

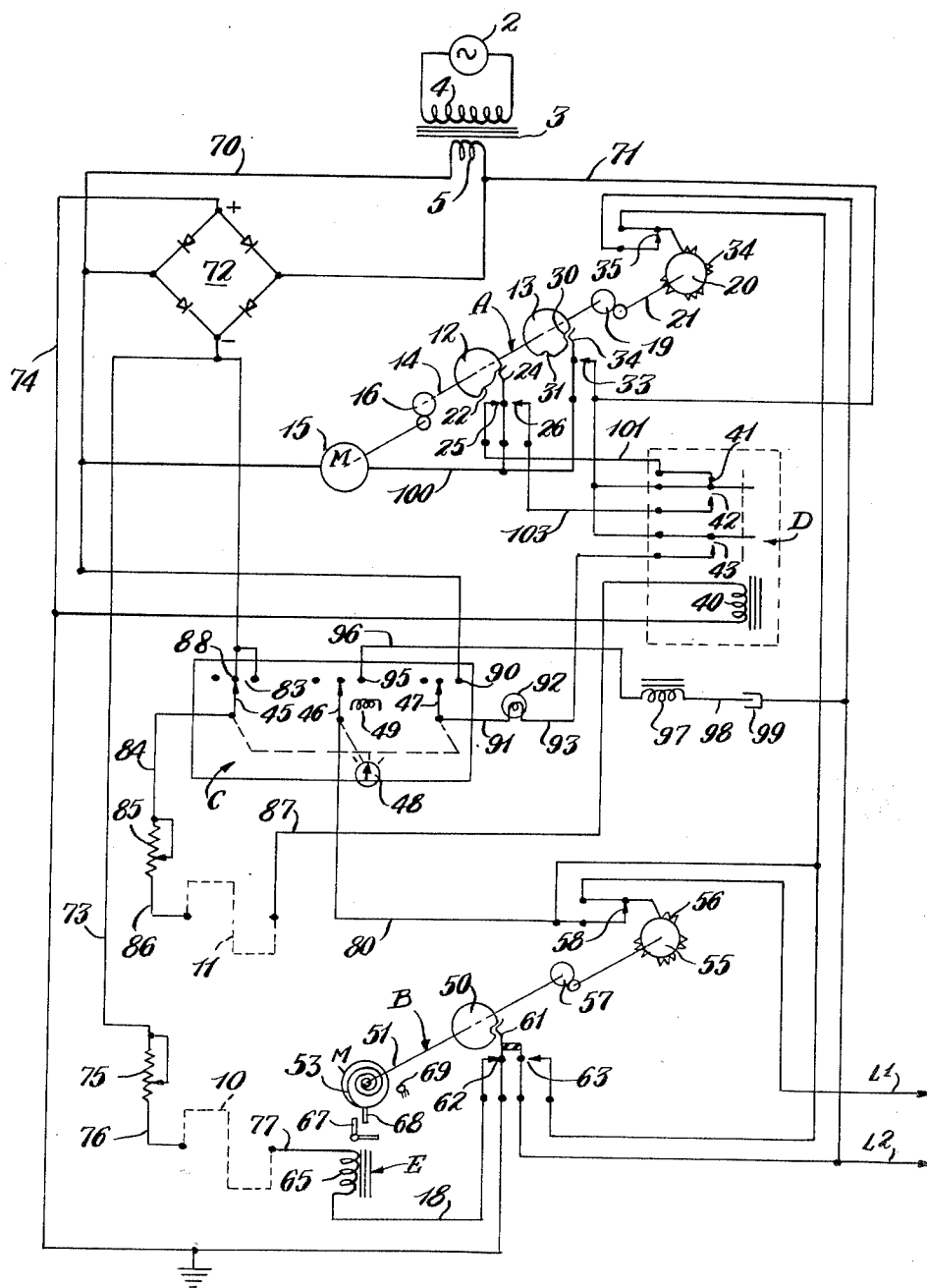
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BURGLAR AND FIRE ALARM

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BURGLAR AND FIRE ALARM

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This invention relates to the art of burglar and fire alarms of the remotely supervised type and more particularly to apparatus for supervising burglar and fire detecting circuits and generating and transmitting coded signals to a remote supervisory central station in the event of an alarm.

