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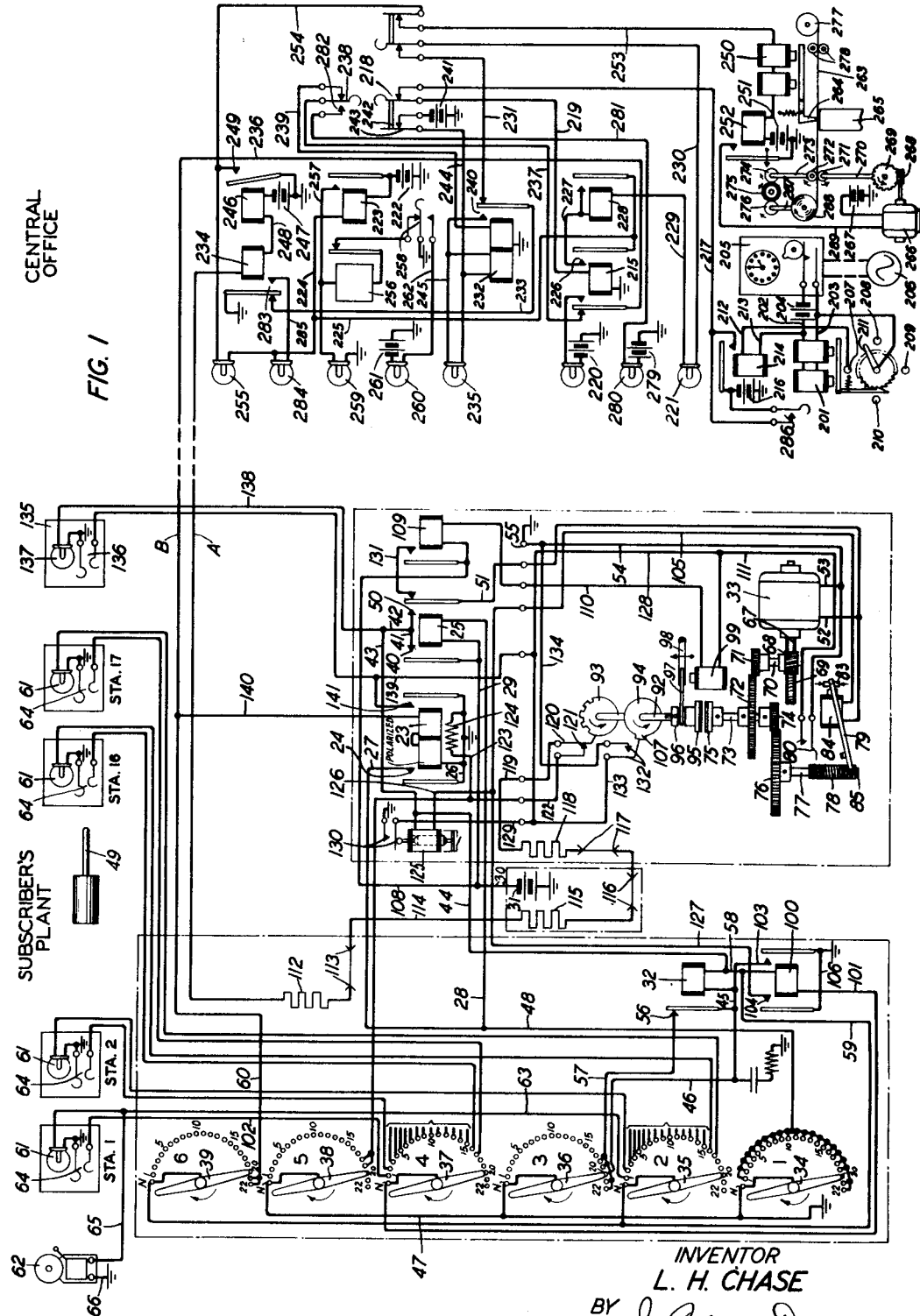
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1,919,007

SIGNALING SYSTEM

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SIGNALING SYSTEM

Application filed August 21, 1931. Serial No. 558,436.

This invention relates to signaling systems and more particularly to a signaling system adapted for use in premises to be patrolled.

The object of this invention is to supervise from a central station the patrolling of protected premises.

A feature of this invention resides in the provision of means for signaling from a central office to a watchman in the protected premises when it is time for him to begin making his tour of the premises.

Another feature resides in the provision of means for signaling back from the protected premises to the central office when a starting impulse has been given to indicate to an attendant at the central office that the starting impulse has been sent from the central office and received at the protected premises.

Another feature resides in the provision of means for automatically allotting a predetermined time interval for a watchman to reach a substation and attend to apparatus thereat.

Another feature, which reduces traffic on a register, resides in the provision of means for automatically sending a signal to the central office only when a watchman is delinquent in arriving at a substation and attending to apparatus thereat or when certain unstandard conditions occur in the system.

Another feature resides in the provision of recording means at the central office which makes a record only when a watchman is delinquent or when certain unstandard conditions occur in the system.

Another feature of this invention lies in the provision of means for conditioning from a preceding station apparatus at a substation for attendance by the watchman. This feature makes necessary the visiting of substations in proper sequence.

Another feature resides in the provision of means whereby a watchman may send an emergency call to the central office when aid is required.

Still another feature resides in the provision of means for testing the system from the central office and for sending a code sig-

nal from the protected premises back to the central office to indicate the condition of the system.

Other features including the separation into groups of the various pieces of apparatus and the provision of protective means such, for instance, as traps and networks located within and between the various groups which when disturbed or tampered with will automatically cause the operation of signals at the central office are disclosed in this specification.

In watchmen's signaling systems it is the usual practice to have a watchman signal in from each substation visited and to have a recording device at a central office make a record each time a watchman sends in such a signal.

