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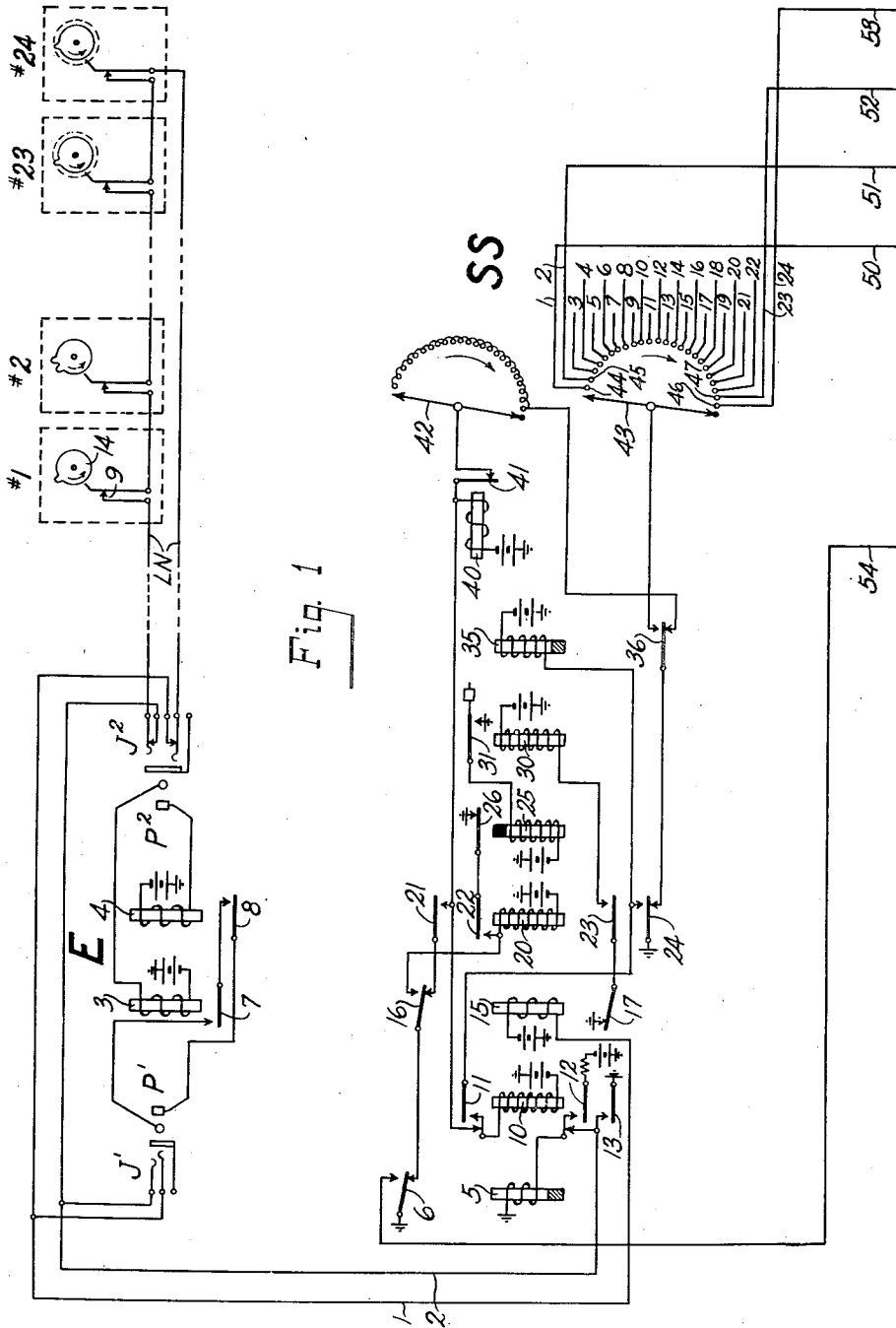
C. E. LOMAX ET AL

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WATCHMAN'S SUPERVISORY SYSTEM

