

Nov. 13, 1934.

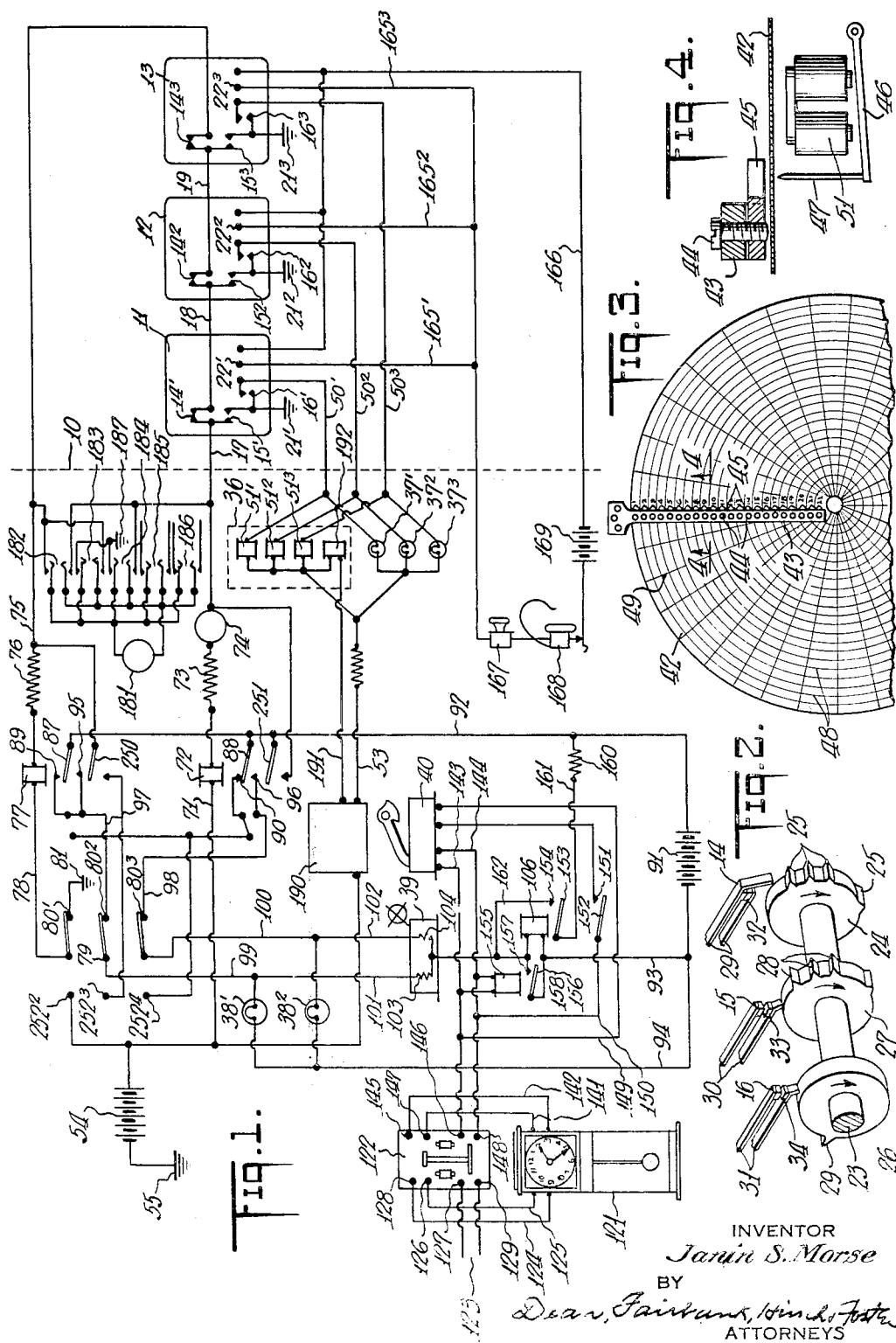
J. S. MORSE

1,980,494

SIGNALING AND RECORDING SYSTEM

Filed Oct. 30, 1931

2 Sheets-Sheet 1



Nov. 13, 1934.