In the present invention a starting signal is given to notify a watchman that it is time to begin his tour of the premises. A time spacing device is automatically set in operation to space off a predetermined time interval allotted the watchman to reach the first substation in his tour, and apparatus at the first substation to be visited is set in condition for attendance by the watchman. If the watchman fails to reach the first substation and attend to apparatus thereat within the predetermined time limit, a code signaling device is automatically brought into operation to send a code signal to the central office. Upon the sending of the code signal a recording device at the central office is automatically brought into operation to make a delinquency record. If the watchman arrives at the first substation and attends to the apparatus thereat within the predetermined time limit, the apparatus at the next substation to be visited is automatically set in condition for attendance by the watchman and the time spacing device is automatically operated to prevent the sending of the code signal and to begin spacing off a new time interval allowed the watchman to reach the next substation and attend to apparatus thereat. Apparatus at the first substation is automatically set in condition for attendance by the watchman when the starting signal is given. The apparatus at each succeeding substation

is automatically set in condition for attendance by the watchman, by the watchman's attendance to apparatus at a preceding substation.

5 In the drawings, Fig. 1 is a schematic of a complete system;

Fig. 2 is a plan view of the time spacing device;

10 Fig. 3 is an end elevation taken on the line 3—3 in the direction of the arrows in Fig. 2;

Fig. 4 is a side elevation of the traveller and trip magnet therefor shown in the lower left hand portion of Fig. 3; and

15 Fig. 5 is a side elevation of a code wheel and cooperating contacts taken on the line 5—5 in the direction of the arrows as shown in Fig. 2.

20 The system is divided into two main parts, a central office and a subscriber's plant, which, as shown in Fig. 1, are connected by the line wires A and B. Control of the apparatus in the subscriber's plant portion of the system is accomplished from the central office over the line wire B and this connection between the central office and the subscriber's plant will be referred to in this specification as the "B" circuit. Code signals indicating delinquencies of the watchman in the performance of his duty and signals indicating unstandard conditions in the system pass from the subscriber's plant to the central office over the line wire A, and this connection between the central office and the subscriber's plant therefore will be referred to in this specification as the "A" circuit.

At the central office are the following: A secondary clock 201 which controls the sending of a starting impulse to the subscriber's plant, a comparatively high potential battery 220 to supply a high potential negative impulse to a polarized relay at the subscriber's plant, a comparatively high potential battery 279 to supply a high potential positive impulse to the polarized relay at the subscriber's plant under certain conditions, a recording device 250 to record delinquencies in the watchman's visits to the substations, a buzzer signal 256 to audibly indicate delinquencies, lamps to indicate various conditions occurring in the system, and the necessary keys and relays to control the operation of the different signal elements.

At the subscriber's plant are a local battery 25 31, a starting signal device 62 to notify a watchman that it is time to begin his tour, the substations to be visited by the watchman, an emergency station through which emergency signals may be sent to the central office when aid is required, a selector switch with connections to the various substations and the time spacing apparatus which automatically spaces off the time intervals allowed the watchman to travel from one substation to another.

A suitable enclosure is provided at the subscriber's plant to house the selector switch and protect the switch from tampering with by the watchman or any unauthorized person.

An enclosure is also provided at the subscriber's plant to house the time spacing device and protect this apparatus against tampering with by the watchman or any person unauthorized to have access to the apparatus.

An enclosure is also provided at the subscriber's plant to house the local battery employed to energize the selector switch, the time spacing apparatus and the associated relays. The enclosures referred to are indicated by broken lines in Fig. 1.

Located within the enclosures at suitable places are protective contacts and networks to automatically cause the display or sounding of signals at the central office when any of the apparatus in the protective system is disturbed or tampered with. These protective contacts and networks are of the type usually employed in burglar alarm or like protective systems, and are so placed in the line circuits joining the system at the subscriber's plant and the system at the central office that any severance or disconnection of the wires at the protected premises or opening of the enclosures housing the various pieces of apparatus will result in the operation of signal devices at the central office.

The selector switch has six banks of contacts and a corresponding number of double-ended wiper arms attached to a common shaft. The shaft is rotated and the wiper arms are successively driven over the contacts upon release movements of the stepper magnet. The No. 1 bank serves as a locking bank to lock in a relay serving to connect into the system at the subscriber's plant the local battery. The No. 2 bank provides a means of connection between the local battery and the lamps at the various substations. The No. 3 bank provides a connection to ground for the stepper magnet of the selector switch during its first operation, connections for obtaining successive operations of the stepper magnet to move the wiper arms to select the first substation and connections for obtaining successive operations of the stepper magnet to move the wiper arms from the bank contact representing the last substation in the system to the normal position for the wiper arms of the selector switch. The No. 4 bank provides a means of connection between the local battery and jacks at the substations through which ground connection may be completed for the operation of a stepper relay which assists in the operation of the stepper magnet under certain conditions and completes a circuit to a trip magnet employed to prevent sending of a code signal when the substations are visited in proper sequence and within the predetermined time limits. The No. 5 bank provides

a means of connection from the system at the protected premises to a finish indicator at the central office. The No. 6 bank provides a means of connection between the local battery at the protected premises and a start indicator at the central office.

The time spacing apparatus operates continuously during the tour by the watchman of the protected premises and operates to send a code signal to the central office at the end of a predetermined time interval unless reset by the watchman's arrival at a substation and attendance to apparatus thereat within the predetermined time interval.

The time spacing apparatus comprises a motor, a shaft driven thereby, a spring restored contact-making traveller driven by a threaded cylinder on the shaft, a trip magnet to trip the traveller and allow it to be returned to starting point by the restoring spring, a shaft bearing a code wheel and a contact closing cam, a clutch to couple the two shafts and a clutch magnet to operate the clutch.

The substations in the subscriber's plant are numbered 1 to 17 inclusive and each contains a lamp signal 61 and a jack 64. The lamp in substation 1 is lighted automatically when the starting signal for the watchman is operated. The lamp in the second substation is lighted when the watchman extinguishes the lamp in the first substation. Each succeeding substation lamp is lighted in turn by the watchman's arrival and attendance to apparatus at the preceding substation.

There are twenty-three contacts in each bank of the selector switch. The first contact in each bank is designated as N. The remaining contacts are numbered 1 to 22 inclusive.

A brief description of the operation of the system will now be given.

At the hour and minute on which the watchman is to begin to make his tour, a time impulse is sent over the "B" circuit from the central office by means of a clock contact. This impulse operates polarized relay 23 in one direction to close the start contact 24 momentarily. The closing of this contact operates local battery relay 25 which operates to provide battery for the apparatus at the protected premises. As soon as this battery is applied the motor 33 starts to drive the elapsed time mechanism, and stepper magnet 32 of the selector switch operates. Upon release by the polarized relay 23 of the start contact 24 the stepper magnet 32 is deenergized and the wiper arms of the selector switch move from the No. 20 contacts in the respective banks to the No. 21 contacts. A circuit is thereupon completed for local battery relay 25 through the No. 1 bank. Relay 25 operates and locks in to supply battery to the apparatus at the protected premises. The stepper magnet 32 is then successively energized and deenergized to move the wiper

arms to the No. 1 contacts in the respective banks.

