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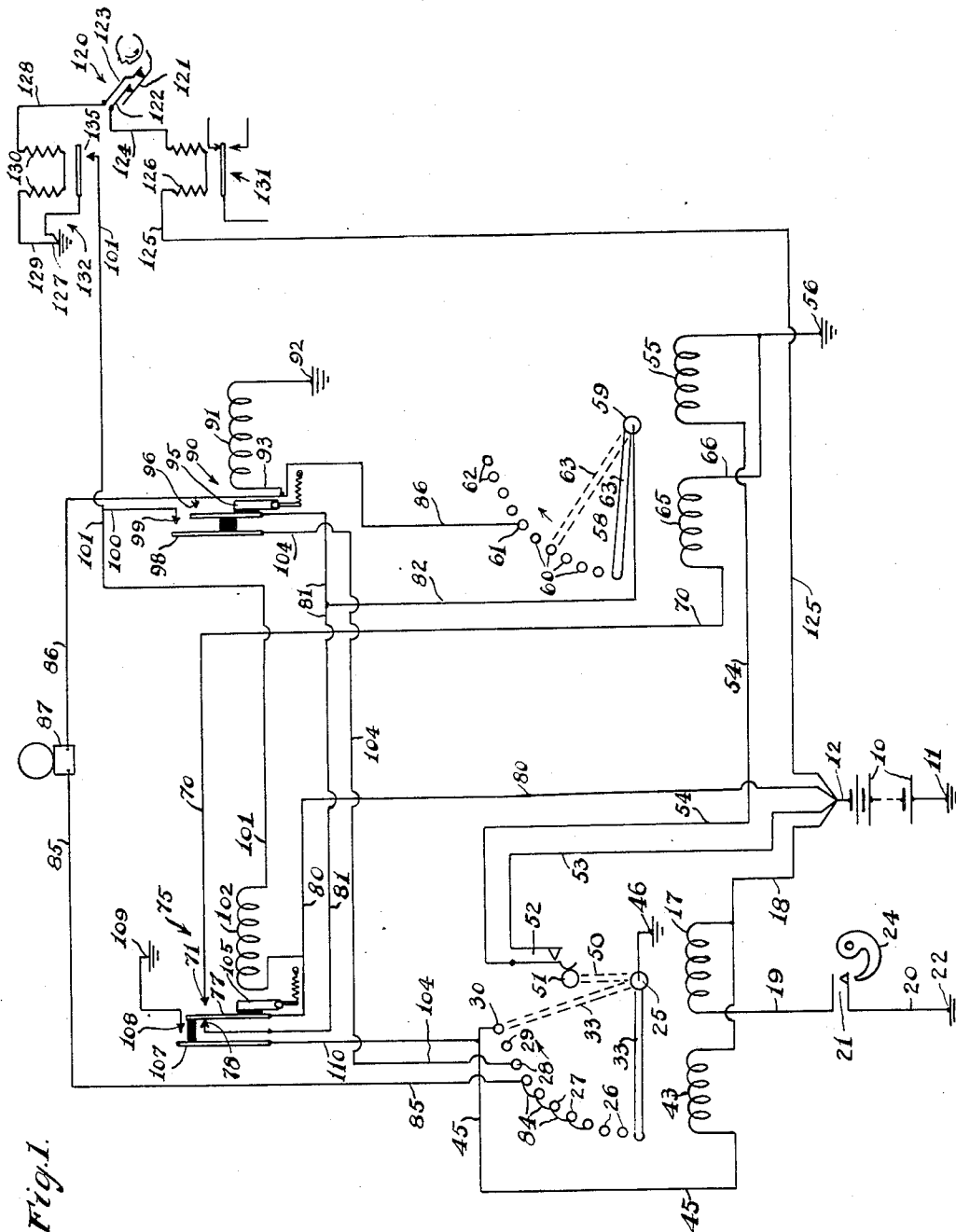
R. M. HOPKINS