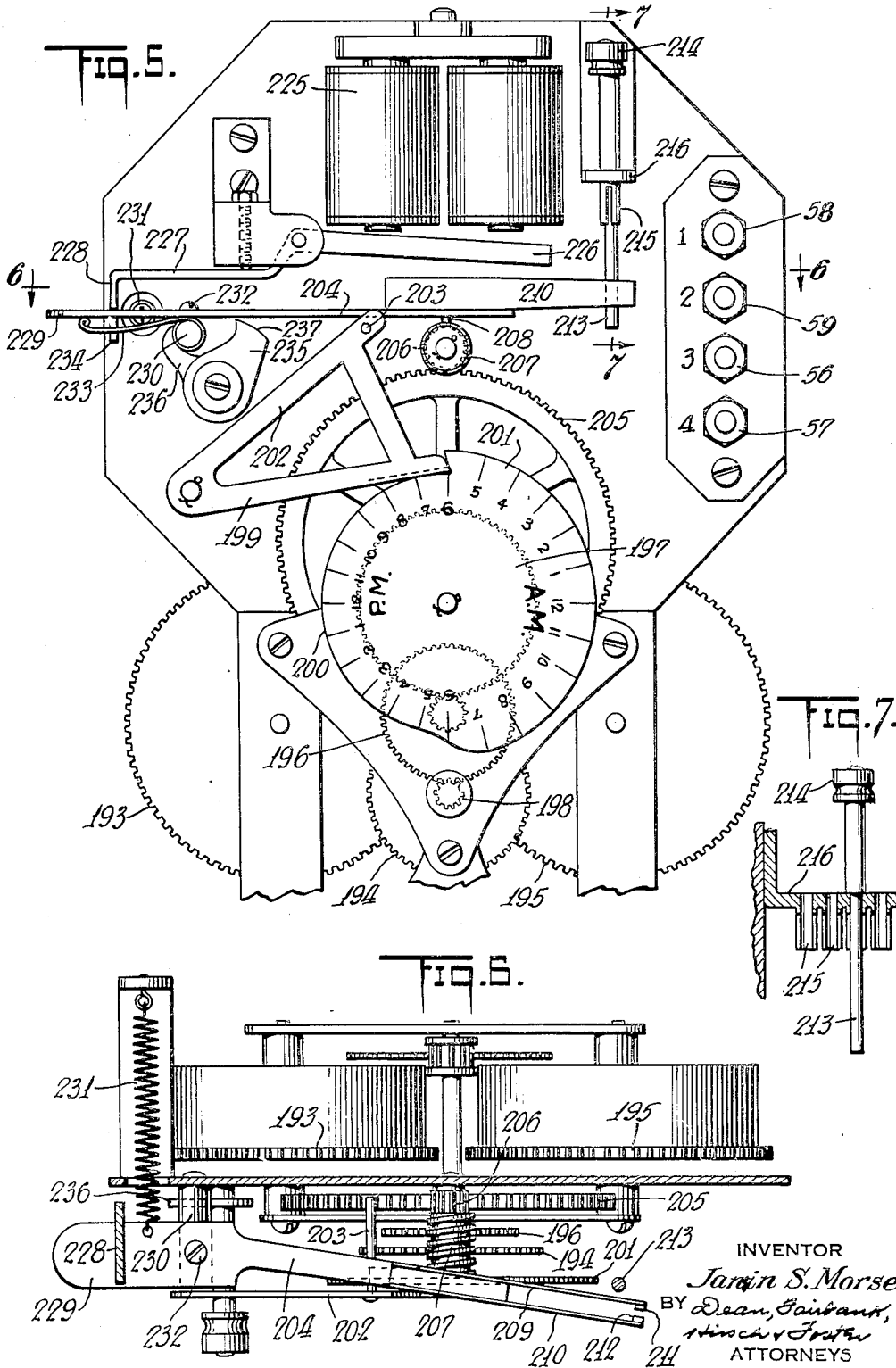
J. S. MORSE

1,980,494

SIGNALING AND RECORDING SYSTEM

Filed Oct. 30, 1931

2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

1,980,494

SIGNALING AND RECORDING SYSTEM

Jamin S. Morse, New York, N. Y.

Application October 30, 1931, Serial No. 572,017

16 Claims. (Cl. 234—37.5)

This invention relates to electrical protective systems and it particularly relates to centrally supervised watchmen's signal and fire alarm systems.

5 It is an object of the present invention to provide a system and arrangement for permanently and automatically recording tours of duty by watchmen, both in respect to time and location, in which the signals transmitted from the various
10 watchmen's boxes, particularly in the case of fire alarm signals, may be grouped separately from each other, so that confused recordings will not result from the simultaneous registering of signals from a plurality of boxes, the record made
15 being in permanent form as required without the need for recopying or transcription.

Another object is to provide a signal system for watchmen which will provide means for sending signals from signal stations to form auto-
20 matically a complete visible record of their movements along their tours of duty and their approximate location at any time, and which will automatically operate to give a warning at the central station, directly to the supervisor in
25 charge without delay, if a watchman is not performing or continuing upon his tour of duty in regular course.

Another object is to provide a central control station for watchmen's signal and fire alarm
30 systems which will automatically record the watchmen's movements, or their lack of movements, both by the flashing of lights and by duplicate permanent records, and will also provide for telephonic communication between the
35 watchman and the central station.