When the wiper arms of the selector switch reach the No. 1 contacts, the lamp at station No. 1 lights and a starting signal 62 operates to notify the watchman that it is time for him to begin his tour. The watchman is awakened by the gong 62 and goes to station 1 where he inserts a plug 49 momentarily in the jack 64. The plug 49 which is preferably carried by the watchman for insertion in the jack 64 serves to conductively bridge the contacts of the jack and may be of any desired form providing it will perform this function. As soon as the plug 49 is inserted in the jack 64, the trip magnet 84 will energize and the traveller 79 is restored by its restoring spring to normal position. Should the watchman leave the plug 49 too long in the jack, the dash pot relay 125 will function and close its contacts to cause energization of the clutch magnet 99; this causes the code wheel 93 to revolve and to send a signal over the "A" circuit to the central office. Upon removal of the plug 49 the selector moves its wiper arms from the No. 1 segments in the respective banks to the No. 2 segments and the watchman proceeds to station 2. Thus at each station he moves the selector to the segment connected to the station head. At each station a light indicates that the selector has functioned and he must put the light out. At his final station the selector is restored to the No. 20 segments in the respective banks by the No. 3 bank and as it reaches this position ground is cut off relay 25 which removes battery from the system. At the operation of each station the traveller 79 is restored to normal.

The traveller 79 consists of an arm which is moved along by a pin riding in a thread of a screw that is revolved by the motor. At the end of the screw are contacts 80 which when closed cause the clutch magnet 99 to become energized. When the trip magnet 84 is energized the traveller 79 is lifted from the screw and returned to normal by a spring.

The clutch magnet 99 is energized upon closing of the contacts 80 by the traveller 79. Normally the code wheel 93 is at rest but is set in rotation to send a code signal to the central office upon operation of the clutch magnet 99. Contacts 120 and 121 are normally closed and as the code wheel 93 turns contact 120 follows the depressions in the code wheel to produce an alternate opening and closing of circuit "A" which causes the operation of a register 250 at the central office. Contacts 132 close as soon as the wheel starts to revolve and the closing of these contacts holds power on clutch magnet 99. In series with clutch magnet 99 is relay 109 whose contacts close to hold power on the motor 33 through one revolution of

the code wheel. Thus if contacts 80 are opened after the code wheel starts to revolve the code will be completed. Further, if the code is coming in as the selector is restoring and battery is cut from the motor 33 through the No. 1 bank the code will complete itself. The clutch magnet 99 is a slow-release magnet to allow contacts 132 to open properly.

If contacts 80 are closed by the traveller 79 before the watchman arrives at a substation, the clutch magnet 99 is operated and the code wheel 93 is set in rotation to send a delinquency signal to the central office to cause the operation of the register 250.

The emergency station 135 is located along the line of the tour as a means for the watchman to send in a signal to the central office at any time during the tour. The jack contacts of this station may be conductively bridged by a plug 49 inserted in the jack by the watchman. When the jack contacts of this emergency station are conductively bridged by the plug 49, the clutch magnet 99 is energized and the code wheel 93 is caused to revolve to send a code signal to the central office. Other stations such as buttons or footrails may be connected to this station so that the apparatus may be used as a holdup alarm during the open hours of the protected premises.

A full description of the operation of the system will now be given.

At the central office the secondary clock 201 operates on minute impulses received over the conductors 202 and 203 from a suitable source of current 204, under control of a controlling device designated as 205 which may be operated from any suitable source of current supply such as the generator 206. The secondary clock 201 has a set of fixed contacts 207, 208, 209 and 210 and a movable contact 211. The fixed contacts 207, 208, 209 and 210 represent quarter-hour time intervals and may be connected into the system as desired.

When the movable contact 211 engages one of these fixed contacts which has been connected into the system, such for instance as contact 207 a circuit is closed over the conductors 212 and 213 to relay 214. Relay 214 closes a circuit to relay 215 as follows: ground, battery 216, armature and front contact of relay 214, conductor 217, lower left hand inner contacts of key 218, conductor 219, winding of relay 215 to ground. Relay 215 through its left hand armature connects into the "B" circuit a comparatively high potential battery 220, to send a comparatively high potential negative impulse over the "B" circuit and conductor 140 to operate polarized relay 23 at the subscriber's plant. Relay 215 also through its right hand armature closes a circuit for impulse indicator lamp 221 which is lighted to indicate the sending of the impulse which conditions the system for operation. This circuit is as follows:

ground, battery 222, winding of buzzer relay 223, conductor 224, conductor 225, right hand armature of relay 215, contact 226, conductor 227, winding of relay 228, conductor 229, impulse indicator lamp 221, conductor 230, lower right hand inner contacts of key 218, conductor 231, back contact and armature of differential relay 232, conductor 233, back contact and armature of relay 234 to ground. Relay 228 locks up to hold battery on the impulse indicator lamp 221 until the differential relay 232 is operated from the subscriber's plant to close a circuit to the tour indicator lamp 235. So long as the impulse indicator lamp 221 remains lighted, it indicates that the starting impulse has been sent to the subscriber's plant and has not as yet caused sufficient rotation of the wiper arms of the selector switch to bring about operation of the start signal device and the lighting of the lamp at the first substation. The locking-in circuit through relay 228 may be traced as follows: ground, battery 222, winding of buzzer relay 223, conductor 224, conductor 225, armature and front contact of relay 228, winding of relay 228, conductor 229, impulse indicator lamp 221, conductor 230, lower right hand inner contacts of key 218, conductor 231, back contact and armature of differential relay 232, conductor 233, back contact and armature of relay 234 to ground.

Polarized relay 23 upon receiving the start impulse pulls up its left hand armature to a start contact 24 and closes a circuit to local battery relay 25 as follows: ground, conductor 26, left hand armature of polarized relay 23, start contact 24, conductor 27, conductor 28, winding of local battery relay 25, conductor 29, conductor 30, local battery 31 to ground.