1,942,814

DELINQUENCY INDICATOR OF FLYBACK TYPE

Filed June 21, 1930

3 Sheets-Sheet 1



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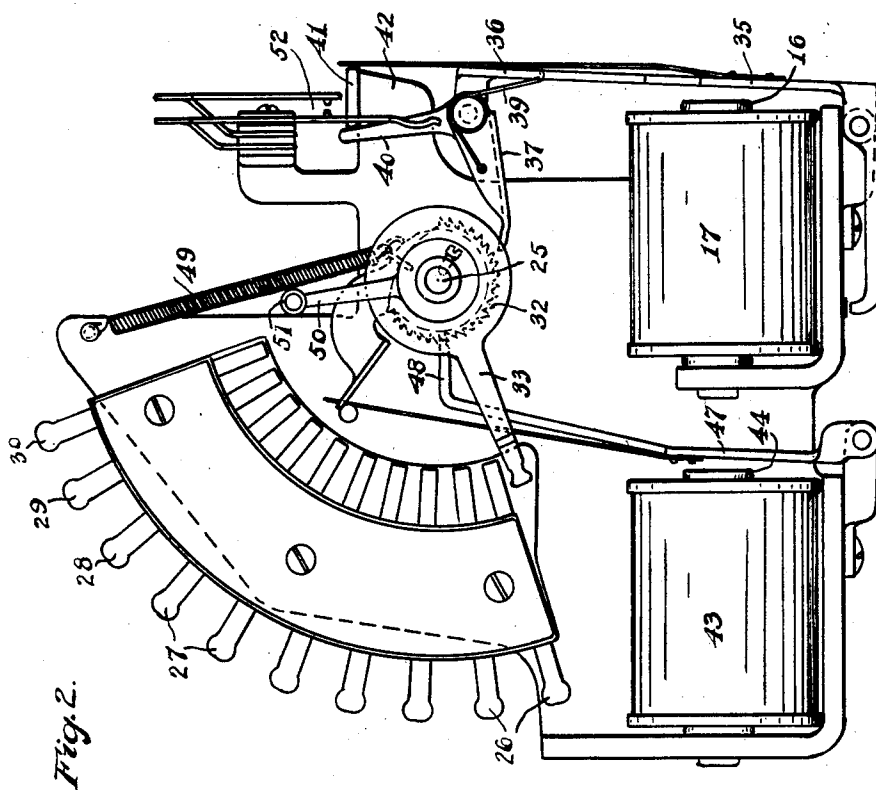
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DELINQUENCY INDICATOR OF FLYBACK TYPE

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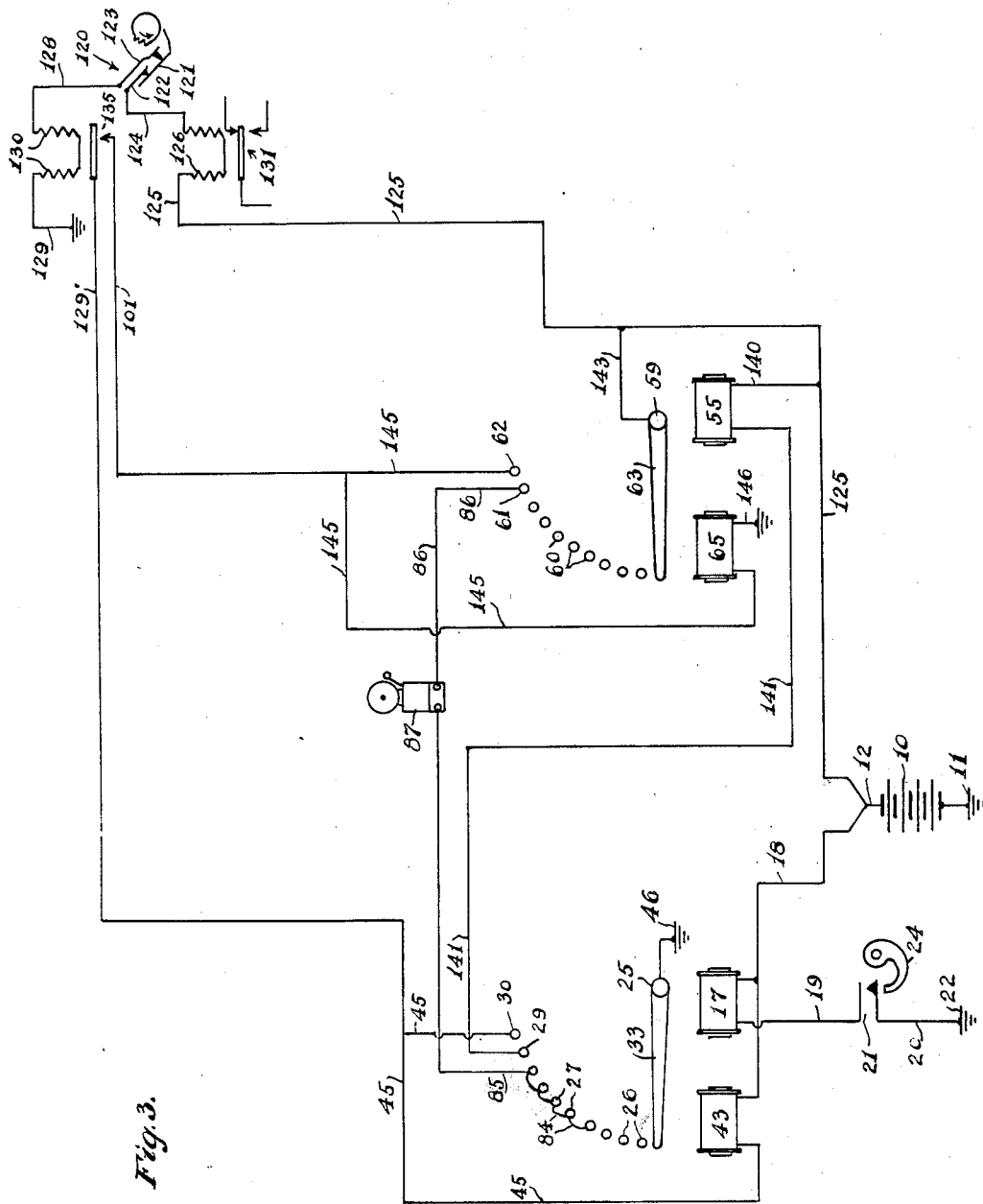


