transmitter, the latter comprises a normally closed contactor 126 in series with the transmission circuit 12 and a normally open contactor 128 connecting on one side to the ground conductor 96 by conductor 132. An operating cam 134 has a normal position of rest midway between the two contactors and is arranged to actuate each one twice during each complete revolution thereof. I have found that cam 134 may be very conveniently operated by the conventional telephone dial mechanism generally indicated at 136.

In operation, assuming that the authorized personnel are about to leave the protected premises, the control cabinet door is opened which opens the switch 56. After switch 58 is pulled from the open position shown to close, the manual setting switch 42 is slowly moved across the contacts 50, 46 and 38 by manual actuation. For this purpose the switch 42 may be operated by the key of a cylinder lock mechanism. The momentary contact with contact 50 closes the circuit for the alarm 10 through conductors 44, 42, 50, 38, 36, 34, 28, 30, 32 and 20, thus testing the alarm bell. As the switch 42 momentarily closes contact 46, a circuit is established through conductors 44, 42, 46, 48, 14*a*, 52, 26, 54, 58 (which has been manually pulled out to close), 14, 15, 17, 18 and 20 energizing the relay 26. Switch 58 enables setting of relay 26 with the control cabinet door open. When the relay closes, its holding contact 24 closes the holding circuit 36 which is completed when switch 42 is moved to the contact 38. The wiper contact of switch 42 is arranged to bridge both contacts 46 and 38 momentarily and the relay 26 is thus held closed through its holding contact 24 and through the protective wiring 14. At the same time the circuit for alarm 10 is established at switch 42 in readiness for operation whenever relay 26 releases to close contact 28. The alarm system is now set and the control cabinet door may be closed which closes switch 56 and opens the switch 58. Switches 56 and 58 are arranged such that the control cabinet door 57 closes switch 56 before opening switch 58.

The closing of switch 56 completes the circuit through the motor 98 through conductors 44, 66, 60, 64, 70, 118, 112, 102, 104, 100 and 20. This in turn produces rotation of the supervisory wheel

106 and the break wheel 72. The supervisory wheel continues to rotate until contact between spring 102 and 112 is broken at point A. The momentum of the motor carries it so that spring 102 is elevated to surface B and makes contact with contact 110. At this time the first code signal has been transmitted to the central station indicating that the alarm has been set. It will be observed that switch 56 has a dual function. It serves as a tamper switch in connection with switch 56 and also acts to complete the circuit through the transmitter motor to send in the first round of signals after the alarm has been set and the control cabinet door closed. When the authorized personnel leave the premises, opening of the door will open the detection circuit at 14 or 14*a* and trip the relay 26 completing a circuit to the bell 10 and also a circuit through the motor since contacts 102 and 110 are closed. The break and supervisory wheels will thus rotate and spring 102 will drop to position C at which time contact 102 breaks with 110 and closes with 112, 114 and 116. In so doing a circuit through the motor and battery is closed by contacts 102 and 116. If the door to the premises is closed before point D on supervisory wheel 106 reaches spring contact 102, relay 26 will set automatically since contacts 114 and 116 complete a circuit through the coil of the relay. In the arrangement shown rotation of the supervisory wheel through this arc consumes about 8 seconds. At point D contact between 102, 114, 112, and 116 is broken thereby opening the circuit through the motor but its momentum permits contact 102 to ride up to point E and thereby make contact with contact 110. The relay, however, stays set since the holding circuit through its energizig coil, that is, through conductors 44, 42, 38, 36, 34, 24, 22, 14*a*, 52, 54, 56, 14, 17, 18 and 20 is complete. This movement of the break wheel thereby transmits the second code to the central station, the prefix of which indicates that the premises have been alerted for further interference with the alarm system. Any subsequent unauthorized entrance will break the circuit through protective wiring 14 or 14*a* releasing relay 26 to establish the local alarm circuit through contact 28 and to start the transmitter motor in operation through contacts 60 and 62 on the relay and contacts 102 and 110 at the supervisory wheel.

The break wheel thus begins to transmit three consecutive alarm signals and will continue to operate until contact 102 drops down to point F. It will be observed that closing the alarm circuit through the protective wiring 14 will not reset the relay 26 during this interval and therefore transmission of the alarm signal is not interrupted by any subsequent restoration of the circuit through the protective wiring. It will also be observed that by employing a low amperage motor which is driven by the battery of the system, that when the battery begins to run down, the motor will rotate slower and this battery condition will be automatically indicated to the central station operator by the greater spacing of the code signals and therefore continual checking of the batteries is eliminated and the timely notice affords ample time for replacing them before they completely run down.