Local battery relay 25 pulls up both its right and left hand armatures and closes two circuits, one including the stepper magnet 32 of the selector switch and the other including the motor 33 of the time spacing apparatus.

The wiper arms 34, 35, 36, 37, 38 and 39 of the selector switch normally engage the No. 20 contacts of the respective banks. When the start contact 24 is closed by the operation of polarized relay 23 and the local battery relay 25 operates to connect into the system the local battery 31, a circuit is closed to the stepper magnet 32 of the selector switch as follows: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, contact 40, conductor 41, conductor 42, conductor 43, conductor 44, winding of stepper magnet 32, conductor 45, conductor 46, the No. 20 contact of restoring bank No. 3, wiper arm 36, N contact of the No. 3 bank, conductor 47 to ground. The circuit just described remains closed and the stepper magnet 32 energized for the brief period the start contact remains closed. The

wiper arms of the selector switch, however, are not moved from engagement with the No. 20 contacts of the respective banks until this circuit is broken. Upon release by the
 5 polarized relay 23 of its left hand armature and opening of the start contact 24, the local battery relay 25 becomes deenergized, the left hand armature of local battery relay 25 is released from contact 40 and the circuit to
 10 stepper magnet 32 is opened. Upon the deenergization of stepper magnet 32 the wiper arms move to the No. 21 contacts of the respective banks.

By movement of the wiper arms of the
 15 selector switch to the No. 21 contacts of the respective banks, a locking circuit for the local battery relay 25 is completed. The circuit established is through the No. 1 bank and is as follows: ground, local battery 31,
 20 conductor 30, conductor 29, winding of local battery relay 25, conductor 28, conductor 48, bridged contacts of the No. 1 bank, wiper arm 34, N contact of the No. 1 bank, conductor 47 to ground. With this circuit estab-
 25 lished through the No. 1 bank, the local battery relay 25 is again energized and locks in to maintain the local battery 31 in the system.

Local battery relay 25 for the second time
 30 completes circuits to the stepper magnet 32 and the motor 33 respectively. The circuit to the motor 33 is as follows: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, con-
 35 tact 40, conductor 41, contact 50, right hand armature of local battery relay 25, conductor 51, conductor 52, motor 33, conductor 53, conductor 54, terminal 55 to ground. The motor circuit thus established is maintained
 40 during the watchman's tour of the premises. The time interval between the first and second closing operations of the motor circuit is so short that the motor does not have time to stop but continues to operate during the brief
 45 period in which the circuit is open. The motor therefore, carries over the brief period in which the local battery relay 25 is deenergized.

Stepper magnet 32 is energized over the
 50 following circuit: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, contact 40, conductor 41, conductor 42, conductor 43, con-
 55 ductor 44, winding of stepper magnet 32, conductor 45, armature and back contact 56 of stepper magnet 32, conductor 57, the No. 21 contact of the No. 3 bank, wiper arm 36, N contact of the No. 3 bank, conductor 47 to ground.

60 With the local battery 31 again connected into the system and the wiper arms on the No. 21 contacts of the respective banks, a circuit is completed over the "B" circuit to the central office to differential relay 232 to close a
 65 circuit for a tour indicator signal. The cir-

cuit for this operation of differential relay 232 may be traced as follows: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, con-
 70 tact 40, conductor 41, conductor 42, conductor 43, conductor 44, conductor 58, conductor 59, N contact of the No. 6 bank, wiper arm 39, contact 21 of the No. 6 bank, conductor 60, line wire of the "B" circuit, conductor 236,
 75 left hand armature and back contact of relay 215, conductor 237, upper left hand spring contact 238 of key 218, upper left hand inner contact of key 218, conductor 239, primary winding of differential relay 232 to ground. Polarized relay 23 does not operate at this
 80 time because of the comparatively high resistance of its windings. Differential relay 232 pulls up its armature against front contact 240 and completes a circuit to a tour indicator lamp 235 as follows: ground, battery 241,
 85 lower left hand contact 242 of key 218, spring contact 243, conductor 244, tour indicator lamp 235, conductor 245, front contact 240, and armature of differential relay 232, con-
 90 ductor 233, back contact and armature of differential relay 232, conductor 233, back contact and armature of relay 234 to ground. The lighting of the tour indicator lamp 235 at the central office indicates that the system
 95 is in operation, that a starting impulse has been received in the protected premises and that the selector switch is in operation. When the circuit for energization of the primary winding of differential relay 232 is
 100 opened by movement of the wiper arm 39, beyond the contacts 21 and 22 of the No. 6 bank as will be later explained, the secondary winding of differential relay 232 holds the armature of this relay against front contact
 105 240, and locks in to keep battery on the tour indicator lamp 235 for the duration of the tour. The circuit through the secondary winding of this relay is as follows: ground, battery 241, contact 242, spring contact 243,
 110 conductor 244, secondary winding of differential relay 232, conductor 245, front contact 240 and armature of differential relay 232, conductor 233, back contact and armature of relay 234 to ground.

The stepper magnet 32 upon being brought
 115 into operation over the circuit including its armature and back contact 56, and contact 21 of the No. 3 bank operates to open the circuit by separation of its armature from back con-
 120 tact 56. Deenergization of the stepper magnet 32 thereupon occurs and the wiper arms are moved on the release movement of the stepper magnet to the No. 22 contacts of the
 125 respective banks. Stepper magnet 32 is then energized over a circuit including the No. 22 contact of the No. 3 bank. Stepper magnet 32 again operates to open the circuit including its armature and back contact 56 and the
 130 wiper arms are again advanced by the release

movement of the magnet so that the ends of the wiper arms opposite to the ends moving off No. 22 contacts engage the No. 1 contacts in the respective banks.

5 When the wiper arms engage the No. 1 contacts in the respective banks, a circuit is completed through wiper arm 35 and the No. 1 contact of the No. 2 bank to the first substation lamp 61 and the starting signal device 62. The circuit may be traced as follows: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, contact 40, conductor 41, conductor 42, conductor 43, conductor 44, conductor 58, conductor 59, N contact of the No. 2 bank, wiper arm 35, No. 1 contact of the No. 2 bank, conductor 63, lamp 61, to the sleeve side of jack 64 to ground. Conductor 65 leads from conductor 63 in this circuit to the starting signal device 62 which is grounded through conductor 66.