Fig. 3.

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DELINQUENCY INDICATOR OF FLYBACK
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Application June 21, 1930. Serial No. 462,827

18 Claims. (Cl. 161—20)

This invention relates to delinquency indicators, and is intended primarily for use in connection with night-watchman supervisory systems of the kind in which signals are sent to a distant or local central or head watchman's office, the function of such indicators being to sound a signal device in case the watchman does not start his rounds within a predetermined period of time or permits more than a predetermined period of time to elapse between rounds or between signals sent from watchman's stations.

It is noted, however, that the invention is not limited to delinquency or signal devices or to electrical devices.

One object of the invention is to provide a conveniently operated electrical apparatus of this kind suitable for operation from time clock systems and for installation in connection with signal systems already in use.

Another object of the invention is to provide an apparatus which may be made up wholly or in part of stock parts already on the market.

Another object of the invention is to provide an apparatus of this kind which is adjustable for periods of different length.

Other objects of the invention are to improve generally the simplicity and efficiency of such apparatus and to provide a device or apparatus of this kind which is economical, durable and reliable in operation, and economical to manufacture.

Still other objects of the invention will appear as the description proceeds; and while herein details of the invention are described and claimed, the invention is not limited to these, since many and various changes may be made without departing from the scope of the invention as claimed in the broader claims.

The inventive features for the accomplishment of these and other objects are shown here in connection with an improved delinquency signal apparatus, which, briefly stated, includes a primary selector comprising means whereby a primary arm is continually slowly advanced by steps to its limit of movement and then automatically restored; a means to automatically advance a secondary arm a step each time said primary arm substantially reaches said limit; and a signal device automatically operated each time both arms have reached certain respective predetermined points of their travel.

Reset means automatically restore both arms after said signal device is operated; but a watchman's transmitting station is provided for at will operating the reset means to restore both arms

before the signal device is operated, thereby to prevent the signal.

While in this specification and claims mention is made of delinquency alarms, signal devices and contact arms and it is stated that one part is moved relative to the other rather than vice versa, it is understood that this is for designation and description and that for purposes of protection the language is to be construed broadly enough to cover other equivalent means and devices in other relative arrangements, and in general all terms of the claims are to be given broad interpretation when necessary for purposes of protection.

In the accompanying drawings showing, by way of example, two of many possible embodiments of the invention,

Fig. 1 is a diagram of one form of apparatus; Fig. 2 is a side elevation of the primary selector; and Fig. 3 is a diagram of another form of apparatus.

The parts of the apparatus of Fig. 1 and their functions will first be very briefly indicated after which the parts will be described in detail.

The apparatus comprises a bank of spaced primary contacts 26 to 30, a primary contact arm 33 successively engageable with said contacts, and means 10, 17, 21, 22, 35 (Fig. 2) 37, 32 whereby said member is advanced, in the direction of the arrow, one contact every minute, until the arm 33 reaches the contact 30 and is restored by means 43, 47, 48.

An actuating switch 52 is closed by a member 50 before the last contact 30 is reached; and this actuates means 55 in circuit with said switch, which serve, each time said switch is closed, to advance a secondary arm 63 one contact along a secondary bank of contacts 60, 61, 62. Thus the contact arm 63 is moved one contact each time the arm 33 makes a complete excursion of ten minutes duration.

The apparatus also comprises a normally de-energized reset relay 75 including a reset solenoid 102 and a normally closed switch 77, 78; means 84 electrically connecting adjacent intermediate primary contacts 27 to provide a group of signal contacts, and signal circuit means 80, 81, 82, 86, 85 connecting, in series circuit, said normally closed switch 77, 78, the secondary arm 63 and a predetermined secondary contact 61 when by the secondary arm, a signal alarm device 87, and said group when engaged by said arm 33, whereby current may pass through and operate the signal alarm device 87.