Another object is to provide a system of the character described which although it is provided with an automatic recording arrangement will give immediate indication upon the watch-
40 man's operation of a signal system without the need for waiting for the completion of or until an interval after the recording process.

Other objects are in part obvious and in part pointed out hereinafter.

45 The invention is primarily concerned with a protective signal system of the type in which a plurality of signal boxes or watchmen's stations are connected in an electrical circuit with a central supervisory and recording station, each
50 being provided with suitable circuit making and breaking arrangements to produce the desirable record at the central station.

55 In one form of the present invention the watchman's actuation of the signal arrangements at a signal box or watchman's station will be auto-

matically recorded both upon a tape register or recorder and upon a dial register or recorder. The tape and dial registers are preferably respectively actuated from separate circuits, passing through each of the signal stations or boxes. 60 The dial register is preferably directly actuated by a plurality of open circuits passing in parallel through the signal stations while the tape register is preferably actuated indirectly by a closed circuit through a subsidiary open circuit, said
65 closed circuit passing in series through each of the boxes.

The dial register recording sheet is so laid out with said radial lines indicating the time, and concentric circles indicating the box that a per-
70 forated recording upon it will indicate the box which has been operated and the time of such operation. Where the signal is repeated a number of times, as in the case of a fire alarm, the perforation will be of increased size. 75

The tape register may be associated with a time stamp arrangement which will be actuated to stamp the time on the tape at the next minute following the recording of a signal thereupon. The time stamp is most desirably arranged so that
80 it will not operate unless during the preceding minute a signal has been received and the tape has moved. Both the dial register and the tape register may be associated with lights which will flash upon the reception of signals, the dial reg-
85 ister having an individual light for each box and the tape register having a single arrangement which will be illuminated upon the reception of a signal from any box.

In one embodiment of the invention every box
90 is also provided with a telephone by means of which the central station or supervisor may be immediately reached through a loud speaker, an ear phone, and/or a bell, and a full oral report made as to the tour of duty of the watchman
95 or as to any untoward circumstances occurring during such tour of duty.

The system may also be provided with an automatic delinquency recorder which will indicate failure of a watchman to continue or complete
100 his tour of duty, or to appear at a station within a predetermined period of time. Such failure will be visibly recorded so that the supervisor will be advised and may take appropriate action. The delinquency recorder is so arranged that normal
105 operation of the signal system will prevent any record of delinquencies.

The tape register and lights associated therewith also serve to indicate any breaks and/or
110 grounds in the system requiring attention and

the system is further provided with suitable switching arrangements by means of which it may be operated in spite of such breaks and/or grounds. These same devices will also indicate when the breaks or grounds have been repaired and will enable the supervisor to restore the circuits to normal condition without delay.

In the accompanying drawings in which there are shown one or more of the various possible embodiments of the features of this invention:—

Fig. 1 shows a schematic wiring diagram of one form of the electrical protective system of the present invention,

Fig. 2 is a diagrammatic prospective view of the contact arrangements of the watchman's signal box or station,

Figs. 3 and 4 are detail views of the dial register, Fig. 3 being a diagrammatic fragmentary front view and Fig. 4 being a diagrammatic side sectional view upon an enlarged scale along the line 4—4 of Fig. 3; and

Figs. 5, 6 and 7 show the details of the delinquency register, Fig. 5 being a fragmentary front view of the delinquency register, and Figs. 6 and 7 being respectively top and side sectional views upon the lines 6—6 and 7—7 of Fig. 6.

In Fig. 1 the conduits and instruments shown on the right of the dotted line 10 extend and are positioned throughout the building or area to be protected, while the various instruments and wiring on the left of the dotted line are in the central control station, or in the office of the building where they are under observation and control of a supervisor.

Three signal stations or boxes 11, 12, 13 are illustratively shown, but it is to be understood that any number of said boxes may be positioned at various stations along the tour of duty of the watchman throughout the area to be patrolled and guarded. Each of these boxes is provided with a plurality of contacts 14, 15 and 16 (see also Fig. 2), two of which 15 and 16, are normally open and one of which 14, is normally closed to form a continuous circuit through the conductors 17, 18, 19 and 20 through the boxes 11, 12, 13 in series. One side of each of the normally open contacts 15 and 16 is grounded as indicated at 21. A telephone arrangement 22 may also be provided in each box.

Each of the contacts 14, 15 and 16 (see also Fig. 2), are respectively provided with spring fingers 29, 30 and 31 having contact points 32, 33 and 34 normally together in the case of contact 14 and normally separated in the case of contacts 15 and 16. The toothed signal wheels 24, 26 and 27 are all mounted rigidly upon a manually operable control member in the form of a shaft 23 so that said wheels will turn together and upon rotation will cause successive closings of the contacts 15 and 16 and successive openings of the contact 14.