Systems of the type to which this invention apply normally consist of a night protective alarm circuit and a day protective alarm circuit, both positioned on the premises to be protected. These circuits are supervised by apparatus situated on the premises. In the event of any breakage or alteration in the circuits, this apparatus generates and sends a coded signal over land telephone wires to a central supervisory station.

The apparatus normally includes means for shifting from the night to the day protective circuit and vice versa, which shift must also send a signal indicating that the shift has been made and that the circuit is then in normal operating condition. Further, the apparatus includes a code transmitter which is set into operation by any break in the night or day protective circuit.

It is normally conventional for the transmitter at each premise under protection to generate a distinctive identifying code signal. The supervisory station then analyzes the signal to determine the location of the transmitter and the type of signal—that is, whether it is an alarm signal or an opening or closing signal, and this is usually done by noting the number of times that an individual coded signal is repeated. Thus, in the event of a breakdown in a supervised protective circuit, the signal is repeated three times. If the circuit is then restored to its normal condition, a fourth signal is transmitted, indicating that the system is back in normal operation. If any signal is received at an odd hour, it is considered an alarm signal and one to be investigated. If the fourth signal is not repeated at the opening or closing hour, the system is not in proper working order and should be investigated.

Normally, the code transmitter includes a motor mechanism which drives a coding disk upon the happening of the above events to transmit the required signal.

Heretofore such motors have normally been of the spring driven type which must be wound at spaced intervals or, in many cases, each evening as the premises are vacated and placed under the supervisory control of the central office. Winding the motor is an inconvenience to the proprietor as he leaves and enters the premises and may often not be done properly, resulting in an improper closing signal and requiring investigation. Spring motors are dependable if properly wound. In the event the spring is not properly wound, as may often be the case, the transmitter cannot perform its prime function, that of sending an alarm signal.

To avoid the difficulties of a spring motor, it has been proposed to employ an electric motor for driving the coding disks. These electric motors may either be energized from the standard commercial power lines or from self-contained batteries. In the event of using the commercial lines and the power fails, no signal can be transmitted. The premises are then unprotected. Actually the protection in such a case is not sufficient for the average commercial location. In the event batteries are employed, these will become exhausted after a time even though there is no drain on them so that the proper signal might not be given when an alarm occurs. Renewing the batteries is an expensive procedure. Storage batteries have a habit of shorting out internally without warning and they require maintenance.

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The present invention contemplates burglar and fire alarm apparatus of the type referred to for transmitting coded signals to a central control station which overcomes all of the above difficulties and combines the convenience of an electric motor powered from commercial power lines for driving the coding disk with the overall dependability of operation of a spring wound motor and yet does not require the periodical rewinding of the spring motor.

In accordance with the invention, the apparatus includes in combination an electric motor and a spring wound motor for actuating the coding disks, the electric motor functioning for all normal uses and the spring motor functioning in the event that the commercial electric power should in any way fail, such as being cut by intruders, so that the electric motor could not be actuated to send an alarm.

The invention has for its principal object a new and improved apparatus for use in supervised fire and burglar alarm systems which is, primarily, dependable and fool proof in operation but is simple and convenient to operate and requires a minimum of supervisory maintenance.

Another object of the invention is the provision of a new and improved transmitter of the type referred to which includes in combination an electrically driven coding means for generating all usual day-to-day signals and a spring driven coding means for generating warning signals in the event the power for the electrically driven disc should fail.

The invention may be comprised of certain parts and arrangements of parts in combination, a preferred embodiment of which will be described in this specification and illustrated in the attached drawing which is a part hereof and wherein the single figure shows a schematic wiring diagram of a burglar and fire alarm apparatus embodying the present invention.