Filed March 2, 1929

2 Sheets-Sheet 1



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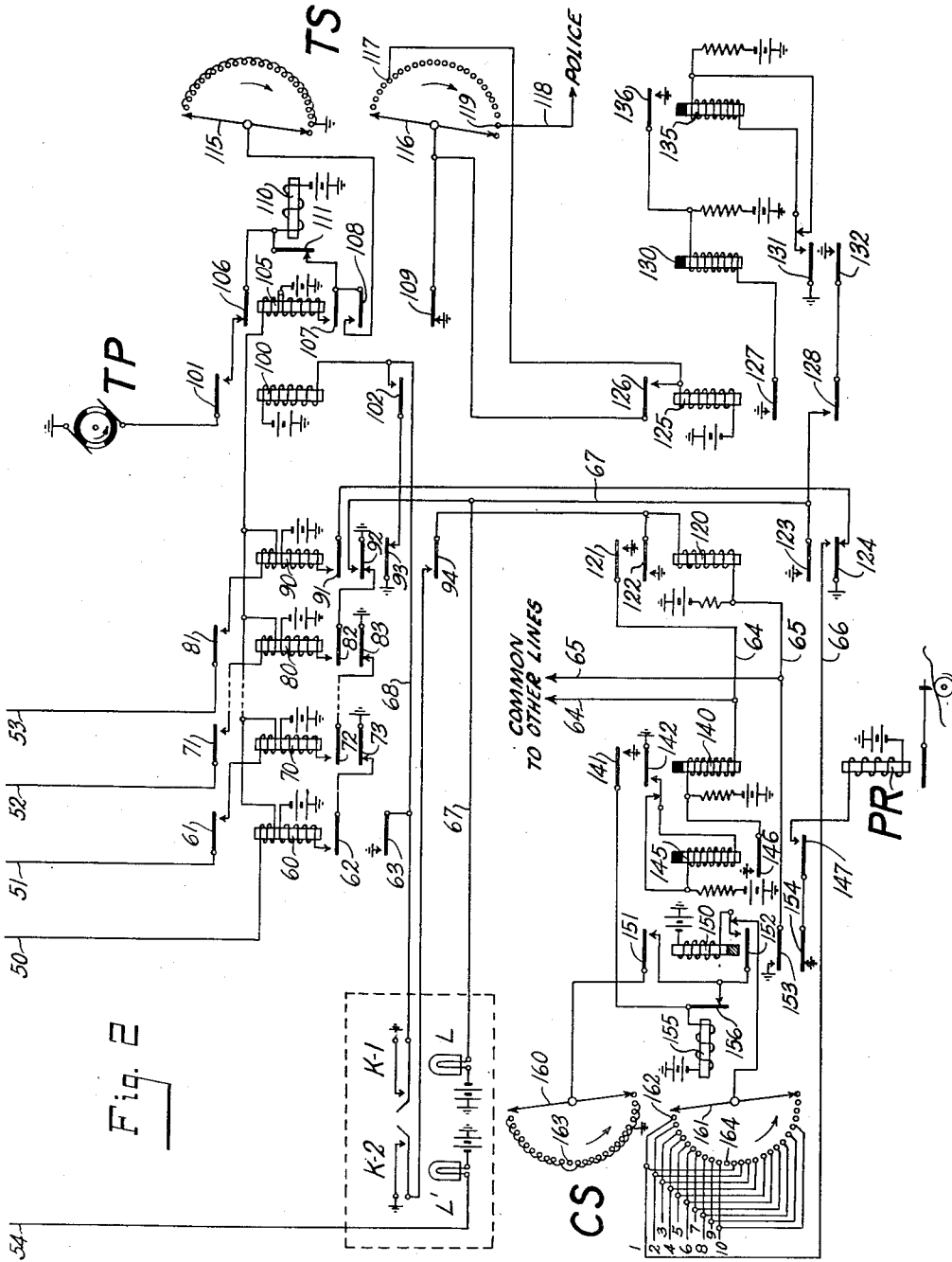
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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WATCHMAN'S SUPERVISORY SYSTEM

Application filed March 2, 1929. Serial No. 343,871.

This invention relates in general to signalling systems, but more particularly to a watchman's supervisory and signalling system of the type wherein there are a number of watchman's stations arranged throughout a building which are operated at regular intervals and successively to transmit signals over a line extending to a central supervising operator. In systems of this kind it is the usual practice for the watchman to operate one pull box after another in succession to inform the supervising operator of his position on the route. If he fails to operate one of the boxes when he should, an alarm is usually sent over the line to inform the operator of this condition. A system of this general type is disclosed in Patent 1,540,786, issued June 9, 1925, to C. E. Lomax.

The principal object of the invention may be said to be broadly, the provision of new and improved apparatus of the above type for use as a watchman's supervisory and signalling system.

Another object of this invention is to design a system of the above type that will be of inexpensive manufacture and require a minimum amount of maintenance after being installed.

A further object is to provide a system of this type wherein the supervising officer will be released from a large number of unnecessary duties formerly required during the normal operation of the system, thereby being enabled to supervise a larger number of lines with a minimum amount of effort.

A further object of the invention is the provision of means whereby a watchman on going through the building to operate the pull boxes on his route must operate these in successive order, one after the other, and if he fails to pull the succeeding box a signal will be transmitted over the line to the supervisor. After he has operated the last pull box on his route the supervisor is made aware of this fact by the steady lighting of a route lamp, after which the supervisor controls means to register the number of this particular route.

A further object of the invention is the provision of means whereby the watchman

must operate his pull box within a definite time interval in accordance with the automatic stepping of a rotary switch. Should he fail to do this the supervisor will be aware of this fact by the intermittent lighting of the route lamp. 55

Other objects and features not herein mentioned but which will be apparent later on will be pointed out in connection with the detailed description, which together with the drawings constitute a preferred embodiment of the invention. 60

In the drawings, comprising Figs. 1 and 2 the invention is illustrated by means of the usual schematic circuit diagrams in which Fig. 1 shows a line LN extending throughout the premises of a building with a number of watchman's pull boxes thereon, #1, #2, #23, and #24, it being understood that there are twenty-four boxes on this particular line. This line extends to the central supervising office and terminates in a station selector switch SS and a group of relays. The emergency cord circuit E is inserted in the line in case the line becomes grounded. 65 70 75

Fig. 2 illustrates a group of relays 60, 70, etc., one for each pull box on the line; the timing switch TS to govern the interval during which the watchman must operate his next pull box, and the code switch CS which is common to ten lines or routes and is operable to control a punch register PR. 80

A brief general description of the operation of the system and apparatus used in connection therewith will now be given, reference being had to the drawings. The line LN, as has been stated, extends throughout a particular building or a number of floors therein and has twenty-four watchman's pull boxes arranged in a series circuit on it. Each pull box, for example box #1 comprises a pair of normally closed interrupter springs 9 adapted to be opened and closed under control of the teeth on the code wheel 14. The pull box #2 is similar in construction except that the code wheel on this box has two teeth and is adapted to send two impulses over the line by operating the springs twice. Box #23 transmits twenty-three impulses and box #24 twenty-four. Each box on the line transmits 85 90 95 100

a particular series of impulses characteristic of that station. As these pull boxes are well known in the art it is not thought necessary to further describe them or their operation.

5 The impulses from the boxes are transmitted from the line LN over conductors 1 and 2 to the station selector switch SS. They control the stepping magnet 40 of the switch SS in such a manner that the wipers 42 and 43 will
10 be stepped in accordance therewith onto the contact corresponding to the operated pull box. It may be here stated that the switches SS, TS and CS are of the same general type as disclosed in Patent No. 1,693,027, issued to
15 John Erickson, November 27, 1928, wherein the wipers have a normal position and are advanced in a forward direction each time the stepping magnet is deenergized.