Lamp 61 in substation No. 1 is thereupon lighted and the starting signal device 62 is set in operation to notify the watchman that it is time to begin his tour of the premises.

While the various movements of the selector switch above described are taking place, the time spacing apparatus is operating to space off the time interval allowed the watchman to reach the first substation. The time spacing apparatus is driven by the motor 33 which, as shown in Fig. 2, rotates a shaft 67 bearing a worm gear 68. The worm gear 68 engages a worm wheel 69 mounted on a shaft 70 on which is a comparatively small gear 71 driving a larger gear 72 attached to a shaft 73. The shaft 73 is continuously driven by the motor 33 through the gear train described and has on one end a gear 74 and on the other end as shown in Fig. 3 one half of a friction clutch 75. The gear 74 engages a gear 76 which is mounted on a shaft 77. On one end of the shaft 77 is a threaded cylinder 78 which drives a traveller 79 toward a pair of spring contacts 80.

The traveller 79 is an L-shaped bar pivotally supported at 81 and 82 as shown in Fig. 4 on the ends of an armature 83 of a trip magnet 84. The free end of the traveller carries a pin 85 which rests in the helical groove of the threaded cylinder 78. Upon rotation of the threaded cylinder 78 the free end of the traveller 79 is driven toward the spring contacts 80 and when moved to full traverse closes these spring contacts. The traveller 79 is shown in Fig. 2 in its starting position and is provided with a retracting spring 86 to return it to starting position when the trip magnet 84 is energized. The armature 83 of the trip magnet 84 as shown in Fig. 4 is pivotally supported at 87 on one end of a U-shaped member 88 and is returned to normal position by a spring 89 upon deenergization of the trip magnet 84. When the trip magnet 84 is energized and attracts its arma-

ture 83, the traveller 79 is tilted so that the pin 85 on its free end is lifted out of the helical groove of the threaded cylinder 78. The retracting spring 86 thereupon swings the free end of the traveller 79 back to starting position. When the trip magnet 84 is deenergized the spring 89 moves the armature 83 to normal position and brings the pin 85 on the free end of the traveller 79 into engagement with the threaded cylinder 78. A set screw 90, adjustably supported in a bracket 91, is provided to determine the starting point of the traveller 79.

Attached to a suitably supported shaft 92 is a code wheel 93, an insulating disc 94, a friction disc 95 corresponding to the disc 75 carried by the shaft 73, and an annularly grooved collar 96. The collar 96 and friction disc 95 are keyed to the shaft 92 and are slidable longitudinally of the shaft 92 toward the friction disc 75. An arm 97 extending from an armature 98 of a slow-to-release clutch magnet 99 extends into the annular groove of the collar 96. When the clutch magnet 99 is energized it pulls up its armature 98, the arm 97 shifts the collar 96 and the friction disc 95 longitudinally on the shaft 92 and brings the friction disc 95 into engagement with the friction disc 75. The shaft 92 is thereupon driven by the shaft 73 to rotate the code wheel 93 and the insulating disc 94.

It will be seen therefore from the foregoing description and reference to the drawings that the traveller 79 is started on its movement toward the contact springs 80 as soon as the starting impulse is sent from the central office and will continue in its movement toward this contact-making position unless prevented from reaching this point by operation of the trip magnet 84.

The watchman upon hearing the starting signal 62 starts out for the first substation and upon arriving at the first substation inserts the plug 49 into the jack 64 to conductively bridge the contacts of the jack. When he does so a circuit is completed to stepper relay 100 as follows: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, contact 40, conductor 41, conductor 42, conductor 43, conductor 44, conductor 58, winding of stepper relay 100, conductor 101, N contact of the No. 4 bank of the selector switch, wiper arm 37, No. 1 contact of the No. 4 bank of the selector switch, conductor 102, the tip contact of jack 64, the plug 49 inserted by the watchman, sleeve contact of jack 64 to ground. Stepper relay 100 thereupon operates to pull up both its right and left hand armatures against contacts 103 and 104 respectively.

When the stepper relay 100 is energized a circuit is completed through its left hand armature and contact 104 to the trip magnet 84 as follows: ground, local battery 31, conduc-

tor 30, conductor 29, left hand armature of local battery relay 25, contact 40, conductor 41, contact 50, right hand armature of local battery relay 25, conductor 51, winding of trip magnet 84, conductor 105, conductor 127, contact 104 and left hand armature of stepper relay 100, conductor 106 to ground.

The trip magnet 84 when energized attracts its armature 83 which is attached to the traveller 79 and tilts the traveller 79 so that the pin 85 on its free end is lifted from the groove of the threaded cylinder 78. The retracting spring 86 then returns the traveller to its starting position so that when the trip magnet 84 becomes deenergized the traveller 79 will by means of the spring 89 bearing against the armature 83 be moved so that the pin 85 on its free end will rest in the groove of the threaded cylinder 78. The traveller 79 will then again begin to travel from its starting point toward the spring contacts 80.

If the watchman fails to arrive at the substation and cause operation of the trip magnet 84 by inserting the plug 49 in jack 64 before the traveller 79 presses the spring contacts 80 together, clutch magnet 99 will be operated to move the friction disc 95 on the shaft 92 into engagement with the friction disc 75 on the continuously driven shaft 73. The clutch magnet 99 is energized over the following circuit: ground, local battery 31, conductor 30, conductor 108, winding of code holding relay 109, conductor 110, winding of clutch magnet 99, conductor 111, contacts 80, conductor 54, terminal 55, to ground.

When the clutch magnet 99 operates to move the friction disc 95 into engagement with the friction disc 75, shaft 92 is rotated and turns the code wheel 93 and the insulating disc 94. The code wheel 93 operates to alternately open and close the "A" circuit in accordance with the arrangement of notches in the code wheel.