Referring now to the drawing, wherein the showing is for the purposes of illustration only and not for the purposes of limitation, the burglar alarm circuit shown comprises day protective wiring 10 and night protective wiring 11, both adapted to be located about the premises to be guarded for the purposes of detecting a burglary or fire. Trunk lines L1, L2 connect to a central office (not shown). An electric-motor driven code transmitter A, and a spring-motor driven code transmitter B, operate to generate a coded signal for transmission over the trunk lines. An alarm relay D associated with the night protective wiring 11 controls the operation of the transmitter A, while an alarm relay E associated with the day protective wiring, controls the operation of the transmitter B.

The trunk lines L1, L2 are electrically energized at the central control office through suitable indicating equipment and the circuit between the trunk lines L1, L2 is completed within the apparatus by a pair of electric contacts 35, 58, associated respectively with the transmitters A and B. These contacts 35, 58 are normally closed. When either the transmitter A or B operates, however, the respective contact is opened to break the continuity through the trunk lines L1, L2, thus causing an indication on the equipment at the supervisory office. Thus, to send a signal either contact may be opened and a code signal may be sent by opening either contact a predetermined number of times or in a predetermined manner.

The remainder of the apparatus is energized from any power source 2 such as the local 110 volt alternating current power lines through a transformer 3 having a primary 4 connected to the source 2 and a low voltage secondary 5. A bridge rectifier 72 connects to the terminals of the secondary and provides D. C. for the protective circuits.

The day protective circuit 10 is intended to give protection during the day or at other times when the premises under protection are occupied by the owner or its employees and normally includes electric wiring in series on doors, windows and areaways not normally used in the course of a normal business day or in areas where the proprietor does not desire to have unauthorized entry.

The day protective circuit 10 is in electrical series relationship with the energizing coil 65 of the relay E and is normally continuously energized from the output termi-

nals of the rectifier 72. The current flowing in this circuit is controlled by a series adjustable resistor 75.

The night protective circuit is in addition to the day protective circuit and is intended to give maximum full protection when the premises are normally unoccupied and to this extent includes wiring on all doors, windows and areaways not otherwise protected by the day protective wiring 10. This night protective circuit includes an electrical series relationship the energizing coil 40 of relay D and the circuit is normally continuously energized from the output terminals of the rectifier 72. A variable resistor 85 controls the current flowing in this circuit to near the threshold operating value for the relay. Thus a break in either protective circuit immediately deenergizes the respective relay.

The transmitter A is so constructed and arranged with the relay D as to transmit three complete coded signals in the event of any break in the night protective wiring or in a shift from part to full protection or vice versa and one complete coded signal to signify that the system has been restored to normal operating condition.

The transmitter A provides for positive transmission of all opening and closing signals and also alarm signals without the necessity of any involved procedure by the occupant of the premises to be guarded.

The electric motor transmitter A comprises a pair of cam disks 12, 13, mounted for rotation upon a common shaft 14. The shaft 14 is rotated in a clockwise direction by a synchronous A. C. motor 15, when energized from the secondary 5 of the transformer 3. Preferably the motor 15 drives the shaft 14 through suitable speed reducing spur gears 16.

The transmitter A also includes a code disk 20 mounted on a rotatable shaft 21 which is geared to the shaft 14 through a set of spur gears 19 having a gear ratio of 1 to 4, the shaft 21 rotating four times for every full rotation of the shaft 14.

The cam disk 20 is for the purpose of opening and closing contacts 35 and sending a coded signal to the central control office over the lines L1, L2 and for this purpose has a plurality of lobes 34 provided on its outer edge which when the code disk is rotated by the motor 15 engage the follower arm of the normally closed switch 35 to open its contacts. Depending upon the number and positioning of the lobes 34, any given code signal may be sent. Normally a complete code signal is made up by a complete revolution of the disk 20.

The cam disk 12 has approximately 90° of its periphery cut away, as at 22 and a single pole double throw switch is provided having a cam-follower actuating arm 24, spring biased to ride on the edge of the cam disk 12. This switch includes a normally closed contact 25 and a normally open contact 26.