Each of the twenty-four contacts in the
20 banks of the switch SS are associated with a particular chain relay shown in Fig. 2. These relays 60, 70, etc., correspond to the pull boxes on the watchman's route, one for each box on the line so that there will be twenty-
25 four of them. They are so arranged that they are energized in succession in accordance with the successive operation of the pull boxes. The first of these relays corresponds to the first box on the line and must be energized
30 first before any other relay in this series can become energized. When the last pull box, which in this case is #24 on the route, has been operated and the last relay in the series is energized in accordance therewith, the
35 lamp L is lighted to indicate to the supervisor that the watchman has satisfactorily completed his route.

The timing switch TS is started on the operation of the first pull box and released
40 on the operation of each succeeding one. Should the watchman fail to operate a pull box within the time interval allotted between boxes the switch TS advances far enough to operate the route lamp L in a flashing manner, thereby indicating to the supervisor that
45 the watchman is in trouble. The supervisor upon noting that the watchman has completed his route will operate the recording key K2 which starts the operation of the code switch CS. This code switch CS is associated with ten other routes and is operated
50 over its bank contacts associated with these other routes until it finds a bank contact which is grounded. During this stepping of the
55 switch a printing recorder PR, of well known construction, is operated to give a permanent record of the route which has just been finished.

The lamp L1 at the supervisor's position indicates whenever the line LN has become
60 grounded or open. In this case the watchman will not be prevented from transmitting signals over his route by any of these failures. Should the line become grounded the cord circuit E can be plugged into the jacks J1 and J2

and impulses extending from ground somewhere on the line will operate the station selector SS in the same manner as if the line was not grounded.

It may be stated that a supervisor may
70 have supervision over any number of lines such as LN, and there will be, therefore, a number of positions or panels such as that which comprises the keys K—1 and K—2 and the lamps L and L' which are individual to the line LN or route #1. The code switch CS likewise controls the printing recorder PR for nine other routes.

The system having been described in general, a detailed description will now be given of its operation. For this purpose it will be assumed that the watchman is to operate all the pull boxes on the lines LN, this line extending throughout a particular building, or floor in the building, it being understood of
85 course that there may be other lines similarly arranged extending to the supervisor's office. The watchman operates the pull box #1 and the code wheel is turned in the direction of the arrow and interrupts the contacts 9, sending one interruption over the line LN. The contacts immediately close again. This line LN extends over the conductors 1 and 2 to the station selector SS in the supervisor's office over a circuit from ground through the winding of slow-release relay 5, normally closed contacts on armature 12 over conductor 2 through all the pull boxes in series, back over conductor 1, through the winding of relay 15 to battery. Slow-release relay 5 is so constructed that it does not release when the line LN is rapidly opened and closed because of the copper slug on its heel end, and it only deenergizes a short time after the line becomes permanently opened. Relay 15, however, follows the impulses and falls back when the line is opened and immediately energizes when it closed again. As only one impulse has been transmitted from box #1 relay 15 momentarily releases its armatures 16 and 17 and a circuit is thereby completed extending from ground on armature 6 and its front contact, armature 16 and its back contact, through the winding of relay 20 to battery. Relay 20 thereupon energizes and at its front contact and armature 22 completes a locking circuit for itself extending through the armature 26 and its back contact to ground.

Relay 20, also at armature 21 completes a circuit for relay 10 extending from ground upon armature 6 and its closed contact, armature 16 and its closed front contact, armature 21 and its front contact, alternate contacts of armature 11, through the winding of relay 10 to battery. At front contact and armature 24 relay 20 completes a locking circuit for relay 10 after it has operated, extending to the front contact of armature 24, armature 11 and its locking contact, through the winding
130

of relay 10. Relay 10, upon operating, closes direct ground from armature and front contact 13, to the line conductor 2 instead of to the slow release relay 5 as it did before. At front contact of armature 12 relay 10 completes a local holding circuit for relay 5 and at the alternate contacts disconnects relay 5 from the line. This arrangement is such that if other impulses are sent from the line in addition to the first impulse, as would be the case from other stations on the route, a better impulsing circuit would be provided extending from direct ground at armature 13 to relay 15 instead of to the winding of relay 5.

A branch of the initial energizing circuit of relay 10 extends from the front contact of armature 21 of relay 20 through the winding of stepping magnet 40 of switch SS to battery. The stepping magnet accordingly becomes energized. Relay 20 at its armature 24 also completes a circuit from ground through armature 24 and its front contact, through the winding of slow release relay 35 to battery. This relay operates its armature 36 but without effect at this time. At the front contact of armature 23 relay 20 completes a circuit from ground through the front closed contact of relay 15, through the winding of relay 30 to battery. Relay 30 attracts its armature 31 and completes a circuit after a time interval extending from ground on the front contact of armature 31, through the winding of slow-to-pull-ups relay 25 to battery. Relay 25 is slow to energize and also deenergize because of the copper slug on its armature end. Armature 31, it will be noted, has a weight attached to it. This is so that should a series of impulses, instead of one impulse, be sent over the line as would be the case when other pull boxes on the line are operated, this armature would be vibrated in accordance with the energization and deenergization of relay 30 from front contact of armature 17 and impulsing relay 15; and this armature 31 would only come to rest after the impulses have ceased. The weight on the armature is arranged to vibrate it on its front contacts, and not until the circuit for relay 30 has become permanently closed does the vibrations cease.

When this happens relay 25 will slowly energize and at the back contacts of armature 26 open the locking circuit of relay 20 extending over armature 22. Relay 20 thereupon deenergizes and retracts its armatures. At front contact and armature 21 the circuit extending to the stepping magnet 40 is opened and this stepping magnet upon deenergizing closes its armature 41 and also advances the wipers 42 and 43 one step onto the first set of bank contacts. At armature 23 and its front contact the circuit of relay 30 is also opened, and this relay upon deenergizing in turn at its armature 31 opens the

circuit of slow relay 25, which thereupon releases. At front contact and armature 24 the locking ground is removed from the winding of relay 10 extending to armature 11 and this relay deenergizes and at its armature 13 removes direct ground from the line 2 and transfers the line through the alternate contact of armature 12 to relay 5, including this relay in the line again.