Preferably each box is altogether enclosed and may only be opened by the watchman's key. Upon opening the box the watchman by further operation of his key may actuate the box mechanism (not shown) to cause a single complete rotary of the shaft 23, and of the toothed signal wheels 24, 26 and 27 thereupon. The signal wheels 24 and 27 are each provided with the same number and arrangement of teeth 25 and 28 (a single tooth followed by a group of three, an arrangement which varies from box to box). The teeth 25 and 28 are slightly displaced angularly from each other so that there will be an interval between the opening of the contact 14 and the

closing of the contact 15. Upon operation of the box a code signal (in this particular instance) will be transmitted to the central supervisory station. The single tooth on the wheel 26 will close the contact 16 momentarily and transmit a signal to the central station.

If desirable, at the same time the watchman may telephone to the station and inform the supervisor of his progress upon his tour of duty, or of any incidents which should be promptly reported. The boxes are also preferably provided with another arrangement operated by a lever rather than by a key for causing a plurality of complete rotations of the wheels 24, 26 and 27, and sending in a plurality of signals which will serve as a fire alarm, the arrangement usually being such as to cause repetition of the signals three or more times. Although the boxes are constructed to be opened by the watchman's key before any signal may be transmitted to the central station, it is also desirable to provide a glass therein which may be broken by someone without a watchman's key to give access to a latch device which will permit opening of the box and actuation of the fire alarm lever. Upon actuation of any one of the boxes 11, 12 or 13 duplicate records will be made, the closing of contact 16 actuating the dial register or recorder 36 and causing a flashing of the light 37 associated therewith, while the successive openings and closures of the contacts 14 and 15 will cause operation of the tape register or recorder 39, the time stamp or recording device 40 and the lights 38.

The closing of the contact 16' of box 11 will complete a circuit through the ground 21', the conductor 50', in parallel through the solenoid 51' and the lamp 37', the balancing resistance 52, the conductor 53 to the operating battery 54 and the ground 55. The closing of the contacts 16² and 16³ in boxes 12 and 13 will similarly complete circuits from the grounds 21² and 21³ to the ground 55, similarly functioning individual conductors, solenoids and lamps being indicated by the same numerals as in the case of the circuit closed by the contact 16' distinguished, however, by a superior 2 or 3.

The dial register 36 (as also Figs. 3 and 4) is provided with a recording dial 42 which is rotated by a clock arrangement (not shown) below elongated finger 43. The finger 43 is provided with a plurality of screws 44, each carrying a projecting point 45. Beneath the dial are the solenoids 51 (only one of which is illustratively shown in Fig. 4), each of which is provided with an armature 46. The armatures 46 carry perforating or pin devices 47 which are adapted to be moved upwardly when the solenoid is energized and to cause a mark or readily visible perforation on the dial 42 immediately between the points 45. The dial is ruled with a series of concentric circles thereupon, one for each box or signal station and is also provided with radial lines 49 which are so arranged and moved that the time designated thereupon will correspond with the time at which the perforation or visible indication is made upon the dial 42. The corresponding lights 37', 37² and 37³, which may be conveniently positioned alongside the dial register will flash upon sending in of the signal and will serve as an immediate signal, even before the permanent recordation is made, or while it is in the course of being made.

The lamps 38, the tape register 39 and the time stamp 40 are operated indirectly from a normally closed circuit passing in series through

the signal boxes by the contacts 14', 14² and 14³ and conductors 17, 18, 19 and 20 also includes the ground 55, the battery 54, the conductor 71, the solenoid 72, the balancing resistance 73 and the milliammeter 74 on the battery side of the boxes, and the conductor 75, the balancing resistance 76, the solenoid 77, the conductor 78, the contact 80' of the tri-polar or transmitting switch 79 and the ground 81 on the other side of the boxes.

The solenoids 72 and 77 form parts of the relays which are provided with armatures 87 and 88 normally closing the upper contacts 89 and 90 of said relays respectively.

When one of the contacts 14', 14² and 14³ is opened, upon operation of one of the signal stations or boxes, the solenoids 72 and 77 will be deenergized, the armatures 87 and 88 will drop and the alternate contacts 95 and 96 of the relays will be closed. Upon closing of contacts 95 and 96 the current will flow from the battery 91 through the conductor 92, then in parallel through the armatures 87 and 88, the contacts 95 and 96, the conductors 97 and 98, the contacts 30² and 30³ and the conductors 99 and 100, the lamps 38' and 38². The circuit, which has already been split into two parallel paths, is further split into four parallel paths, two of which pass through the lamps 38' and 38² and reunite in the conductor 94.