The cam disk 13 has a pair of recesses 30, 31 in its periphery spaced approximately 90° apart, which actuate a single pole, single throw normally open switch 33 through a follower arm 34 which bears against the edge of the disk 13 holding the switch 33 closed and opening it when opposite either recess 30 or recess 31. The recess 30 is positioned on the disk 13 so as to open contact 33 just prior to the time the disk 12 will open contact 26. The recess 31 is positioned on the disk 13 so as to open contact 33 just prior to the time disk 12 will close contact 26.

For a three-quarter turn of the cam disks 12, 13, the cam disk 20 makes three complete turns and three sets, that is an odd number of code signals, are transmitted by the disk 20. For a one-quarter turn of the disks 12, 13 one set of code signals are sent which, added to the odd number, makes a total of four or an even number.

The alarm relay "D" comprises an energizing coil 40 which actuates a double throw, single pole switch having a normally closed contact 41 and a normally open contact 42. The relay also includes a normally open contact 43. The energizing coil 40 is connected in series with the night protective wiring 11, and a current adjusting resistor 85 to the output terminals of the bridge rectifier 72. Thus when the protective wiring is in its normal uninterrupted state, the coil 40 is energized and holding contact 41 open and contacts 42 and 43 closed.

The spring wound transmitter B includes the contacts 58 and when actuated transmits its own distinctive coded signal to the central office. This transmitter serves two important purposes. The first is to supervise the A. C. current supply and all circuit wiring from the power

source to and including all of the protective wiring. The second purpose is to provide a separate day protection circuit to which may be connected all of the permanent protection devices and attachments within the premises so that a coded alarm signal is transmitted at any time of the day or night if the day protective circuit is opened or grounded. The transmitter B must be rewound after each such alarm and after the cause for alarm has been determined and corrected.

The term "permanent protection" is used to designate all protection provided for immovable openings, wall and ceiling surfaces, such as foil protection on show windows, lacing and screen protection over sky lights, panels on walls etc. Any alarms transmitted during the day or open period are to be investigated and repairs made where necessary, or power service restored before the customer's regular closing time. Any alarms received during the night or closed period are to be handled as attack alarms and investigated immediately.

The spring wound transmitter B shown comprises a cam disk 50 mounted for rotation on a shaft 51 and driven by a suitable spring wound motor 53. In a like manner to the electric driven transmitter A, a code disk 55 is provided, mounted for rotation on a shaft 56 and driven from the shaft 51 through a one to four gear ratio set of gears 57. The code disk 55 is similar to the code disk 20 and may have identically arranged lobes 56 positioned on the edge thereof. These lobes actuate a normally closed switch 58.

The cam disk 50 is provided with a single recess 60 on its periphery and actuates, through a follower arm 61, normally closed switch 62 and a normally open switch 63.

The spring wound motor is limited to one full revolution by a stop 69 which engages a dog 68 on the motor when the motor is manually wound by turning the shaft 51 counterclockwise and which again engages the dog 68 when the motor has completed one full revolution. The location of the recess 60 is such that when the motor is wound and the dog 68 engages the stop 69, the follower arm 61 is riding on the cam edge and the switches 62, 63 are not actuated until the motor has moved approximately one quarter of a revolution at which point an armature 67 on the relay E may engage the dog 68, if the relay is energized, and stop the motor 53. Reenergization of the relay allows the motor 53 to operate for three quarters of a revolution.

The relay E includes an energizing coil 65 in series with the day protective wiring 10 and the switch 62 and this circuit is energized from the rectifier 72 when the switch 62 is closed so that the normal rest position for the motor 53 is as shown in the figures.

The arrangement is such that when the motor 53 is wound, a single code signal will be sent. When an alarm occurs, three code signals will be sent before the dog 68 engages the stop.

The control panel C includes three rotary selector switches 45, 46, 47, actuated by a single control knob 48. These switches are three position switches. The left hand position switch of each switch sets the apparatus in condition for detecting alarms during the day, the central position being for the purpose of detecting alarms at night, and the right hand position being for test purposes so that the owner of the premises may determine that the apparatus is energized and connected with the central control office. A spring 49 biases the switch away from the right hand position.