At the front contact of armature 24, it will be remembered, slow-release relay 35 had its circuit opened and consequently released its armature slowly. A moment before armature 36 becomes fully restored a circuit is completed extending from ground at armature 24 and its back contact, armature 36 and its front contact, wiper 43 and the bank contact 44 upon which it is now standing to conductor 50, extending to relay 60 of Fig. 2. When the armature 36 has fully restored, ground extending from armature 24 is then extended to the back contact of armature 36, bank contacts upon which wiper 42 is now resting, through the interrupter contacts 41, then to the winding of the stepping magnet 40 to battery. This comprises a self-interrupting stepping circuit for magnet 40 for restoring the switch SS to normal and the stepping magnet 40 alternately energizes and deenergizes due to the opening and closing of its circuit at armature 41. Wipers 42 and 43, accordingly, are stepped in a forward direction until the last contact in the bank of wiper 42 has been reached and the circuit for stepping magnet becomes permanently open. Wipers 42 and 43 are accordingly restored to normal position one step opposite their first set of bank contacts. All the relays comprising the station selector SS have also been restored to normal and the equipment is ready to receive another call from the next pull box in the series on the line LN.

The supervisor at the central office will be aware of the time at which the watchman on the route will operate his first box. He thereby operates his key K1 to start the operation of the timing switch TS. Ground extends from the contact of the key K1, through the winding of relay 100 to battery. Relay 100, upon operating its armatures, at armature 102 completes a locking circuit for itself extending from ground on armature 93 and its back contact on the relay 90 which is associated with the last box on the route, through the armature 102 and its front contact to the relay 100. At armature 101 the time pulse apparatus TP is connected in circuit over back contact and armature 106 through the winding of stepping magnet 110 to battery. This time pulse device TP is arranged to operate the rotary stepping magnet 110 at regular predetermined intervals, for example one minute, and therefore step the wipers 115 and 116 of the timing switch TS over a definite number of bank contacts

between the operation of the successive pull boxes.

Returning now to the operation of the first pull box and the consequent stepping of the switch SS on to its first bank contact 44, and the resultant transmission of the ground from armature 24 over the wiper 43 and the bank contact 44 to the conductor 50; this ground extends to the upper low resistance winding of relay 60, then through the upper low resistance winding of relay 105 to battery. At armature 62 relay 60 completes a locking circuit for itself over its front contact and armature 62 to the back contact and armature 73 to ground on relay 70. At front contact of armature 61 it prepares the circuit for relay 70 which is associated with the next pull box on the watchman's line. At armature 63 ground is also placed on conductor 68 to the relay 100. This ground is for the purpose of taking the place of ground connected from the key K1 in case the supervising officer forgets to operate the key K—1 prior to the operation of the first pull box as has been pointed out.

Referring now to the operation of relay 105, which energized in series with relay 60, at its back contact and armature 106 relay 105 disconnects the timing device TP from the stepping magnet 110 and at back contact and armature 109 disconnects the ground circuit from the wiper 116. At armatures 107 and 108 and their front contacts a locking circuit is completed for relay 105 extending from ground on the bank contacts upon which wiper 115 is resting, to the wiper 115, front contact and armature 108, armature 107 and its front contact, through the high resistance winding of relay 105 to battery. Accordingly relay 105 is locked up to the bank contacts of wiper 115. A branch of this circuit also extends through armature 107, armature 111 and its back contact, through the winding of the stepping magnet 110 to battery. Accordingly the wipers 115 and 116 are further stepped over their bank contacts under control of the stepping magnet 110, this action continuing until the last bank contact with which wiper 115 is associated is reached, and the locking circuit of relay 105 and the stepping circuit of relay 110 becomes open. At armature 106 the time pulse device TP is again connected to the stepping magnet 110.

The watchman on the route next operates the pull box #2 on the line LN, thereby transmitting two impulses under control of the code wheel over conductors 1 and 2 to the station selector SS. Accordingly relay 15 energizes and deenergizes twice to operate the stepping magnet 40 and move the wipers 42 and 43 onto their second bank contacts. The operation of the station selector SS is the same in this instance as when box #1 was operated, with the exception that the arma-

ture 31, associated with relay 30, does not instantly close its front contact to ground because relay 15 was deenergized twice, and only when this relay becomes permanently energized will these contacts become closed. This is so that the release of the switch will be effective. The transmission of a single pulse of current now takes place as before from ground on the armature 24 and its back contact, armature 36 and its front contact, through the wiper 43 and its second bank contact 45, over conductor 51, armature 61 and its front contact, through the upper low resistance winding of relay 70 and the upper winding of relay 105 to battery. Relay 105, upon operating, disconnects the time pulse device TP at its armature 106 and transfers the automatic stepping circuit for the stepping magnet 110 to its armatures 107 and 108, through the wiper 115 to the bank contacts and ground. Accordingly the timing switch TS is automatically stepped to normal position as before, after which relay 105 becomes deenergized and again includes the timing device TP in circuit with stepping magnet 110 to start the automatic timing between the successive pull boxes.