A locking-in relay 90 is locked-in when the contact 61 is engaged and the normally closed switch is closed; and a switch 98, 99 is closed by said locking-in relay so that when the primary contact 28 next above said group is engaged by the primary arm after the signal device is operated, current may pass through conductors 80, 102, 101, 100, members 98, 99, conductor 104 and arm 33 to energize the reset relay 102 to cause it to close the switch 77, 71 to energize reset coil 65 and restore the secondary arm 63 and release the locking-in relay 90. At the same time, the switch 107, 108 closed by the reset relay 75 causes current through the coil 43 to restore the primary arm 33. The watchman's station 120 provides means for at will energizing the reset relay 75 to restore both arms 33, 63 by the operation of the relay 75 as just explained.

Now the apparatus will be described in detail.

Step-by-step mechanism

The improved delinquency alarm apparatus is shown as operated from a source of current 10 having a grounded terminal 11 and an ungrounded terminal 12.

A primary step-by-step selector mechanism comprises an advance magnet 16 (Fig. 2) having an advance coil 17 connected by conductors 18, 19, 20 in series with a normally open, periodically closed switch 21 between said ungrounded terminal 12 and a ground 22, whereby when said contact switch is closed the advance magnet is energized. The switch 21 is conventionally shown as provided with a closing means 24 which may be controlled by the master clock of a time clock system.

Primary selector

A shaft 25 coaxial with an arcuately arranged bank of insulated closely spaced primary selector switch contacts 26, 27, 28, 29, 30, carries thereon a ratchet 32 and a grounded contact arm 33, the arm 33 being engageable with said contacts. A pivoted armature 35 attracted by said advance magnet carries an operating arm 36 carrying pivoted pawl 37, engageable with, and normally disengaged from said ratchet, whereby when said contact arm is moved from one contact to the next each time said magnet is energized. The pawl 37 is pressed toward the ratchet by the spring 39 except when the arm 40 carried by the pawl is engaged by the lug 41 carried by the frame 42.

Primary reset means

A primary reset magnet coil 43 of the magnet 44 is connected by conductors 18, 45 in series between said last primary contact 30 and the ungrounded terminal 12 whereby when the last contact 30 is engaged by the arm 33, current passes through the reset coil 43, conductor 45 and said arm 33 to a ground 46 and energizes the reset coil 43.

A pivoted armature 47 attracted by the reset magnet 44 carries a detent pawl 48, and is adapted to disengage the latter from the ratchet 32 to cause the arm to fly back under the action of a spring 49 to zero position.

Secondary selector actuating switch

An actuating arm 50 carried with said contact arm 33 carries an insulating head 51 engageable

with a normally open actuating switch 52, closed by said head just before the last contact 30 is reached by the arm. Said switch has one element connected by a conductor 53 to said ungrounded terminal 12 and the other by a conductor 54 to the coil 55 of a secondary selector advance magnet, whereby said coil is connected in series between said switch and a ground 56, whereby when the switch 52 is closed, the coil 55 is energized.

Secondary selector switch

Said coil 55 is a part of a secondary selector switch 58, similar to that of Fig. 2. Said secondary switch comprises a shaft 59 rotatable coaxially with an arcuately arranged bank of insulated closely spaced secondary selector switch contacts 60, 61, 62. Said shaft carries a ratchet and a contact arm 63 as in Fig. 2, the arm being engageable with said contacts 60, 61, 62. A pivoted armature is attracted by said advance magnet when the coil 55 is energized, carries an operating arm carrying a pivotal pawl, engageable with, and normally disengaged from said ratchet, whereby said contact arm is moved from one contact to the next each time said magnet is energized.

Secondary reset means

A spring tends to restore the contact arm; and a detent pawl engaging the ratchet and normally holds the arms against retrograde movement, in the same manner as is shown in Fig. 2.

A secondary reset magnet coil 65 associated with the secondary bank and has one end connected by a conductor 66 to the ground 56 and the other end connected by a conductor 70 to said normally unengaged contact 71 later to be described.

An armature attracted secondary reset magnet similar to the magnet 44 carries to the secondary detent, whereby when said reset and secondary magnets are energized, the secondary arm is released and restored.

Reset relay

A reset relay 75 comprises an electro-magnet 76, an armature and a double throw switch 71, 77, 78 controlled by said armature and having a movable element 77 and a normally engaged contact 78 and a normally disengaged contact 71, the movable element 77 being connected by a conductor 80, to said ungrounded terminal 12. Conductors 81, 82 connect the normally engaged contact 78 to the secondary arm 63, whereby the secondary arm is normally charged.

The signal alarm circuit

Conductors 84 connect together a group of intermediate contacts 27 of the primary bank to form signal contacts; and signal conductors 85, 86 connect a bell or other signal device 87 in series between said group and a predetermined signal contact 61 of the secondary bank, whereby when the primary arm is being stepped up and the arms respectively engage one of said group 27 and the signal contact 61, current passes through the conductor 80, the element 77, said normally engaged contact 73, conductor 81, the secondary arm 63, conductor 86, said signal device 87 conductor 85, one of said group 27, 27, the primary arm 33 and ground 46, thus sounding the alarm so long as one of said group 27, 27 is engaged by

the primary arm. Obviously the invention is not limited to a single signal device.