In the embodiment shown the apparatus is set up to supervise two separate alarm circuits, a day protection alarm circuit 10 and a night protection alarm circuit 11. Such circuits are conventional and will not be described here further except to say that they generally comprise a long series electrical connection which if broken at any place or grounded, breaks the entire alarm circuit. The variable resistors 75 and 85 in series with the circuits are for the purpose of adjusting the current in each circuit to a predetermined value generally just sufficient to maintain the relays D and E energized.

For the purpose of describing the operation of the equipment, it will be assumed that the owners of the premises are present such as might occur during the course of any business day—in this event, the control knob 48 would be in the day position—that is, pointed to the left. In this event, the switches 45, 46 and 47 are all in the open circuit position, and the relay coil is deenergized.

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The alarm circuit with the central control office includes the line L1, the normally closed switch 58 on the spring transmitter B, the wire 80, the normally closed switch 35 and the wire L2. It may be noted here that the switches 35 and 38 are in series electrical relationship so that the opening and closing of either may transmit a signal to the central office. Switch 63 is in shunt with the switch 35.

The transformer 3 is energized from the source 2, which in turn energizes wires 70, 71 at a voltage difference of approximately 24 volts. This voltage is rectified by the bridge rectifier 72 shown in the lower left hand corner of the drawing. The rectifier 72 provides approximately 18 volts D. C. output. This voltage appears across the wires 73, 74 which in turn establishes a current flow through resistor 75, the day protection circuit 10, wire 77, the energization coil 65 of the trip relay E, wire 78, the normally closed switch 62 to the wire 74. It is to be noted that the wire 74 is grounded. The resistor 75 is preferably an adjustable resistor and the current flowing in the circuit just described is preferably set to be approximately 30 milliamperes. With such a current the trip relay E is actuated and the motor 53 may be wound.

The relay E is conventional in construction and preferably of the type that if the current is interrupted or increases substantially over the above value which might occur if portions of the day protective circuit 67 were shorted out, it will operate to permit the motor 53 to start. It will also be appreciated that as the rectifier 72 is initially energized through transformer 3, any failure of the main power line will also serve to actuate the trip relay E and therefore start the motor 53. If it be assumed that one of the above eventualities has happened and the relay E permits the motor 53 to start, the cam disk 50 commences to rotate in a clockwise direction. This immediately actuates the arm 61, opening switch 62 and closing switch 63. Opening of switch 62 breaks the circuit for the trip relay E so that the motor 53 may continue to run. Closing of the switch 63 bypasses the switch 35 so that if for any reason the motor 15 should start, two sets of signals would not be sent at the same time.

As the cam disk 50 is rotated, the code disk 55 is also rotated and the lobes 56 open and close the switch 58 in accordance with the positioning of the lobes. Each time the switch 56 is opened, a signal appears at the central control office. The operator on duty at the central office can then immediately dispatch people to the protected premises to determine the difficulty. The signal is repeated three times, a warning signal.

Once the motor 53 starts, normally closed contacts 62 in series with the day circuit 10 open, so that the relay will not be reenergized to interrupt the sending of the signal.

Such a signal must be investigated. After the cause for the alarm is cleared, the motor 53 is wound by rotating it counterclockwise, one full turn. At this point the switch 62 is open and the relay E deenergized. The motor 53 operates to send a single signal at which time the switch 62 closes reenergizing the relay E, assuming everything else is in order.

At the time the owner of the premises desires to close up in the evening, he turns the control knob 48 all the way to the right or the test position. This closes contact 83 on the switch 45 and completes a circuit from the wire 73 through the now closed switch 83, wire 84, resistor 85, wire 86, the night protection circuit 11, which is normally a closed circuit, wire 87, the energization coil 40 of the alarm relay D, to the wire 74, which energizes the alarm relay D, closing its normally open contacts 42 and 43 and opening its normally open contact 41. This is the normal situation when the owner has left the premises, and when the knob 48 is released contact 88 of switch 45 will then be closed and the contacts 83 and 87 are connected by a jumper wire. With the knob 48 in the test or right hand position, contact 90 of the switch 47 is closed, completing a circuit from the wire 70 through the now closed contact 90, the wire 91, a test indicating lamp 92, the wire 93, the now closed normally open switch 43, to the wire 71, thus energizing the lamp 92 and indicating to the occupant of the premises that the power is on and that the night protection circuit is satisfactory and that the alarm relay D is energized. In