The other two parts are through the conductors 101 and 102 through the solenoids 103 and 104 in the tape register device 39 where they may actuate printing devices on different sides of the tape. These paths then unite in the conductor 105 to pass through the solenoid 106 and through the conductor 93 back to the battery 91.

The contacts 14 and 15 actuate two circuits. The action of the teeth 25 of the wheel 24 upon the contact 14 causes the circuit between the ground 55 and the ground 21 to be opened, while the action of the teeth 28 of the wheel 27 upon the contact 15 causes the circuit from the ground 55, through the solenoid 72 and to the ground 21 to be closed. The tooth 29 of the wheel 26 acts upon the contact 16 to close the circuit from the ground 55 through the lamps 37 and the recording device of Fig. 3 to the ground 21. When one of the contacts 14 is opened, assuming that the corresponding contact 15 is left opened, the circuit between the ground 55 and the ground 81 is opened, and the solenoids 72 and 77 deenergized, thereby causing the lamps 38' and 38² to be lit, and the tape recorder 39 to be operated. If the contact 15 is closed simultaneously with the opening of the contact 14 the circuit between 55 and 21 would be closed, the solenoid 77 alone being deenergized. It is seen, therefore, that if the contacts 14 and 15 should be operated simultaneously, the circuit from the ground 55 through the solenoid 72 to the ground 21 would always be closed, so that this circuit would be rendered useless as far as its action on one of the signal lamps 38 is concerned. In order to avoid this condition, the sets of teeth 25 and 28 of the wheels 24 and 27 respectively are placed at slight angular displacements to one another, so that the contacts 14 and 15 are not operated simultaneously. With the teeth of one wheel angularly displaced with respect to the teeth of the other wheel as shown, the operation of both circuits upon the signal lamps 38' and 38² will be assured.

Energization of the solenoid 106 will elevate the armatures 152 and 153, the armature 153 closing a subsidiary circuit including the resistance 160, the silver contact 154 and the conductors 161 and

162. This will continue energization of the solenoid 106 and lock the armatures 153 and 152 in position even after the initial circuit through the tape register 39 has been opened by reenergization of the solenoids 72 and 77.

The time stamp device 40 is controlled through the master clock 121 and the double relay 122 which are supplied from 110 volt source 123, preferably of the DC type. The relay is adapted to connect the source 123 to the winding circuit 124 and 125 of the master clock 121 by closing the gap between contacts 126 and 127, and 128 and 129 respectively.

It is also adapted to close the minute impulse circuit to the time stamp 40 through the conductors 141, 142, 143 and 144 by closing the gaps between the contacts 145 and 146, and 147 and 148 respectively. The minute impulse circuit communicates an impulse every minute to the time stamp 40 and sets the clock device therein to agree with the master clock 121.

Since it is only desirable to have the device 40 mark the tape of the register 39 after the recording of signals thereupon an arrangement is provided whereby the time stamp will not be actuated unless its circuit has been previously closed by the energization of the solenoid 106 incidental to transmission of a signal from a box. The actuating circuit 149 and 150 from the relay 122 to the time stamp 40 is provided with a normally open contact 151, the point of which is preferably of carbon. This circuit is completed, upon energization of the solenoid 106 at reception of a signal, by the armature 152 closing to the contact 151. Even though the time stamp actuating circuit 149 and 150 is closed upon energization of the solenoid 106, the stamp will not be actuated until the relay 122 closes the circuit through the conductors 149 and 150. At the same time the solenoid 155 will be energized to raise the armature 156 and close the contact 157. This will establish a shunt circuit around the solenoid 106 as a result of which it will be deenergized, the armatures 152 and 153 will drop and the contacts 151 and 154 will be opened.

The operation of the system is as follows: The signal boxes 11, 12 and 13 are positioned at suitably designated positions about the plant or area to be protected and guarded and the watchman is instructed to operate these boxes in a certain order and at certain time intervals. As the watchman actuates any box, the closing of the contact 16 by rotation of the wheel 26 will cause an instantaneous illumination of the corresponding lamp 37 and energization of the corresponding solenoid 51 of the dial register 36 with perforation of the dial indicating the box operated and the time of such operation. The perforation will be made between the points 45, upon the circle assigned to the signal box operated and upon a radial line corresponding to the time of perforation and may be immediately observed. At the same time, the wheels 24 and 27 will be rotated to alternately open and close the contacts 14 and 15. A series of dashes will be formed upon the tape of register 39 corresponding to the code number of the box and both lamps 38 will burn to give a series of flashes also corresponding to said code signal. Upon operation of the tape register 39 and illumination of the lamps 38, the solenoid 106 will be energized and will lift the armatures 152 and 153 to close the contacts 151 and 154, the closing of the latter contact locking the ar-

matures in position and the former closing the time stamp actuating circuit.