Locking-in relay

5 A locking-in relay 90 has one end of its magnet coil 91 grounded as at 92, and the other end connected as at 93 to said alarm circuit, whereby the coil 91 becomes energized when the arm 63 engages the contact 61. When the magnet coil 10 91 is energized, an armature 95 is attracted, closing the normally open locking-in switch 96, thus permitting current to flow through conductors 80, 81, the switch 96, conductor 86, coil 91 and ground 92 to lock-in the switch 96 and also the reset 15 switch 98, 99.

Automatic reset means

The reset switch 98, 99 has one element 99 connected by conductors 100, 101 to the reset coil 20 102 of the relay 75 and the other element 98 connected by a conductor 104 to the primary bank contact 28 next above said group 27, whereby when the primary arm reaches such contact 28, the reset relay coil 102 is energized, the ar- 25 mature 105 is attracted and the movable element 77 of the double throw switch is engaged with said normally unengaged contact 71 thus permitting current to flow through conductor 81, switch elements 77, 71, conductor 70, reset coil 65 30 and ground 56, to restore the secondary arm 63.

At the same time, a primary reset switch 107, 108 is closed by said reset relay. This switch has one element 108 grounded as at 109, the other element 107 being operated by the armature 105 35 and connected by conductors 110, 45 to the end of the primary reset coil 43 remote from the battery, whereby when the reset relay coil 102 is energized, current passes through conductor 18, coil 43, conductors 45, 110, switch 107, 108 and 40 ground 109, and the primary arm is restored.

Watchman's transmitting station

If the watchman is properly in attendance he will prevent the sounding of the signal device 87, 45 by operating a watchman's station 120 comprising signal transmitter having a normally closed signal-wheel-operated switch 121, 122, 123 having an element 122 connected through conductors 124, 125 and solenoids 126 to said un- 50 grounded current-source terminal 12, and the other element 123 grounded as at 127 through conductors 128, 129 and solenoids 130.

A pair of relays 131, 132 have their solenoids interposed in circuit with said switch as just explained, the relay 131 controlling a distant alarm or central station signal, the other relay 132 comprising a normally open switch 135 adapted to be closed when the relay magnet is deenergized and having its elements respectively grounded as at 60 127 and connected by the conductor 101 to said reset relay coil 102, whereby when the station 120 is operated the reset relay coil 102 is energized and said primary and secondary reset coils 43 and 65 energized and the primary and secondary arms 33, 63 restored, as above explained.

Obviously any number of stations 120 may be used.

The operation of the apparatus

75 The apparatus, as explained previously, is arranged to be operated from a master clock sending out minute impulses which operate the contact device 21, and if the watchman fails to operate the station 120, an alarm will be sounded 15 after a certain predetermined period. If, how-

ever, the watchman operates a station within this predetermined period, the delinquency indicator is automatically restored to its normal condition and will not be permitted to reach the alarm position as long as these boxes are pulled within the designated period. 80

The operation of the minute impulse 24 closes the switch 21 energizing the advance coil 17 of the primary selector, the circuit being through terminal 12 of the current source to the ground 22. 85 Each time this coil 17 is energized, the primary contact arm 33 is advanced one step. After the arm 33 is advanced ten, for instance, steps, the head 51 closes the switch 52 which energizes secondary advance coil 55 advancing the secondary 90 arm 63 one step. It will be noted that the head 51 closes the switch 52 before the arm 33 reaches the contact 30. This is to make sure that the coil 55 shall operate the arm 63 before the circuit 18, 43, 45, 33, 46 which is made through the con- 95 tact 30 and arm 33 operates reset coil 43 to release the pawl 48 and cause the arm 33 to fly back to its initial position.

As shown in the drawings, it will be noted that the contact 61 of the secondary selector is engaged after the arm 63 has made seven steps. This contact 61 is connected through conductors 84, 85, 86 and the signal device 87 to the group of contacts 27 of the primary selector. This con- 100 tact 61 is also connected by the conductor 86 to the coil 91 of the relay 90, which will lock-in by the closing of the switch 96, after the relay 90 has been energized as the arm 63 contacts said contact 61. 105

In view of the above it will be noted that the 110 arm 33 advances one contact every minute, and that the arm 63 therefore advances one contact every ten minutes, and will reach the contact 61 after an interval of seventy minutes. Of course, the primary and secondary banks could have more 115 or fewer contacts, or conductors 45, 85, 86 and 104 could be connected to other contacts, thus giving an entirely different interval. However, as shown, after this seventy minute period four more minute impulses transmitted to arm 33 will then 120 complete the signal circuit, which may be traced from the terminal through conductor 80, relay contacts 77, 78, conductors 81, 82, arm 63, conductor 86, signal device 87, conductor 85, contacts 84, arm 33, to ground 46. This would cause the sig- 125 nal device 87 to sound for a period of five minutes if, as shown, five contacts 27 are grouped.