When relay 70 became energized in series with relay 105, at armature 73 and its back contact it disconnected the locking ground for relay 60, and this relay accordingly deenergizes. At front contact and armature 72, relay 70 closes a locking circuit for itself extending to the back contact and armature 83 to ground, on relay 80. For convenience this has been shown connected to relay 80, but it should be understood that this is actually the relay next in succession to relay 70. At front contact and armature 71, relay 70 prepares a circuit for relay 80, which is associated with the pull box #23. It will be understood that there are twenty other pull boxes between pull box #2 and pull box #23 and also twenty relays between relay 70 and relay 80 of similar construction and operation connected to the conductors 3 to 22, inclusive, of the switch SS. The timing switch TS will be operated in a similar manner as before in connection with the operation of all these intermediate relays when they have been operated by their associated pull boxes. Upon the operation of pull box #23 by the watchman, twenty-three impulses will be sent over the line LN, and conductors 1 and 2, to the station selector SS, and accordingly the wipers 42 and 43 are stepped over the bank contacts under control of relay 15 in accordance with these impulses, with wiper 43 now resting on bank contact 46. An impulse of ground from armature 24 is now sent over this wiper and its bank contact 46 as before to the conductor 52, armature 71 and its front contact (which is actually the armature of the relay preceding relay 80), through the winding of relay 80 and relay 105 in

series. At armature 83 relay 80 releases the preceding relay, and at armature and front contact 82 locks itself up from ground on the back contact and armature 92 of relay 90, at front contact and armature 81 prepares the next pull box circuit for relay 90, which in this case is assumed to be the last box on the route or box #24. Relay 105 disconnects the timing device TP from the switch TS and restores it to normal after which the device TP is again inserted to operate the switch in the manner previously described.

When the watchman operates the last box on his route, which in this case is #24, and the station selector SS and the wiper 43 is positioned on the last bank contact 47, the ground impulse is sent over this contact to conductor 53, armature 81 and its front contact, through the upper winding of relay 90 and relay 105 in series to battery. Relay 90 operates its armatures and at front contact of armature 91 completes a locking circuit for itself extending to the back contact and armature 124 to ground on relay 120. At back contact and armature 92 the locking circuit for relay 80 is opened and this relay falls back to open the original energizing circuit of relay 90 at armature 81. At the front contact of armature 92 a circuit is completed extending over conductor 67 to the lamp L in supervisor's equipment which lights up and indicates to the supervisor that the watchman on the line LN has completed his route and has satisfactorily operated all the pull boxes on it in regular succession. At armature and back contact 93 the locking ground for relay 100 extending to armature 102 and its front contact and the winding of relay 100 is disconnected and relay 100 deenergizes and at its armature 101 disconnects the timing device TP from the switch TS. The relay 100, it will be remembered, was originally energized from key K-1 or from armature 63 of relay 60 which was the relay associated with the box #1 on the line. Relay 105, it will be remembered, was energized in series with relay 90, and accordingly, closes the locking circuit for itself at armature 107 to the wiper 115 and at armature 108 completed the circuit for the stepping magnet 110 from the grounded bank contacts to restore the switch TS back to normal position, opposite its first set of bank contacts after which relay 105 is deenergized.

The supervisor, upon noting the illumination of lamp L, which indicates to him that the watchman on the route to which line LN is connected has completed his round of all the pull boxes, will thereupon operate the recording key K2, placing ground on the conductor extending to the front contact and armature 94 of relay 90, thence to the winding of relay 120 through the low resistance non-inductive winding to battery. Accordingly relay 120 becomes energized and at

front contact and armature 122 completes a locking circuit for itself. At the back contact of armature 124 relay 120 removes the locking ground for relay 90 and this relay deenergizes; at front contact of armature 123 ground is sent over conductor 67 to maintain the route lamp L illuminated after the relay 90 has deenergized. At the front contact of armature 121 relay 120 places ground on conductor 64; this conductor, it will be understood, is common to nine other routes accessible to the code switch CS. This ground on conductor 64 extends to the winding of slow-to-pull-up relay 140 through the low resistance to battery. Relay 140 slowly energizes and at the front contact of armature 141 completes a circuit extending to the winding of the stepping magnet 155 to battery. Stepping magnet 155 energizes and opens its armature 156, then remains in this position. At front contact and armature 142 a circuit is completed from ground through the winding of slow-to-pull-up relay 145 through the resistance to battery. Relay 145 slowly energizes and at the front contact of armature 146 places ground on the other side of winding of relay 140, thereby short circuiting it so that it slowly falls back and releases its armatures. At armature 141 the circuit of stepping magnet 155 is opened, allowing this magnet to deenergize to rotate the wipers 160 and 161 on to their first set of bank contacts. At armature 142 and its front contact relay 140 opens the circuit of relay 145 and when this armature is fully restored this relay is also short circuited. In this interval between energization and deenergization of relay 145 a circuit is completed by it extending from the back contact and ground of armature 154, armature 147 and its front contact, through the winding of the printing register PR to battery. The printing register PR energizes and attracts its armature once to make an indentation on the roll of paper to indicate to the supervisor at some later period of the time and number of the route. When relay 145 deenergizes it opens the circuit of the register which thereupon releases.

It will be recalled that the code switch CS was stepped on to its first set of contacts, with wiper 161 resting on bank contact 162, this action having taken place at the time of the energization and deenergization of the stepping magnet 155. At the time that relay 120 became energized it caused its armature 124 to be attracted and placed ground on this armature onto conductor 66 which is connected to the first bank contact 162 of the code switch CS. This ground now extends from the bank contact 162 over wiper 161, to the alternate contacts of armature 152, through the winding of slow release relay 150 to battery. Relay 150, upon energizing, locks itself up from its front contact and armature

152, while at the same time it disconnects itself from its original energizing circuit from the wiper 161 and remains locked up to the circuit extending through its front contact and armature 151 to the wiper 160 and the first bank contact to ground. At armature 154 the circuit for printing magnet PR is disconnected by relay 150, and at the front contact of armature 153 ground is placed on conductor 65 which is common to nine other routes. A branch of the locking circuit of relay 150 extends from ground on the bank contact of the code switch, wiper 160, armature and front contact 151, back contact and armature 156, through the winding of stepping magnet 155 to battery. Each time the stepping magnet 155 energizes it opens the contact 156, thereby interrupting its own circuit, and each time it deenergizes it drives the wipers 160 and 161 in a forward direction over the bank contacts. When the bank contact 163 in the bank of wiper 160 has been reached, the circuit for the stepping magnet 155 and also the locking circuit for relay 150 is interrupted and these relays accordingly deenergize.