The next operating impulse from the master clock 121, which impulses will ordinarily occur every minute, will then pass through the contact 151 to actuate the time stamp 40. At the same time this impulse will energize solenoid 155, which will lift the armature 156 and close the contact 157. The shunt circuit thus established around solenoid 106 will result in its deenergization. As a result the armatures 152 and 153 will fall, opening the contact 151 in the time stamp actuating circuit.

Another operating impulse will not be communicated to the stamp 40 until the solenoid 106 has again been energized by a signal and the contact 151 closed.

If desired, a conventional telephone arrangement 22 may be placed in every box and connected by the conductors 165 and 166 with a telephone mouthpiece 167 and earpiece 168 in the supervisor's office, the battery 169 supplying the necessary current. The ear phone 168 may be replaced or combined with a loud speaker and/or a bell arrangement so that the watchman may signal to the central office for telephonic reports, either at every box, at certain boxes and/or in case of emergency and any untoward occurrences.

If desired, the system may also be combined with the annunciator arrangement by means of which the watchman could be called to the nearest box for the purpose of communicating directly with the supervisor by means of the telephone.

Upon the line 53 may be positioned the delinquency register 190 which is connected to the solenoid 192 in the dial register 36 by the conductor 191. The delinquency register (see Figs. 5, 6 and 7) is provided with a standard clock driving gear train 193, 194, 195 and 196 which turn a cam-shaped dial 197 corresponding to an hour hand making one revolution in 24 hours. The dial may be set in any desired position by the setting device 198. The dial 197 is provided with a follower 199 which is adapted to ride over the depressed portion 200, during the night time when the watchmen are on duty, and over the elevated portion 201 during the day time when the signal system is not in operation.

The clock mechanism gear train 193, 194, 195 and 196 is also adapted to drive a large gear wheel 205 which in turn drives the pinion 206 and through said pinion the worm 207. The follower 199 is provided with an arm 202 having a pin 203 contacting with the bar 204. The contact bar 204 is provided with a depending follower stud 208 which cooperates with the worm 207. As a result of the coaction of the pin 203 and the bar 204, the stud 208 is lowered into operative position when the follower is traversing the depressed portion 200 of the dial 197 and is elevated into inoperative position when the follower is traversing the elevated portion 201 of said dial 197.

The contact bar 204 is provided with two spring fingers 209 and 210 (see particularly Fig. 6), which have contact points 211 and 212, one of said fingers being connected through the conductors 191 and 53 and the solenoid 225 to the battery 54 and the other being connected to a ground by suitable connections to the binding posts 56 and 57 respectively. The contact bar 204 will be moved rearwardly of the device by interaction of the stud 208 with the worm 207.

The contacts 211 and 212 will remain separated until the spring fingers 209 and 210 have been pressed together by contact with the pin 213 (see also Fig. 7). The pin 213 is provided with a head for manual manipulation and may be placed in any one of the resilient split depending cylindrical receivers 215 attached to the flange 216, which flange is supported from the clock structure. The position of the pin 213 determines the amount of movement of the contact bar 204 before closing of the contacts 211 and 212.

Since it is only desirable to have the contacts 211 and 212 close and energize the solenoid 192 when the watchman has failed to continue his tour of duty or when too great a lapse of time has occurred from the time of the last signal, an arrangement is provided to return the contact bar 204 and the follower stud 208 to initial position every time a signal is transmitted from the watchman's signal box to the central supervisory control station. For this purpose a solenoid 225 is placed in the normally open circuit by connecting the conductor 53 to the binding posts 58 and 59. With the solenoid 225 is associated the armature 226 which has a rearwardly projecting finger 227 provided with a vertical depending flange 228. Contact between the lower edge of the flange 228 and the lever arm 229 of the pivot bar 204 is maintained by the leaf spring 233, the inner portion of which is wrapped around the pivot post 230.

When the stud 208 is disengaged from the worm 207, the lever arm 229 is drawn rearwardly by the spring 231. This movement is limited by a downwardly projecting finger 234 from the flange 228.

The contact bar 204 is pivoted at stud 230 by the screw 232, the head of which is spaced to permit either lateral horizontal pivotal movements or vertical seesaw movements.

When the circuit through the conductor 53 is closed upon transmission of a signal the current will flow through the solenoid 225, elevate the armature 226 and cause the flange 228 to depress the lever arm 229. This will elevate the follower stud 208 out of the worm 207, and the spring 231 will thereupon move the lever arm 229 of the contact bar 204 against the stop 234 and the stud 208 outwardly. Upon opening of the circuit 53 again, said stud will be lowered into the first turn of the worm 207.