When the arm 33 moves from contact 27 to contact 28 it opens the circuit to the signal device and closes the circuit which may be traced from 130 ground 46, through arm 33 contact 28, conductor 104, switch elements 98, 99, conductors 100, 101, coil 102, conductor 80, to current-source 12, to ground. This energizes reset relay 75, closing switch 107, 108 and transposing switch element 135 77. This makes a circuit from current source through conductor 80, element 77, contact 71, conductor 70, reset coil 65 to ground 56, which restores the arm 63 to initial position, and breaks the circuit, which, through switch elements 77, 78, 140 conductor 81 and switch 96 kept the relay 90 energized. A circuit through 107, 108 may now be traced from ground 109, through conductors 110, 45, reset coil 43, conductor 18, current-source to ground 11, thus restoring the arm 33 to its 145 initial position.

Should the watchman's station 120 be operated before the predetermined alarm period, a circuit will be established from the current-source through conductor 80, coil 102, switch 135 to 150

ground reset relay 132, thus energizing reset relay 75, causing a circuit from current-source 12, through switch elements 77, 71, conductor 70, reset coil 65 to ground 56, thus restoring arm 63 to its initial position. Another circuit through switch 107, 108 will energize reset coil 43 and restore contact arm 33 of the primary selector to its initial position.

The apparatus of Fig. 3

Under the certain circumstances, the relays 75 and 90 are not necessary, in which case the simplified form of apparatus of Fig. 3 may be used.

In this case the primary and secondary selectors are substantially alike, the switch 52 being omitted entirely.

In the form of Fig. 3 parts 10 to 48 are substantially the same as in Figs. 1 and 2; but the secondary advance magnet 55 is connected by conductors 125, 140, 141 in series between the ungrounded terminal and the next to the last primary contact 29, whereby the magnet 55 is energized once, and the secondary arm 63, engageable with contacts 60, 61, 62, is advanced, every time the contact 29 is engaged.

The conductor 18 and the primary reset conductor 45 connect the primary reset magnet 43 in series between said ungrounded terminal 12 and the last primary contact 30, whereby the primary arm 33 is restored each time the contact 30 is engaged.

Conductors 125, 143 connect said ungrounded terminal 12 to the secondary arm 63, whereby when the secondary arm engages the contact 61 and the primary arm engages one of the contacts 27, current passes through the signal circuit comprising conductors 84, 85, 86 connecting the signal device 87 in a series between the group of intermediate primary signal contacts 27 and the predetermined secondary signal contact 61.

A secondary reset conductor 145 connects the secondary contact 62 next above said secondary signal contact 61 to one end of the solenoid of the reset magnet 65, the other solenoid end being grounded as at 146, whereby when the arm 63 engages the contact 62 the secondary arm is restored.

The watchman's station 120 is about the same as in Figs. 1 and 2, and the switch 135 thereof is closed by the relay 132 and is connected by conductors 101, 129' in circuit between the primary and secondary reset conductors 45, 125 to energize both reset magnets 43, 65, when the watchman's station is operated.

Operation of the apparatus of Fig. 3

The operation of the apparatus of Fig. 3 is obvious from the foregoing.

The primary arm 33 is stepped up once each time the switch 21 is closed, until it engages contact 29, whereupon current passes through 12, 125, 140, 55, 145, 29, 33 and ground 46, thus stepping up the secondary arm 63 one step.

On the next closure of the switch 21, the arm 33 reaches the contact 30, and current passes through 18, 43, 45, 30, 33 to ground 46, and energizes 43 and resets the arm 33.

The secondary arm is stepped up once each time the contact 29 is engaged and finally reaches contact 61. Then when the primary arm next reaches one of the group 84, current passes through 12, 125, 143, 63, 61, 86, 87, 85, 84, 27, 33 and ground 46, and the alarm device 87 rings until the arm 33 passes the last contact 27.

Next the arm 33 reaches contact 29 and steps

the secondary arm 63 from contact 61 to 62. When the arm 63 reaches contact 62, solenoid 65 is energized and resets the secondary arm as soon as the advance pawl releases it. Next the arm 33 reaches the contact 30 and resets.

If the watchman's station is pulled, current passes through 12, 125, 120, 135, 129', closing the switch 135. This causes current to pass through 12, 18, 43, 45, 129', 135, 101, 145, 65 to ground 146, energizing magnets 43 and 65, restoring both arms 33 and 63.