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addition, actuation of the switch 46 to the right closes contact 95, completing a circuit from the wire L1, the closed contact 58, the wire 80 through the now closed contact 95, the wire 96, a 20 cycle buzzer 97, the wire 98, and a high capacity condenser 99, to the wire L2. With the knob 48 in such position, a 20 cycle A. C. signal sent over the control wires L1, L2 will actuate the buzzer 97 indicating to the operator that the lines to the central control office are in working order.

Upon release of the knob 48, the switches 45, 46, 47 return to their initial position. At this time the occupant of the premises must leave the premises through a guarded doorway or the like. As he does so the night protection circuit is broken, thus deenergizing momentarily the alarm coil D which opens its contacts 42, 43 and closes contact 41. Closing of the contact 41 completes a circuit from the wire 70, through the energizing coil of the motor 15, wire 100, closed contact 25, wire 101, the now closed contact 41, to the wire 71, thus energizing the motor 15. The motor 15 immediately commences to turn, rotating the cam disks 12 and 13 in a clockwise direction and the cam 20 in a counterclockwise direction, the cam 20 rotating at approximately four times the speed of the cam disks 12 and 13. As the cam disk 13 commences to rotate it closes contact 33, completing a circuit from the wire 71 to the wire 100, thus bypassing the switches 41 and 25 and maintaining the motor 15 energized even though the switch 41 should be reopened due to reenergization of the alarm relay D. When the cam disk 12 commences to rotate, it opens switch 25 but not before switch 33 has first closed, and closes switch 26 which completes the circuit from the wire 103 to the wire 100. Closure of the contact 26 has no effect at this moment as the contact 42 is open because the alarm relay D is not energized.

The motor 15 will continue to operate until the cam disk 13 has advanced three-quarters of a revolution, at which time the switch 33 opens, thus deenergizing the wire 100 and the motor 15 stops. During the time that the cam disk 13 has been advancing its three-quarters of a revolution, the code disk 20 has made three complete revolutions, sending out three complete sets of code signals. This indicates to the operator in the central office that something is wrong, and that the operator has failed to close the door. It is to be noted at this point that the recess 22 on the disk 12 is so disposed that its normally closed contact 25 will be open and its normally open contact 26 will be closed.

When the owner or occupant of the premises closes the door as he leaves, the relay D becomes reenergized, thus opening contact 41 and closing contact 42, the wire 103, the now closed contact 26 to the wire 100, reenergizing the motor 15. Reenergization of the motor starts the cam disks 12 and 13 rotating clockwise again, closing the contact 33 and immediately thereafter opening contact 26 and closing contact 25. Closing the contact 33 maintains the motor 15 energized even though the contact 26 has opened. The motor remains energized until the cam disk 13 has advanced clockwise one-quarter of a revolution when the contact 33 again opens, deenergizing the wire 100 and stopping the motor 15. During this one-quarter revolution the cam disk 20 has advanced one entire revolution, sending out a single code signal and indicating to the operator at the central control office that everything is in satisfactory working order, he having now received a total of four code signals.

The specific apparatus above described is for the purpose of illustrating the invention only. This embodiment is subject to many modifications such as with limitation, the electric motor 15 and spring motor 53 may each drive the same coding disk either through over running clutches or the equivalent. Also other known types of motors may be used for the supervisory transmitter B as full equivalents of that described. The important feature of the motor for the supervisory transmitter B is that it be dependable and operable even though the means for operating the motor 15 of the main transmitter should fail.

The alarm relays may control the operation of their respective motors other than that shown for example, the electric motor 15 may be of the type that can be continuously energized while stalled without damage and the relay D when energized may simply act to stall the motor somewhat similar to the operation of the relay 5 on the spring motor 53.