If the entry has been made by an authorized person, he may indicate to the central station operator such fact by operation of the manual code transmitter. The dial may be operated to actuate contactors 128 and 126 through any predetermined sequence of contacts agreed upon in

advance, that is, the particular code signal for the local station. In so doing the transmission circuit is alternately interrupted and grounded thus producing an effective signal even though the transmission circuit has been interfered with by accidental or deliberate opening or grounding. I have found that the use of a telephone dial in this manner is ideal since the dial will give uniform impulses and spacing between them which eliminates confusion and guess work on the part of the central station operator without requiring any particular skill on the part of the authorized person entering the premises and that operation of cam 134 by a telephone dial mechanism as described provides convenient means for performing the sequence of opening the transmission circuit, closing the circuit, grounding the circuit, and thereafter removing the ground.

In Figure 2 I have shown a somewhat modified arrangement of the system shown in Figure 1. In place of an ordinary electric motor, a rotary switch may be used to actuate the break wheel. In the arrangement shown the break wheel 200 is provided with a set of interruptor teeth 202 on its periphery which actuate a movable contact 204 connected to one of the transmission circuit conductors 12. The normally closed contact 206 is connected by a conductor 208 to the other transmission conductor through the manual transmitter and is normally opened in relation to the ground contact 210. It will be seen that by this arrangement contact 204 in traveling over the interruptor teeth 202 will open the transmission circuit, close it, ground it and then remove the ground. The break wheel 200 is arranged to be actuated by an electro-magnetic motor 212, the armature of which operates a pawl 214 which drives wheel 200 through a ratchet wheel 216. On the same shaft as wheel 200 is a second cam wheel 218 having a notch 220 on its periphery which controls a normally open contactor 222 which is in series with a conductor 224 which is connected to the battery conductor 44. The magnetic motor 212 is controlled by a magnetic relay 225, one side of which is connected to conductor 224. Relay 225 is of the slow operating intermittent type and when energized will alternately open and close the circuit between its movable contactor 226 and its front and back contacts 228 and 230. The back contact 230 controls the intermittent action of the relay through conductor 232 and conductor 240 leading to the battery conductor 20 while the front contact 228 controls the actuation of magnetic motor 212 through a conductor 242, the other side of the motor being connected to conductor 224 by conductor 244.

The supervisory wheel 246 in the modified arrangement is mounted on an independent shaft and is geared to the break wheel 200 by a five to one reduction gearing 248. The supervisory wheel 246 has four different cam levels around its periphery to control a movable contactor 250 with respect to spring contacts 252, 254, 256 and 258. Contact 250 is connected to conductor 224 by means of conductor 260 and in the normal position, that is, at A, contacts 254 which is connected to conductor 70, by conductor 262. A switch 264 is interposed between conductors 70 and 262 and is adapted to be automatically closed simultaneously with tamper switch 55 when the control cabinet door is closed. Switches 55 and 264 are illustrated as independent switches each actuated to close upon closing of the cabinet door. If desired these switches can be mechanically coupled in which case they will operate as a single

switch such as is illustrated at 56 in Fig. 1. Contact 252 connects with conductor 22 by means of conductor 266 and contact 256 is connected to conductor 68 by means of conductor 268 while contact 258 is connected to conductor 66 through conductor 270.

The operation of this modified arrangement is somewhat similar to the arrangement previously described. When switch 42 is set so as to close successively with contacts 50, 46, and 38 relay 26 is set and stepping relay 225 is energized through a circuit completed by contacts 250 and 254. Relay 225 produces intermittent actuation of magnetic motor 212 which thus causes pawl 214 to rotate cam wheel 218 and break wheel 200. Movement of cam wheel 218 closes contact at 222 and shunts contacts 250 and 254. In the meantime, contact 250 rides up to position B closing with contact 256 and when cam wheel 218 has made one complete revolution contact is broken at 222 which opens the circuit through stepping relay 225 and stops rotation of the break wheel 200. Then when the authorized personnel leave the premises by opening the door the detecting circuit opens and trips relay 26. This closes the bell circuit through the relay contacts 34 and 28 and the local alarm will sound. At the same time, a circuit is closed through the tripping relay 225 between contacts 60 and 62 and at the supervisory wheel 246 between contacts 250 and 256 which actuates the break wheel and transmits the second code signal. Contact 250 drops to the low cam surface between positions B and C closing with contacts 254 and 252. If the door to the premises is closed before contact 250 rides up to the position C relay 26 will automatically reset and alert the premises for further interference with the alarm circuit. When the cam wheel 218 has completed the second revolution the stepping relay circuit is open at contact 222 and the break wheel ceases to rotate. At this point contact 250 is at position C and any further interference with the alarm circuit trips relay 26 and closes the circuit through stepping relay 225 which actuates the transmitter. Between positions C and D contact 250 raises and closes with contact 258 thereby shunting contact 222 and three successive code signals are transmitted to the central station.