At the central office is the code relay 246 which is normally energized over the "A" circuit as follows: ground, battery 247, winding of code relay 246, conductor 248, winding of relay 234, line wire of the "A" circuit, network 112, and door contact 113, which are in the enclosure housing the selector switch, conductor 114, network 115, and door contacts 116 which are in the enclosure housing the local battery 31, door contacts 117 and network 118 which are in the enclosure housing the time spacing apparatus, conductor 119, spring contact 120, contact 121, conductor 122, conductor 123, resistance 124 to ground. The spring contact 120 is normally pressed against contact 121 to close the circuit to the code relay 246 at the central office. As the code wheel 93 revolves the indentations in the periphery of the code wheel 93 allow separation of the contacts 120 and 121 and open the circuit to the code relay 246. The teeth on the code wheel 93 obvi-

ously close the circuit to the code relay 246 by pressing the contact 120 into engagement with the contact 121.

Upon the deenergization of code relay 246 the armature of this relay falls into engagement with contact 249 and closes a circuit to record magnet 250 as follows: ground, battery 251, winding of tape feed control relay 252, which is a slow-release relay, windings of record magnet 250, conductor 253, lower right hand outer contacts of key 218, conductor 254, back contact 249 and armature of code relay 246 to ground. A circuit is also closed by this release action of code relay 246 to buzzer relay 223 and open pilot lamp 255 as follows: ground, battery 222, winding of buzzer relay 223, conductor 224, open pilot lamp 255, conductor 254, back contact 249 and armature of code relay 246 to ground.

Buzzer relay 223 operates to alternately close and open a circuit to buzzer 256 which may be traced as follows: ground, battery 222, armature and front contact of buzzer relay 223, conductor 257, buzzer 256, armature and back contact of buzzer 256, key 258 to ground.

A night alarm pilot lamp 259 is also provided to flash with the operation of the buzzer 256 and is energized over the following circuit: ground, battery 222, armature and front contact of buzzer relay 223, conductor 257, night alarm pilot lamp 259, to ground. The night alarm pilot lamp 259 may be used in conjunction with buzzer 256 or may be used separately when no audible signal is required. This lamp flashes with open pilot lamp 255 in accordance with code signals but will not light as does open pilot lamp 255 if there is a permanent break in the circuit "A". The buzzer circuit may be opened by operation of key 258 and a circuit completed for a night alarm cut-out lamp 260 which, when lighted, will indicate to an attendant at the board in the central office that the buzzer signal is not being used to indicate the reception of code signals. The circuit to the night alarm cut-out lamp 260 is as follows: ground, battery 261, night alarm cut-out lamp 260, conductor 262, lower contact of key 258 to ground.

With the alternate deenergization and energization of the code relay 246 and the consequent alternate closing and opening of the circuit to the recorder magnet 250, the recorder operates to make a series of records on a tape 263 corresponding to the code notches in the code wheel 93. The recorder may be any suitable recording device but is shown for the purpose of illustration as a tape recorder having a driven tape 263, a striker 264 to mark the tape, an anvil 265 under the tape and a recorder magnet 250 to operate the striker. A motor 266 energized by a suitable source of current supply such as a battery 267 serves to feed the tape 263 across the anvil 265. Attached to the motor shaft is a worm gear 268

which drives a worm wheel 269 in a counter-clockwise direction. The worm wheel 269 is mounted on a shaft 270 on one end of which is a roller 271 which is in contact with one side of the tape 263 of the recorder and serves to draw the tape 263 across the anvil 265. Bearing against the opposite face of the tape to that engaged by the roller 271 is a roller 272 which is frictionally driven by the tape 263 in a clockwise direction. The roller 272 is mounted on a shaft 273 on one end of which is a disc 274 engaging a felt-covered wheel 275 which is turned in a counter-clockwise direction and engages a disc 276 attached to a shaft 287 extending from a roller 288 on which the tape 263 of the recorder is wound. The tape 263 is drawn by the roller 271 from a storage spool 277 between two rollers 278 across the anvil 265 and is wound up on the roller 288. The roller 271 which draws the tape 263 is positively driven and the speed of travel of the tape 263 therefore is constant. The speed of rotation of the roller 288, however, gradually decreases as the tape builds up on the roller because there is sufficient slippage between the disc 274, the felt-covered wheel 275 and the disc 276 to prevent increase in the speed of the tape due to the building up of the tape on the roller 288. The circuit for the motor 266 is closed each time the tape feed control relay 252 is energized. The circuit for the motor may be traced as follows: ground, battery 267, motor 266, conductor 289, front contact and armature of tape feed control relay 252 to ground. It will be obvious that the recorder may be common to a plurality of subscribers' plants, each having a different code wheel and that records may be made of the different code signals employed on a common tape.

Assuming now that the watchman arrives at substation No. 1 before the expiration of the predetermined time interval and causes operation of the trip magnet 84 before the traveller 79 has travelled far enough along the threaded cylinder 78 to close the contacts 80. The insertion of the plug 49 in jack 64 closes the circuit to the stepper relay 100. The stepper relay 100 thereupon operates and closes a circuit to stepper magnet 32 as follows: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, contact 40, conductor 41, conductor 42, conductor 43, conductor 44, winding of stepper magnet 32, front contact and right hand armature of stepper relay 100 to ground. Stepper magnet 32 is thereby energized. Stepper relay 100 is also energized while the plug 49 remains in jack 64 at substation 1. When the plug 49 is removed from jack 64 the circuit to stepper relay 100 is opened. Stepper relay 100 is deenergized and the circuit to stepper magnet 32 is opened. Upon release of stepper magnet 32 the wiper arms are all moved to the No. 2 contacts in

the respective banks. The lamp 61 at substation 1 is extinguished. The circuit to the starting signal device 62 is opened and the lamp 61 at substation 2 is lighted.

Should the watchman, however, fail to remove the plug 49 from jack 64, dash pot relay 125 would in a comparatively short time operate to close a circuit to clutch magnet 99 and cause the sending of a code signal to the central office to operate the recording device to make a delinquency record. The circuit to the dash pot relay 125 is as follows: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, contact 40, conductor 41, conductor 42, conductor 43, dash pot relay 125, conductor 126, conductor 127, front contact 104 and left hand armature of stepper relay 100, conductor 106 to ground. Dash pot relay 125 operates to close a circuit to the clutch magnet 99 as follows: ground, local battery 31, conductor 30, conductor 108, winding of code holding relay 109, conductor 110, winding of clutch magnet 99, conductor 128, conductor 129, contacts 130 to ground. The clutch magnet 99 thereupon operates to shift the friction disc 95 into engagement with the continuously rotating friction disc 75 to cause the sending of the code signal to the central office.