It will thus be seen that an embodiment of the invention has been described which accomplishes the objects of the invention, and which combines the convenience of electric powered code transmitter with the dependability of self energy storing motors arranged in a supervisory setup for the electric motor.

Having thus described my invention, I claim:

1. In a remotely supervised alarm system, a fault detecting and signal generating arrangement comprising in combination, coded-signal-generating equipment and means for actuating same, said means comprising a pair of motors each independently energized, one of said motors being an electric motor and having a power source, a fault detecting circuit, means for connecting said power source to said electric motor upon the occurrence of a fault in said circuit, and means associated with said power source for actuating the other of said motors upon a failure of said power source, said last mentioned means also being associated with means for detecting entry into said premises.

2. In a remotely supervised alarm system, a fault detecting and signal generating arrangement comprising in combination, a pair of independent means for detecting entry into premises to be guarded, each of said means including both a series electric circuit positioned about the premises and an alarm relay normally maintained energized by electric current flowing in the respective circuit about the premises, a power source for energizing both of said means, coded signal generating apparatus including an electric motor and an independently energized motor, common electric circuit means adapted to communicate said apparatus with said central office associated with said apparatus, one relay of one means connecting said electric motor to said source upon failure of relay energization, the relay of the other means actuating the other motor upon failure of relay energization which may be caused by a break in said electric circuit or failure of said power source, in which latter event said electric motor could not operate whereby said other motor then causes a signal to be generated.

3. In a remotely supervised alarm system, the new and improved combination of a day protective circuit and a night protective circuit, a day relay in series electrical relationship with said day circuit, a night relay in series with said night circuit; a power source connected to each of said circuits and maintaining said relays normally energized, code generating apparatus, an electric motor for driving said apparatus, means operatively associating said apparatus with apparatus in a central supervisory office, said night relay including actuating means for said electric motor upon failure of energizing current in said night relay, a second motor independently energized separate from said power source, said day relay including means for actuating said second motor upon deenergization thereof caused by a break in said day circuit or failure of said power source, and means for connecting said code generating apparatus to a central supervisory station.

4. A burglar and/or fire alarm system of the remotely supervised type, including in combination a central supervisory office; fault detecting apparatus on the

premises to be protected; signal generating equipment on the premises to be protected; electric power means on the premises for energizing said apparatus and equipment; a normally closed electrical circuit communicating said office with said equipment and energized at said office; said equipment including a normally closed switch in series relationship with said office-equipment circuits and a driven code wheel for opening and closing said switch; an electric motor energized from said power source for driving said code wheel; means operatively associated with said motor and said apparatus for energizing said motor, manual means for energizing said motor; a second motor energized independently of said power source for driving a code wheel and means for actuating said second motor upon failure of said power source.

5. In a remotely supervised alarm system, a fault detecting and signal generating arrangement comprising in combination, coded-signal-generating equipment and means for actuating same, said means comprising a pair of motors each independently energized, one of said motors being an electric motor and having a power source, a fault detecting circuit, means for connecting said power source to said electric motor upon the occurrence of a fault in said circuit, and means associated with said power source for actuating the other of said motors upon a failure of said power source, said coded-signal-generating equipment being in electrical series relationship with a signal electrical circuit communicating with a central supervisory office, said circuit being energized at said office.

6. A burglar and/or fire alarm equipment adapted to be located on premises to be protected and transmit coded signals to a central supervisory office over a single electrical circuit, said equipment including a rotatable code disk; electrical contacts actuated by said code disk and adapted to be connected in an electrical circuit communicating with a supervisory station; rotatable cam members; switch means actuated by said cam members; an electric motor for rotating both said code disk and said cam members, said cam and disk having a fixed ratio of rotational speed; an alarm relay having a coil adapted to be energized in electrical series with a fault detecting circuit on the premises and including switch means actuated thereby, said switch means being operatively connected to energize and deenergize said motor, said switch means and said cams being electrically connected as to rotate said switch means and said cams, and being so arranged as to rotate said code disks a predetermined number of turns when said alarm relay is deenergized and a predetermined different number of times when said alarm relay is reenergized.

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