Wiper 160 is now resting on bank contact 163 and wiper 161 on bank contact 164. This position, it will be noted, is approximately in the center of the bank contact field and the purpose of this arrangement is to make it unnecessary for the code switch CS to be rotated all the way back to its original normal position, as the bank contact adjacent to contact 164 has the conductor connected with it that is also multiplied with the conductor attached to bank contact 162. All the other conductors leading to other routes are also multiplied with their associated conductors in the first half of the contact field.

It will be remembered that when relay 150 became energized it closed ground from armature 153 onto conductor 65 to the relay 120. This ground therefore places a short circuit around the winding of relay 120 and it deenergizes and restores its armatures. At the back contact of armature 122 relay 120 extinguishes the route lamp L, and the supervisor noting this condition thereupon restores his key K2. At the front contact of armature 121 ground is removed from conductor 64 to prevent relay 140 from again energizing, this relay having been previously short circuited by relay 145, while relay 145 is short circuited and deenergized by relay 140 at the alternate contacts of armature 142.

The foregoing describes the operation of the apparatus when a watchman successfully completes his round on the line LN and when the number of the line has been noted by the supervisor on the lamp L and it has also been registered on the punch register PR. A description of the operation of the system will now be given of an instance wherein the watchman fails to operate a pull

box during the time interval allotted between boxes or fails to operate the pull boxes in regular succession.

It will be remembered that the relays 60 to 90, inclusive, were responsive to the successive operation of the pull boxes 1 to 24, inclusive, and that the time pulse device TP operated to step the timing switch TS over its bank contacts a certain distance at definite time intervals after the operation of one pull box and before the operation of the succeeding box on the line. Each time the watchman has operated one of his pull boxes and energized the associated relays 60, 70, 80, or 90, inclusive, depending on which pull box was operated, the relay 105 became energized to disconnect the time pulse TP and substitute therefor an automatic stepping circuit for the rotary stepping relay 110 to rotate the wipers of the timing switch TP over their bank contacts until its normal position has been reached or the last contact in the bank. Should it happen now that the watchman operates one of his pull boxes and fails, after a definite time interval determined by the timing switch TP, to operate the succeeding pull box, the timing switch TS will have advanced its wipers 115 and 116 under control of the timing pulse TP over its bank contacts to a position where the wiper 116 reaches its bank contact 117. In this case relay 105 will not have been operated by the succeeding pull box and there will be a circuit completed extending from the back contact and armature 109 of relay 105, wiper 116, bank contact 117 upon which it is now resting, through the winding of relay 125 to battery. Relay 125, upon operating, completes a locking circuit for itself independent of the bank contact 117 and wiper 116, over a circuit extending from the back contact of armature 109, armature 126 and its front contact, through the winding to battery. The timing switch TS continues to step its wipers over its bank contacts until such time as the pull box which should have been operated is operated.

As a further result of the energization of relay 125 a circuit is completed extending from ground on the front contact of armature 127, through the winding of slow-to-pull-up relay 130, through the resistance to battery. Relay 130, upon operating, at armature 131 and its front contact closes ground through the winding of slow-to-pull-up relay 135 through the resistance to battery. Relay 135, upon operating after a slight interval closes its armature 136 to one side of the winding of relay 130, thereby short circuiting this relay, which after a time interval restores its armature. The resistances in circuit of the slow operating relays 130 and 135, it may be stated, are for the purpose of preventing a direct short circuit of the battery when these relays short circuit each other. When

it first became energized relay 130 closed a circuit from ground on the front contact of armature 132, armature 128 and its front contact on relay 125, conductor 67, through the route lamp L to battery. The lamp L becomes illuminated and due to the successive energization and deenergization of relays 130 and 135 which operate alternately, lamp L is accordingly flashed on and off; this being an emergency indication to the supervisor that the watchman has failed to pull his next pull box in the time allotted to him and that there is a possibility that the watchman may be in trouble of some nature, and therefore requires immediate assistance.

The timing switch TS, after having reached bank contact 117 with its wiper 116, continues to advance its wipers until wiper 116 reaches the bank contact 119, this action taking place a slight interval after the flashing of the lamp L, for example, five minutes or so. Conductor 118 attached to bank contact 119 may be arranged to extend to a distant police station, so that aid may be furnished to the watchman independent of any action of the supervisor. The above flashing operation of the lamp L will continue to take place until the watchman has the trouble rectified and then operates a pull box that in the first place should have been operated. The operation of this pull box will then operate the associated chain relay and relay 105. Relay 105, at armature 109 then interrupts the locking circuit for relay 125 extending over armature 126, and at its armatures 107 and 108 locks itself up and completes the circuit for the stepping magnet 110 so that the timing switch TS can be restored to normal position. When the last bank contact of the switch has been reached the circuit for relay 105 is opened and this relay restores and inserts the timing device TP in circuit to control the switch TS. The deenergization of relay 125 causes the armature 127 to open the circuit for relay 130, and relay 130 upon restoring causes armature 131 to short circuit relay 135 which also falls back. The circuit for flashing the route lamp L is thereby opened at armatures 128 and 132, and the equipment has been restored to its normal means of operation.

Referring now to the operation of the code switch CS, it will be noted that the bank contacts through which wiper 161 has access are connected to nine other routes similar to routes connected with line LN. As this line LN has been the first route connected to this bank contact only one impulse will have been sent to the printing magnet PR. If this had been another route the code switch CS would have been connected over conductors 64 and 65 from similar apparatus such as the switch TS and associated relays, and the associated conductor 66 would have been grounded to the bank contacts. If the fourth bank con-

tact had been grounded by route #4 the printing magnet would have been operated four times to permanently register the number of this route. The last half of the bank contacts are multiplied with the first half of the bank contacts in order that the code switch CS would not have been unnecessarily operated.