The elevator device 235, which is provided with the stop 236, to contact with the post 230 when the device is not in operative position, may be used to permanently disengage the follower stud 208 from the worm 207. By turning the device counter-clockwise, its end portion 37 will contact with the bottom of the bar 204 and elevate it to disengage the stud 208.

Closing of the contacts 211 and 212 upon failure of any signal to come in after a length of time predetermined by the setting of the pin 213, will cause energization of the solenoid 192 (see Fig. 1) which is combined with a perforating arrangement of the same construction as shown in Fig. 4. The perforating needle in this instance, however, serves to form a perforation in a circle not assigned to the signal from any box.

In case the circuit 17, 18, 19 and 20 is grounded or broken at any point, indication will be had by lighting of the lamps 38' and/or 38² and a continuous running of the tape register 39. The system may be immediately put into operative condition by throwing over the transmitting switch 79 and/or the single switches 250 and 251.

For example in the case of a break, both the lamps 38' and 38" will burn, the line may be restored to operating condition by moving the switches 79 from the normal circuit contacts 80 to the open circuit contacts 252. This movement of the switch 79 will extinguish the lights 38, will stop operation of the tape register 39, will eliminate the ground 81 and will connect the positive side of the battery 54 to both sides of the circuit. As a result, two open circuits will be formed, one including the contact 252', and the conductors 78, 75 and 20, and the other including the conductors 53 and 50. Upon actuation of a box the circuit will be completed from the ground 55 to the ground 21 of the box so actuated. When the switch 79 is placed in this position, the solenoids 72 and 77 will have been deenergized and the armatures 83 and 87 will have fallen from the contacts 90 and 89. Whereupon the circuit through the lamps 38 and the tape register 39 will be normally open and completed upon energization of either the solenoid 72 or 77. Completion of the circuit will light one of the lamps 38 and actuate one of the solenoids 103 or 104 of the tape register 39. When the break is repaired the transmitting switch 79 may be thrown from its open 252 position to its normal 80 position, whereupon the line will again be in its normal operative position.

The testing arrangement 180 is provided with a voltmeter 181 and with a series of plug-in arrangements 182, 183, 184, 185 and 186. These plug-in arrangements are adapted to cooperate with a manually inserted plug to close a circuit across the voltmeter and give a voltage reading thereupon. The plug-in arrangement 182 will indicate the voltage between the line 17 and the line 20; the arrangement 183 the voltage between the line 20 and the ground 187; the arrangement 184 the voltage between the ground 187 and the conductor 17; and the plug-in arrangements 185 and 186 respectively the voltages of the local battery 91 and the telephone battery 169.

It is most convenient for purposes of central control to place the testing arrangement 180, the voltmeter 181, the milliammeter 74, the normal and ground solenoid-armature arrangements 72—88 and 77—87, the transmitting switch 79, the single switches 251 and 250, the lamps 38 and the relay arrangements 106—152—153 and 155—158 upon a single central control board.

The signaling and recording installations and the delinquency register of the present invention, may be widely applied to other systems, than the watchman's and fire alarm systems specifically described. For example they may be applied to sprinkler and low water alarm systems and to many other electrical control arrangements.

What I claim is:—

1. In an electrical signaling and recording system for recording the tours of duty of a plurality of watchmen, said recording being simultaneously accomplished upon a single record for all of said watchmen together and upon separated records, one for each watchman, the former serving to indicate the location of the watchman and the latter to indicate the activity of the watchman for immediate reference, an automatic signaling arrangement including a clock mechanism, a cam-shaped dial with elevated and depressed portions driven from said clock mechanism, a gearing arrangement between said dial and said clock mechanism to rotate said dial once in every twenty-four hour periods, a follower associated with said cam-shaped dial, a worm driven by said clock

mechanism, a normally open contact arrangement, a contact closing device, said contact arrangement being driven by said worm against said device, means associated with said follower and with said contact arrangement to prevent actuation of said contact arrangement upon contact of the follower with the elevated portions of said dial, a manually operated device and means for disengaging said contact arrangement and said worm incidental to operation of said manual device.

2. In a system of the class described, a plurality of control stations, each of which includes a manually actuated control member, a recording device, a normally closed circuit passing in series through all of said stations and opened upon actuation of a control member, a secondary normally opened circuit for actuating said recording device, and means automatically operable upon the opening of said first mentioned circuit for closing said secondary circuit, whereby said device is operated to record the actuation of said last mentioned control member.

3. In a system of the class described, a control station having a manually actuated control member, a device for recording the manual actuation of said control member, a circuit passing through said station and actuated by said control member, a signaling device, means operable by the actuation of said circuit for simultaneously operating said signaling device and said recording device, and means automatically operable upon a failure of said circuit, for continuing the operation of said signaling device irrespective of the operation of said control member.