It will thus be seen that the code transmitting system which I have provided is fool-proof in its operation and renders it impossible to unconsciously leave the premises in an unguarded condition by improperly setting the alarm. If the switch lock 40 is inadvertently turned on without closing switch 58 on completing alarm circuits 14 and 14*a*, the local alarm will be sounded. No signals will be transmitted to the central office but the personnel leaving the premises will be informed of the improper setting by the continual ringing of the local alarm. If switch 58 and switch lock 40 are properly actuated but the person setting the alarm forgets to close the control box door no code signals will be transmitted upon leaving the premises but the local alarm bell will sound upon the opening of the premises' door and will continue to ring after the door is closed. This also will indicate to the personnel leaving the premises that the alarm has been improperly set. If the alarm is properly set with respect to the switches 40 and 58 and the control box is closed and locked properly and the person opens the premises' door and closes it without leaving the premises the first two code signals are transmitted and the premises are in an alerted condition. Then if the person remaining on the premises attempts to surreptitiously open the cabinet door in order to turn off the system at switch 40 tamper switch 56 causes the alarm code signal to be transmitted to the central station as soon as the control cabinet door is opened, since switch 58 was pushed to open when the cabinet door was first closed, and the transmission of this code signal will not be interrupted by turning switch contact 42 to the off position since the circuit through the battery and the motor is closed independently of switch lock 40 through relay contacts 60 and 62. And likewise if the persons leaving the premises fail to close the premises' door within the allotted time, the transmitter will send in a round of four signals instead of one, indicating an improper setting of the alarm.

I claim:

1. In an alarm system having a detection circuit in a protected structure, and a central station connected with the protected structure by a transmission circuit of the McCollough type, the combination of an automatic code signal transmitter responsive to interference with the detection circuit and a manually operated code signal transmitter comprising a rotatable cam, a normally closed circuit breaker operated by the cam and connected in series in the transmission circuit for momentarily opening the transmission circuit, a normally open circuit breaker operated by the cam and connected between the transmission circuit and ground for momentarily grounding the transmission circuit, and dial means for manually rotating said cam to produce a predetermined sequence of signals.

2. In an alarm system having a detection circuit in a protected structure, and a central station connected with the protected structure by a transmission circuit, the combination of an automatic code signal transmitter responsive to interference with the detection circuit and a manually operated code signal transmitter comprising a pair of circuit controllers, one normally closed for momentarily opening the transmission circuit and the other normally open for momentarily grounding the transmission circuit, and dial means for operating said circuit controllers to produce different predetermined sequences of signal impulses in response to different manual operations of said means.

3. In an alarm system having a detection circuit in a protected structure, and a central station connected with the protected structure by a transmission circuit, the combination of an automatic code signal transmitter responsive to interference with the detection circuit and a manually operated code signal transmitter comprising a pair of circuit controllers, one normally closed for momentarily opening the transmission circuit and the other normally open for momentarily grounding the transmission circuit, and means including a single finger operated ratchet dial for operating said circuit controllers to produce different predetermined sequences of signal impulses in response to different manual operations of said means.

4. In a system for transmitting code signals having a local detection circuit in a protected structure and a central station connected with the protected structure by a transmission circuit comprising a wire circuit and at least one grounded circuit, the combination of a local control box, a code signal transmitter in the control box connected with the transmission circuit and arranged to send into said central sta-

tion a plurality of different sequences of signals, a motor for operating said transmitter, a relay responsive to interference in the detection circuit for actuating said motor and sending in a sequence of signals comprising an alarm signal, means for setting said relay and energizing said detection circuit, and a circuit controller driven by said transmitter and arranged to render the transmitter effective to deliver a different sequence of signals comprising a preliminary conditioning signal only when said setting means are actuated with the detection circuit in the closed condition.

5. In a system for transmitting code signals having a local detection circuit in a protected structure and a central station connected with the protected structure by a transmission circuit, the combination of a local control box within the protected structure, a code signal transmitter within the control box connected with the transmission circuit and arranged to send into said central station a plurality of different sequences of code signals, a motor for operating said transmitter, a relay in the local detection circuit, said relay when set being responsive to interferences in the detection circuit for actuating said motor and sending in a sequence of signals comprising an alarm signal, means for setting said relay and energizing said detection circuit when in the closed condition, and a circuit controller driven by said transmitter and effective to energize said motor when said setting means are actuated with the detection circuit in the closed condition to send in a different sequence of signals and effective to prevent energizing of said motor when the setting means are actuated while an interference exists in the detection circuit whereby no signals are transmitted to said central station if setting of said relay is attempted while an interference exists in said detection circuit.

FRANK W. HOUGHTON.

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