It will be noted that the station selector SS and the code switch CS, after having been operated each time automatically restore their wipers back to normal position. The time switch TS operates in a different manner under the control of the relay 105 to restore it to normal. The twenty-four chain relays from 60 to 90, inclusive, it will be understood, must be operated in regular succession. The operation of one relay always preparing the circuit of the succeeding relay which is operated by the succeeding pull box and these relays must be operated in regular order by the watchman. Should the watchman fail to operate the pull box which is the next one on the route, the flashing of the lamp L indicates to the supervisor this condition which is brought about by the operation of the timing switch TS and the relay 125.

Referring now to the operation of the station selector SS, Fig. 1, it will be remembered that relay 5 is permanently energized over the loop circuit over conductors 1 and 2 of line LN in series with the relay 15. In case it should accidentally happen that the line LN became grounded, or a break occur somewhere between any of the stations or any where along the line, relay 5 deenergizes from the grounded line while relays 5 and 15 deenergize when a break occurs. In any event relay 5 deenergizes and releases its armature 6. A circuit is thereby completed extending from ground on armature 6 and its back contact, conductor 54, through the alarm lamp L' to battery. This lamp L' is associated with keys K1 and K2 and the lamp L at the supervisor's equipment. These keys and lamps are individual to the line LN and, it will be understood of course, that there may be any number of these positions and lines similarly equipped extending to this supervisor's position. The illumination of lamp L' will inform the supervisor of the condition of the line and that it is not in its normal condition.

In case the line be open it would obviously be impossible to transmit a signal from any of the pull boxes to the station selector SS. However, should the line be merely grounded it is possible to operate the pull boxes on this line to transmit their codes, through the medium of the cord circuit E. The supervisor will insert the plug P2 into the jack J2 and plug P1 into jack J1. Relays 3 and 4 will thereupon both energize from the ground on the line LN and operate their armatures 7 and 8, thereby completing a loop circuit extending

over the line from plug P' and jack J' and, conductors 1 and 2, so that relays 5 and 15 of the station selector SS will again be energized in series with each other. Relay 5 will remain energized while relay 15 will energize and deenergize in consequence of the impulses. If the ground exists somewhere between stations No. 2 and No. 23, for example, and the watchman then operates station No. 2, relay 3 will be energized and deenergized by the ground impulses from the code impulse springs of station No. 2, while relay 4 will remain in an energized condition at this time. When station No. 23, however, is operated, relay 3 will be energized permanently from the ground on the line and close armature 7, while relay 4 will follow the grounded impulses from the code impulse springs of station No. 23, and at its armature 8 repeats the impulses as loop impulses by way of armature 7, plug P', and jack J' to the lines 1 and 2. The inclusion of the cord circuit E in the line loop over conductors 1 and 2 is for the purpose of forming an auxiliary line circuit so that relay 5 will again become energized instead of short circuited from the ground over the line LN, and consequently close its armature 6 on its front contact so that the ground from this armature will control the operation of the switch SS.

It will be appreciated that the number of pull boxes on the line is not limited to twenty-four as illustrated, but may be increased to any number desired. The station selector SS may have its bank contacts similarly increased to accommodate more stations, if desired. Other relays such as 60 may be added between relays 60 and 90. The time interval between the operation of the successive pull boxes may also be suitably altered by governing the rotation of the timing device TP while the timing switch TS may have its bank contacts increased any desired amount or the conductor upon which the contact 117 is attached may be connected to any one of the bank contacts, either closer or farther away from the normal position of the wiper 116.

The code switch CS can likewise have its bank contacts increased to accommodate any number of routes or lines, such as LN, in this instance only ten routes having been shown. In case the number of routes is increased it is not necessary to supply more printing registers as the punch register PR will serve for an unlimited number of routes. A considerable saving of equipment is thereby effected.

From the foregoing it will be appreciated that a new type of watchman's service system has been devised which relieves the supervisor of a great many duties during the normal operation of the system and which gives immediate warning if a predetermined time interval is exceeded between any two successive stations which a watchmen must operate in regular sequence. The number of punch reg-

isters usually required at the central office is reduced to one which serves for any number of watchman's routes. Continuous supervision of the line is maintained and an immediate alarm is sent in in the event of a ground or an open circuit; and if grounded the line can be put back into service by means of the emergency cord circuit E.

It will be appreciated that the invention, as illustrated in the drawings, is applicable to any other kind of systems, such as fire alarm or similar signalling systems and is not to be understood to be limited to the precise structure illustrated, as there may be any number of modifications made of the invention by those skilled in the art, and applicant therefore does not desire to be limited to the exact embodiment illustrated and described, but only by the extent of the appended claims.

What is claimed is:

1. In a watchman's supervisory system, a line extending to a central office and terminating in an automatic selector switch, a plurality of watchman's stations arranged in series relationship on said line, each one having means adapted to send out a distinctive series of impulses characteristic of that particular station, a slow operating relay and a fast operating relay in said switch normally energized in series with each other and all the stations on the line, means responsive to an abnormal condition on said line for operating said slow relay to give an indication of said condition, means responsive to the operation of one of said stations for operating said fast relay and maintain said slow relay operated during the transmission of impulses, means responsive to the first operation of said fast relay for disconnecting said slow acting relay from said line and maintaining it energized over a local circuit while at the same time said fast relay is energized in series over said line exclusive of said slow relay signalling means connected to said switch, means under control of said fast operating relay for controlling the wipers of said switch in accordance with the impulses received from said operating station to operate said signalling means, and means responsive to the cessation of impulses from said station for automatically restoring said switch to normal position and again energizing said slow and said fast relay in series with each other over said line.

2. In a watchman's supervisory system, a line extending to a central office and terminating in an automatic selector switch, a plurality of watchman's stations on said line connected in series and each having means adapted to send a particular series of impulses over said line characteristic of said station, a slow operating relay and a fast operating relay normally energized in series over said line with all of said stations, means responsive to an abnormal condition on said

line for operating said slow relay to give an indication of said condition, means responsive to impulses from one of said stations for operating said fast relay, means responsive to the initial operation of said fast relay for disconnecting said slow relay from said line and for connecting it to an independent circuit, signalling means connected to said switch, means controlled by said fast operating relay for stepping the wipers of said switch over the back contacts according to said impulses to connect with said signalling means, means responsive to the cessation of said impulses from said operating station for again energizing said fast operating relay and said slow operating relay in series, and controlling a further circuit for rotating the wipers of said switch back to their normal position, and means when said impulses cease for effecting the transmission of current over said wipers to operate said signalling means for effecting the supervision of said operating station.