I claim as my invention:

1. An apparatus comprising a primary member; means whereby said member is advanced to a predetermined position and restored; a secondary member; means to advance the secondary member a small increment each time said primary member substantially reaches said position; a translating device; means for operating said device each time both members reach respective predetermined points; means to automatically restore both members when said device is operated; and means for at will restoring both members.

2. An apparatus comprising a primary member; means whereby said member is advanced to a predetermined limit and restored; a secondary member; means to advance the secondary member a small increment each time said primary member substantially reaches said limit; a translating device; means for operating said device each time both members reach predetermined points; and means to automatically restore both members when said device is operated.

3. An apparatus comprising a primary member; means whereby said member is advanced to a predetermined position and restored; a secondary member; means to advance the secondary member a small increment each time said primary member substantially reaches said position; a translating device; means for operating said device each time both members reach predetermined points; and means for at will restoring both members.

4. An apparatus comprising a primary arm; means whereby said arm is slowly advanced to a limit; a secondary arm; means to advance the secondary arm a step each time said primary arm substantially reaches said limit; a signal device; means for operating said device each time both arms have reached respective predetermined points of their travel; restoring means to automatically restore the primary arm each time it reaches the end of its travel; means automatically operable to restore both arms after said device is operated; and means for at will restoring both arms before or during operation of the device.

5. An apparatus comprising a movable member; means operable by electric impulses whereby said member is slowly advanced step-by-step; means for supplying such impulses; a translating device set in operation by said member after the member has moved a predetermined distance; reset means automatically set in operation after said device is operated to restore the member to initial position; and means for at will operating the reset means.

6. An apparatus comprising a bank of spaced primary contacts; a primary contact member successively engageable with said contacts; means whereby said member is periodically advanced one contact; an actuating switch closed by said member before the last contact is reached; a secondary bank of contacts; a second-

ary arm engageable with said contacts; means in circuit with said switch to advance the secondary arm one contact each time said switch is closed; means electrically connecting adjacent intermediate primary contacts to provide a group of signal contacts; a signal device; and signal circuit means connecting, in series circuit, said normally closed switch, the secondary arm, a predetermined secondary contact when engaged by said arm, said signal device, and said group when engaged by said member, whereby current may pass through and operate the signal device.

7. An apparatus comprising a movable primary contact member; means whereby said member is normally slowly advanced, and restored; a movable secondary member; means to advance the secondary member one each time said primary member substantially reaches end of its movement; a normally deenergized reset relay; a signal contact engageable by the primary member intermediately of its travel; a signal device; a secondary contact; means for operating said signal device when said secondary and signal contacts are engaged by said members and said relay is deenergized; means automatically operable to energize the reset relay after the signal device has been operated; means operable by the reset relay when energized to restore both arms; and means for at will energizing the reset relay.

8. An apparatus comprising a primary arm; means whereby said arm is slowly advanced to a limit; a secondary arm; means to advance the secondary arm a step each time said primary arm substantially reaches said limit; a signal device; means for operating said device each time both arms have reached respective predetermined points of their travel; restoring means to automatically restore the primary arm each time it reaches the end of its travel; reset means automatically operable to restore both arms after said device is operated; and means for at will operating the reset means to restore both arms.

9. An apparatus comprising a movable primary contact member; means whereby said member is normally slowly advanced; a movable secondary member; means to advance the secondary member one each time said primary member substantially reaches end of its movement; a normally deenergized reset relay; signal contact engageable by the primary member intermediately of its travel; a signal device; a secondary contact; means for operating said signal device when said secondary and signal contacts are engaged by said member and said relay is deenergized; a locking-in relay; means to lock-in the locking-in relay when the signal is operated; means operable by said locking-in relay to energize the reset relay after the signal device has been operated; means operable by the reset relay when energized to restore the secondary arm and release the locking-in relay; means operable by said member when at the end of its travel or by the reset relay when energized to restore the primary arm; and means for at will energizing the reset relay to restore both arms.

10. An apparatus comprising a bank of spaced primary contacts; a primary contact member successively engageable with said contacts; means whereby said member is periodically advanced one contact; an actuating switch closed by said member before the last contact is reached; a secondary bank of contacts; a secondary arm engageable with said contacts; means in circuit with said switch to advance the secondary arm one contact each time said switch is closed; a

normally deenergized reset relay including a reset solenoid, and a normally closed switch; means electrically connecting adjacent intermediate primary contacts to provide a group of signal contacts; a signal device; signal circuit means connecting, in series circuit, said normally closed switch, the secondary arm and a predetermined secondary contact when interengaged, said signal device, and said group when engaged by said member, whereby current may pass through and operate the signal device; a locking-in relay; means to lock in the locking in relay when the signal is operated and the normally closed switch is closed; means operable by said locking-in relay to energize the reset relay when the primary contact next above said group is engaged by the primary member; means operable by the reset relay when energized to restore the secondary arm and release the locking-in relay; means operable by said member when engaging the last contact; or by the reset relay when energized to restore the primary arm; and means for at will energizing the reset relay to restore both arms.