Whenever the clutch magnet 99 is energized, the code holding relay 109 is energized to hold battery on the motor 33 so that once a code signal is started battery will be held on the motor 33 until the completion of the code signal. If the local battery relay 25 releases before a code signal is completed, the circuit to the motor 33 will be as follows: ground, local battery 31, conductor 30, conductor 108, armature and front contact of code holding relay 109, conductor 131, back contact and right hand armature of local battery relay 25, conductor 51, conductor 52, motor 33, conductor 53, conductor 54, terminal 55, to ground.

To hold the circuit for the clutch magnet 99 for one complete revolution of the code wheel 93, the clutch holding contacts 132 are maintained closed until the insulating disc 94 has made one complete revolution and brought the peripheral knob 107, into position to separate the contacts 132. When once the clutch magnet 99 is operated and the insulating disc 94 is rotated to allow the closing of the clutch holding contacts 132 the following circuit to the clutch magnet 99 is maintained for one complete cyclic movement of the code wheel 93: ground, local battery 31, conductor 30, conductor 108, winding of code holding relay 109, conductor 110, winding of clutch magnet 99, conductor 128, conductor 133, clutch holding contacts 132, conductor 134, terminal 55 to ground.

Assuming that the watchman has visited each substation up to and including the six-

teenth substation and attended to the apparatus thereat within the predetermined time intervals spaced off by the time spacing apparatus and the wiper arms are on the No. 17 contacts of the respective bands, when the watchman plugs into the seventeenth substation the stepper relay 100 operates to close the circuit to the stepper magnet 32. When the plug 49 is removed from the jack 64 at the substation 17, the stepper relay 100 and the stepper magnet 32 release. The wiper arms are then moved on to the No. 18 contacts of the respective banks. With wiper arm 36 on the No. 18 contact of the No. 3 bank a circuit to stepper magnet 32 is completed as follows: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, contact 40, conductor 41, conductor 42, conductor 43, conductor 44, winding of stepper magnet 32, armature and back contact 56 of stepper magnet 32, conductor 57, the No. 18 contact of the No. 3 bank, wiper arm 36, N contact of the No. 3 bank, conductor 47 to ground. Stepper magnet 32 thereupon is energized and separates its armature from back contact 56 and breaks its energizing circuit. The wiper arms upon release of the stepper magnet 32 move to the No. 19 contacts of the respective bands, and the stepper magnet 32 is again energized to break its own circuit by separating its armature from back contact 56. The wiper arms are then moved on to the No. 20 contacts of the respective banks.

When the wiper arm 34 arrives on the No. 20 contact in the No. 1 bank the locking circuit of the local battery relay 25 is opened. Local battery relay 25 releases its armature and opens the local battery circuit of the system at the subscriber's plant. The system at the subscriber's plant is then in normal condition and will not be energized again until an impulse is sent from the central office to energize polarized relay 23.

Should the watchman at the subscriber's plant at any time wish to summon aid he may send an emergency signal to the central office from the emergency station 135. The apparatus at the emergency station 135 comprises a jack 136 and a signal lamp 137. Signal lamp 137 at the emergency station 135 remains lighted during the watchman's tour of the subscriber's plant and is supplied with lighting current from the local battery 31 over the following circuit: ground, local battery 31, conductor 30, conductor 29, left hand armature of local battery relay 25, contact 40, conductor 41, conductor 42, conductor 138, lamp 137 to ground. When the watchman wishes to summon aid he inserts the plug 49 into jack 136 to conductively bridge the contacts of the jack and complete the circuit for the clutch magnet 99 as follows: ground, local battery 31, conductor 30, conductor 108,

winding of code holding relay 109, conductor 110, winding of clutch magnet 99, conductor 128, conductor 139, to the tip contact of jack 136 through the plug 49 inserted therein to the sleeve contact of jack 136 to ground. With this circuit completed the clutch magnet 99 operates to move the friction disc 95 into engagement with the continuously driven friction disc 75. The shaft 92 is rotated and a code signal sent to the central office in the same manner as when delinquency signals are sent.

To send a code signal from the emergency station to the central office, it is not necessary that the lamp 137 be lighted through current supplied from the local battery 31 or that the local battery relay 25 be operated. The watchman may by inserting the plug 49 into the jack 136 at the emergency station at any time cause the sending of the code signal.

Assuming that aid is required at a time when no tour is in progress and the local battery relay 25 is deenergized so that the local battery 31 is not connected into the system, the watchman by inserting the plug 49 into jack 136 at the emergency station 135 completes a circuit to the clutch magnet 99 and code holding relay 109 as follows: ground, local battery 31, conductor 30, conductor 108, winding of code holding relay 109, conductor 110, winding of clutch magnet 99, conductor 128, conductor 139, tip spring of jack 136 through the plug 49 inserted in the jack to the sleeve spring of jack 136 to ground. The closing of this circuit causes operation of the clutch magnet 99. It also puts battery on the motor 33 over the following circuit: ground, local battery 31, conductor 30, conductor 108, armature and front contact of code holding relay 109, conductor 131, back contact and right hand armature of local battery relay 25, conductor 51, conductor 52, motor 33, conductor 53, conductor 54, terminal 55 to ground. The code signal is thereupon sent to the central office and since all code signals are answered by guards sent from the central office to the subscriber's plant regardless of whether the code signal is an emergency call or a delinquency signal the watchman's call for aid is immediately answered.

Key 218 is provided as a connecting means between various apparatus parts in the system and is normally in the position shown in Fig. 1. To test the system from the central office without causing operation of the selector switch and the consequent operation of the start signaling device at the subscriber's plant, the key 218 may be operated at the central office to connect in a comparatively high potential battery 279 to send a comparatively high potential positive impulse over the "B" circuit to the polarized relay 23 at the subscriber's plant. This positive impulse is sent over the following circuit: ground,

high potential battery 279, lamp 280, conductor 281, contact 282, spring contact 238, conductor 237, back contact and left hand armature of relay 215, conductor 236, over the
 5 "B" circuit line wire, conductor 140, windings of polarized relay 23, conductor 26 to ground. On receiving this positive impulse polarized relay 23 will pull up its right hand armature against contact 141, and close a
 10 circuit to the clutch magnet 99 and code holding relay 109 as follows: ground, local battery 31, conductor 30, conductor 108, winding of code holding relay 109, conductor 110, winding of clutch magnet 99, conductor 128,
 15 conductor 139, contact 141, right hand armature of polarized relay 23, conductor 26, to ground. The operation of the code holding relay 109 will put battery on the motor 33 over the circuit including conductor 108,
 20 armature and front contact of code holding relay 109, conductor 131 and back contact and right hand armature of local battery relay 25. The operation of the clutch magnet 99 will result in the turning of the code
 25 wheel 93 and the sending of code signals over the "A" circuit to the central office in the same manner as when code signals are sent indicating a delinquency in the watchman's visit to a substation.