3. In a watchman's service system, a line extending to a central office and terminating in an automatic selector switch, signalling means connected to said switch, a plurality of serially connected watchman's stations on said line, a pair of relays at said station normally energized in series over said line through all of said stations, means responsive to impulses transmitted over a loop circuit from any station on said line for operating one of said relays to position said switch on said signalling means, means responsive to an abnormal condition on said line for operating the other of said relays to give an indication of said condition, emergency equipment normally disconnected from said line but adapted to be manually connected thereto in case said line becomes grounded, means responsive to the transmission of impulses from said ground over said line for operating said emergency equipment, and means responsive to the operation of said emergency equipment for controlling said relays over a loop circuit.

4. In a watchman's supervisory system, an automatic selector switch, signalling means controlled by said switch, a line extending to a central office and terminating in a pair of normally energized relays in said switch, watchman's stations on said line connected in series relationship with said relays, means responsive to an abnormal condition on said line for operating one of said relays to give an indication of said condition, means responsive to the transmission of impulses from one of said stations over said line for operating the other of said relays to control said switch in accordance with said impulses to operate said signalling means, emergency operating equipment adapted to be manually connected to said line in case said line becomes grounded, means responsive to im-

pulses from said grounded line from one of said stations for operating said connected emergency equipment for translating said grounded impulses into loop impulses in said line circuit to operate the other of said relays to control the operation of said switch.

5. In a watchman's supervisory system, a line extending to a central office and terminating in an automatic selector switch, signalling means operated by said switch, watchman's signalling stations on said line, each having means adapted to send a particular series of impulses characteristic of that station over said line, a slow operating relay and a fast operating relay normally energized in series over said line and through all of said stations, said fast operating relay being rendered operative by said impulses while said slow operating relay is not, means controlled by said fast operating relay for operating said switch to operate said signalling means, emergency equipment adapted to be manually connected to said line, means responsive to the grounding of said line whereby said slow operating relay deenergizes and gives an indication of said grounded condition, and means responsive to the connecting of said emergency equipment on said line for operating said emergency equipment from said grounded line to translate said ground impulses into loop impulses over said line to effect the normal operation of said relays.

6. In a signalling system, a line extending to a central office and terminating in an automatic selector switch, signalling stations on said line each having means for progressively operating said switch onto a different one of its bank contacts, a group of relays one for each station and each controlled by the preceding relay and connected in successive order to consecutive ones of said bank contacts, means responsive to the operative means at the first of said stations for operating said switch onto a bank contact to operate the first of said relays, means responsive to the operative means at the succeeding stations in consecutive order for operating the succeeding relays one after another, signalling means controlled by said relays, and means responsive to the operation of the last of said relays for operating said signalling means.

7. In a signalling system, a line extending to a central office and terminating in an automatic selector switch, signalling stations on said line controlled in consecutive order each having means for progressively operating said switch to a position corresponding to the station, a group of relays one for each station and each controlled by the preceding relay and connected in consecutive order to the corresponding different positions of said switch associated with the different stations, means responsive to the operative means at said stations in consecutive order for positioning said switch and operating said relays in suc-

cessive order, signalling means controlled by said relays, and means responsive to the operation of all of said relays in succession for operating the signalling means.

8. In a watchman's supervisory system, a watchman's route comprising a line extending to a central office and terminating in an automatic selector switch, watchman's signalling stations on said line arranged in consecutive order and each having signal-transmitting means for operating said switch to a different one of its bank contacts, a group of relays one for each station on said line, each relay controlled by a preceding relay and each connected to different bank contacts of the switch in consecutive order, a signal controlled by said relays, means responsive to the transmitting means at each of said stations in the prescribed order for operating the relays in succession and responsive to the last station for operating the last relay to operate said signal in a particular manner to give an indication that the watchman has completed his route, and means responsive to the failure of the watchman to operate the stations in consecutive order and the consequent failure of the operation of said relays in consecutive order for operating said alarm signal in a different manner.

9. In a watchman's service system, a line extending to a central supervisor's office and terminating in an automatic selector switch, watchman's signalling stations on said line arranged thereon in a predetermined order and each having means for operating said switch to a different one of its positions, a group of relays one for each station and each connected to a different position of the switch corresponding to the station and each controlled by the preceding relay, an alarm signal at said office controlled by said relays, means responsive to the operative means from each station in succession for operating said switch to operate the corresponding relays one after the other and responsive to the last station for operating the last relay to control said alarm signal in a certain manner to inform the supervisor that the watchman has operated all the stations on the line in the predetermined order, and means controlled by any of said relays in the event the watchman fails to operate the stations in predetermined order for operating said alarm signal in a different manner.

10. In a watchman's service system, a line extending to a central supervisor's office and terminating in an automatic selector switch, watchman's signalling stations on said line arranged in a predetermined order and each having means for operating said switch to a different position, a group of relays one for each station connected to the different positions of said switch corresponding to the stations and each controlled by the preceding

relays, an alarm signal at said office controlled by said relays, means responsive to the operative means at each of said stations in the predetermined order for operating the corresponding relays one after the other and responsive to the last station for operating the last relay to control said alarm signal in a certain manner to inform the supervisor that the watchman has operated all of the stations on line, and means controlled by any of said relays when the watchman fails to operate the corresponding station for operating said signal in a different manner.

In witness whereof, I hereunto subscribe my name.

CLARENCE E. LOMAX.

In witness whereof, I hereunto subscribe my name.

OSCAR C. LEVY.