11. A delinquency alarm apparatus comprising a source of current having a grounded and an ungrounded terminal; a normally open minute contact switch; means for closing said switch periodically; a step-by-step selector mechanism comprising an advance magnet having an advance coil connected in series with said switch between said ungrounded terminal and the ground, whereby when said contact switch is closed the advance magnet is energized; an arcuately arranged bank of insulated closely spaced primary selector switch contacts; a rotatable shaft coaxial with said bank; a ratchet and a grounded contact arm, fast on said shaft; the arm engageable with said contacts; a pivoted armature attracted by said advance magnet and carrying an operating arm carrying a pivoted pawl, engageable with, and normally disengaged from said ratchet whereby said contact arms are moved from one contact to the next each time said magnet is energized; and signal means constructed to be connected in circuit with said arm and a predetermined contact of the bank for at times operating the signal when such contact is engaged by the arm.

12. An apparatus comprising an arm; means whereby said arm is slowly advanced; a signal device; means for operating said device each time said arm reaches a predetermined point of its travel; reset means automatically operable to restore the arm when the signal is operated; means including an electro-magnet for operating said reset means when the magnet is energized; a watchman's station comprising signal transmitter having a normally closed signal wheel operated switch; a relay having its solenoid interposed in circuit with said switch and comprising a normally open switch adapted to be closed when the relay magnet is deenergized and having its elements respectively connected in circuit with said electro-magnet whereby when the station is operated the magnet is energized and said arm restored.

13. An apparatus comprising a bank of spaced primary contacts including intermediate signal contact or contacts, and a secondary-advance contact near the end of the bank; a primary contact member engageable with said contacts; means whereby said member is at intervals advanced one contact; a secondary advance magnet connected in circuit with said advance contact; a

a secondary bank of contacts including an intermediate signal contact; a secondary contact member engageable with the secondary contacts; means to advance the secondary member one contact each time the secondary magnet is energized; a signal device; and a signal circuit means connecting the signal device in a series between the primary and secondary signal contacts when engaged by the respective contact members.

- 10 14. An apparatus comprising a bank of spaced primary contacts including intermediate signal contact or contacts, a reset contact near the end of the bank and a secondary-advance contact between the signal and reset contacts; a primary
15 contact member engageable with said contacts; means whereby said member is at intervals advanced one contact; means to restore the primary member including a primary reset magnet in circuit with the primary reset contact; a sec-
20 ondary advance magnet connected in circuit with said advance contact; a secondary bank of contacts including an intermediate signal contact, and a reset contact nearer the end of the bank; a
25 secondary contact member engageable with the secondary contacts; means to advance the secondary contact member one contact each time the secondary magnet is energized; a signal device; a
30 signal circuit means connecting the signal device in a series between the primary secondary signal contacts when engaged by the respective arms; means including a secondary reset magnet to
35 restore the secondary member; a secondary reset circuit means connecting in series circuit the secondary reset contact and magnet; and means for at will connecting the reset magnets in series circuit.

15. An apparatus comprising a circuit having primary spaced contacts, a movable arm therefor, means including an electromagnet for advancing said arm step-by-step over said contacts, means for returning said arm; secondary spaced contacts, another movable arm for said latter contacts, and means including a relay for advancing

said second arm one step previous to the return of said first arm each time said first arm reaches a predetermined contact.

16. An apparatus comprising an electric circuit a bank of spaced primary contacts, a pivot, an arm mounted on said pivot for step-by-step advance movement over said contacts to a predetermined position, means whereby said arm is advanced to said position and returned; a bank of secondary spaced contacts, a second pivot, another arm mounted on said latter pivot, and means for advancing said second arm one step over its contacts each time said first arm reaches said position.

17. An apparatus comprising in combination an electric circuit having a bank of spaced contacts, a pivot, an arm mounted on said pivot for step-by-step advance movement over said contacts, means for advancing said arm, said means including a ratchet rigid with said arm, a pawl engaging said ratchet, an armature carrying said pawl, an impulse operated means controlling the electric circuit, a magnet for actuating said armature, a releasable detent for holding said ratchet after each actuation, means for releasing said detent after the advance movement, and a spring cooperating with said ratchet to return said arm.

18. An apparatus comprising an electric circuit having a primary bank of contacts, a secondary bank of contacts, a movable arm for the first bank, a movable arm for the second bank, an alarm in the circuit, unitary time operated means for closing and opening the circuit whereby to continuously advance the first mentioned arm step-by-step to the last contact of its bank, means for repeatedly restoring the last mentioned arm to its initial position, means for advancing the second mentioned arm a single step each time the first mentioned arm reaches its last contact, and means for operating said alarm each time the second mentioned arm reaches a predetermined contact.

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