30 Located at the central office in the "A" circuit in series with the code relay 246 and the protective contacts and networks in the apparatus enclosures in the subscriber's plant is relay 234. This relay may have a higher
 35 resistance winding than the code relay 246 or it may have a comparatively heavy armature or spring armature held so that the relay will not be operated by the current normally flowing in the "A" circuit. This relay therefore does not operate under normal conditions.
 40 Should the resistance in the "A" circuit, however, be decreased such as would happen if the "A" circuit were grounded between the central office and the subscriber's plant, or if
 45 the protective contacts and networks in the apparatus boxes were bridged around by conductors of low resistance, the relay 234 would operate to pull up its armature against front contact 283 and complete a circuit to ground
 50 pilot lamp 284. The circuit for the ground pilot lamp 284 is as follows: ground, battery 222, winding of buzzer relay 223, conductor 224, ground pilot lamp 284, conductor 285, front contact 283, and armature of relay 234
 55 to ground. The lighting of the ground pilot lamp 284 would indicate to an attendant at the central office the abnormal condition of the "A" circuit. The buzzer relay 223 would also be operated to switch battery on the buzzer circuit and the night alarm pilot lamp
 60 259. Buzzer 256 would therefore operate and the night alarm pilot lamp 259 would be lighted to indicate the abnormal condition of the system.

65 Code relay 246 in addition to serving as a

means for controlling operation of the buzzer 256 and the recorder 250 during the reception of a code signal also serves in connection with the open pilot lamp 255 as a means for
 10 indicating an opening in the protective system such as would be caused by severance of the conductors in the "A" circuit or opening of any of the door contacts of the apparatus boxes. Should code relay 246 be deenergized
 15 by an opening in the conductors of the "A" circuit the armature of code relay 246 will engage back contact 249 and complete the following circuit to the open pilot lamp 255: ground, battery 222, winding of buzzer relay 223, conductor 224, open pilot lamp 255, conductor 254, back contact 249 and armature of
 20 code relay 246 to ground.

At the central office a key 286 is provided so that in case the secondary clock 201 is not
 25 operating or it is desired to make a test of the system when the movable contact 211 is not in engagement with one of the contacts 207, 208, 209 and 210, the key 286 may be operated to put battery 216 in circuit connection with relay 215 to send a start impulse
 30 to the polarized relay 23 at the subscriber's plant.

What is claimed is:

1. In combination, a central station, patrolled premises, a plurality of substations at the patrolled premises, a signal device at each
 35 substation, a selector at the patrolled premises having contacts to which said signal devices are connected, a circuit extending from the central station to the patrolled premises
 40 and including a relay at the patrolled premises to control the operation of said selector to cause it to select and operate the signal device of the first substation, a code circuit extending from the patrolled premises to the
 45 central station, time controlled means at the central station to close said first circuit, a circuit closed by the operation of said relay and including an electromagnetic timing switch at the patrolled premises for measuring time
 50 intervals, said electromagnetic switch closing said code circuit at the expiration of a certain time interval, means operated by the patrolman at each substation within a certain time
 55 interval for causing said selector to select the next substation, operate the signal device thereat and reset said automatic time spacing means to prevent the closure of said code circuit.

2. In combination, a central station, patrolled premises, a plurality of substations at the patrolled premises, a signal device at each
 60 substation, a selector at the patrolled premises having contacts to which said signal devices are connected, a circuit extending from the central station to the patrolled premises
 65 and including a relay at the patrolled premises to control the operation of said selector to cause it to select and operate the signal device of the first substation, a code circuit ex-

tending from the patrolled premises to the central station, time controlled means at the central station to close said first circuit, a circuit closed by the operation of said relay and including an automatic timing switch for measuring time intervals, said timing switch closing said code circuit at the expiration of a certain time interval, means operated by the patrolman at each substation within a certain time interval for causing said selector to select the next substation, operate the signal device thereat and reset said automatic timing switch to prevent the closure of said code circuit, a signal at the central station operated by the time controlled means, and a relay at the central station actuated by the response of the selector to render said signal inert.

3. In combination, a central station, patrolled premises, a plurality of substations at the patrolled premises, a signal device at each substation, a selector at the patrolled premises having contacts to which said signal devices are connected, a circuit extending from the central station to the patrolled premises and including a relay at the patrolled premises to control the operation of said selector to cause it to select and operate the signal device of the first substation, a code circuit extending from the patrolled premises to the central station, time controlled means at the central station to close said first circuit, a circuit closed by the operation of said relay and including a timing switch for measuring time intervals, said timing switch closing said code circuit at the expiration of a certain time interval, means operated by the patrolman at each substation within a certain time interval

for causing said selector to select the next substation, operate the signal device thereat and reset said timing switch to prevent the closure of said code circuit, a signal at the central station operated by the time controlled means, a relay at the central station actuated by the response of the selector to render said signal inert, a second signal means operated by said last mentioned relay to operate said second signal, and means actuated by the patrolman at the last substation to render said second signal inert.

4. In a watchman's signaling system, a central station, patrolled premises, substations thereat, a signal device at each substation, a selector having terminals to which said signal devices are connected, time controlled means at the central station for causing said selector to select and operate the signal device at the first substation, a manual switch at each substation associated with each signal device, means at the patrolled premises for automatically spacing off time intervals, set in operation by said time controlled means, a delinquency signal at the central station operated thereby at the expiration of a given time interval, means actuated by the operation of the manual switch by the patrolman at the substations within given time intervals to cause said selector to select and operate the signal device at the next substation, reset said time spacing means and delay mechanism set in operation by the operation of the manual switch at each substation and operating by failure to operate the switch within a given time interval to cause the operation of said delinquency signal at the central station.

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