4. In a system of the class described, a control station having a manually operable control member, a device for recording the manual operation of said control member, a pair of circuits, both actuated from said control member, and means operable upon the actuation of either or both of said circuits for operating said recording device.

5. In a system of the class described, a control station having a manually operable control member, a device for recording the manual operation of said control member, a normally closed circuit and a normally opened circuit, said circuits being opened and closed respectively by the actuation of said control member, and means operable when said first mentioned circuit is opened or when said second mentioned circuit is closed for operating said recording device.

6. In a system of the class described, a control station including a manually operable control member, a device for recording the operation of said control member, a pair of circuits operated by said control member, a pair of signaling devices, means operable upon the operation of said circuits for operating said recording device, and said signaling devices, and means automatically operable upon the failure of one of said circuits for continuing the operation of one of said signaling devices irrespective of the actuation of said control member.

7. In a system of the class described, a normally closed circuit and a normally opened circuit, a single manually operable control member, means responsive to the actuation of said control member for alternately operating said circuits, a device for recording the operation of said control member, and means operable when one or both of said circuits is operated for operating said recording device.

8. In a system of the class described, a manually operable control member, a device at a dis-

tance from said control member and actuated therefrom for recording the operation of said control member, said recording device including a clockwork device, means for supporting a circular chart on said clockwork device and for rotating said chart, a finger adapted to extend substantially radially with respect to said chart when said chart is mounted in position, and to engage the front surface of said chart, a pair of spaced projections on said finger extending transversely with respect thereto, and an electromagnetic device operated from said control member and disposed on the rear side of said chart, said electro-magnetic device having a puncturing member adapted to puncture said chart between said projections, and away from said finger, and said projections serving to hold the portions of said chart therebetween against frontwise movement while said puncturing member is operating.

9. In a system of the class described, a plurality of control stations, each having a manually operable control member, a device for recording the operation of said control members and actuated therefrom, said recording device including a clockwork device, means for supporting a circular chart on said clockwork device and for rotating said chart, a finger adapted to extend substantially radially with respect to said chart and to engage the front surface of the latter, a plurality of projections spaced lengthwise of said finger and extending transversely with respect thereto, and a plurality of electro-magnetic devices mounted on the rear side of said chart and actuated respectively from said control members, each of said electro-magnetic devices having a puncture member for puncturing said chart between adjoining projections and away from said finger, said projections serving to hold the portions of said chart therebetween while said puncture member is operating.

10. An electrical protective system including a manually operable control member, a delinquency indicating device at a distance from said member, means for automatically operating said indicating device upon a failure to manually operate said control member at a predetermined time, whereby the delinquency in the operation of said control member is made apparent, and means for automatically rendering said indicating device inoperative during predetermined periods of the day irrespective of the operation or failure of operation of said control member.

11. An electrical protective system including a manually operable control member, a circuit including a pair of normally spaced contacts which open and close said circuit, a delinquency indicating device operated from said circuit, a clockwork mechanism, means actuated from said clockwork mechanism for gradually bringing said contacts together, and means automatically operable upon

the operation of said control member for releasing said contacts into their normal spaced positions.

12. An electrical protective system of the class described, including a manually actuated control member, a delinquency indicating device, a circuit for actuating said indicating device, and including a pair of spaced contacts for opening and closing said circuit, means for automatically bringing said contacts together at a predetermined interval after the actuation of said control member, and means responsive to the actuation of said control member for maintaining said contacts in separated position for a predetermined time after said latter actuation.

13. An electrical protective system of the class described, including a manually operable control member, an indicating member including a clockwork, a rotatable member having a helical groove on the surface thereof, a circuit for actuating said indicating member, and having a pair of normally spaced contacts for opening and closing said circuit, a pin connected to one of said contacts and extending into said groove of said rotatable member, whereby the rotation of said latter member causes movement of said latter contact towards the other to close said circuit, and means automatically operable upon the actuation of said control member for releasing said pin from engagement with said groove whereby said contacts are separated into normal position.

14. In a device of the class described, a plurality of manually actuated control members, a device operable from said members for recording the actuation of said member, a device operable from said members for recording the time of actuation of said members, and means for actuating said time recording device only when said first mentioned recording device has been actuated.

15. In a protective system of the class described, a plurality of control stations, each including a manually operable control member, a device operable from said members for recording the actuation of said members, a normally open circuit closed when said recording device is actuated, and a device in said circuit and operable from said members for recording the time of actuation of said members.

16. An electrical protective system including a manually operable control member, a delinquency indicating device, means for operating said delinquency indicating device at predetermined periods, and means automatically operable upon the operation of said control member at any time between successive delinquency operating periods for rendering said indicating device inoperative at the next succeeding delinquency operating period.

JAMIN S. MORSE.