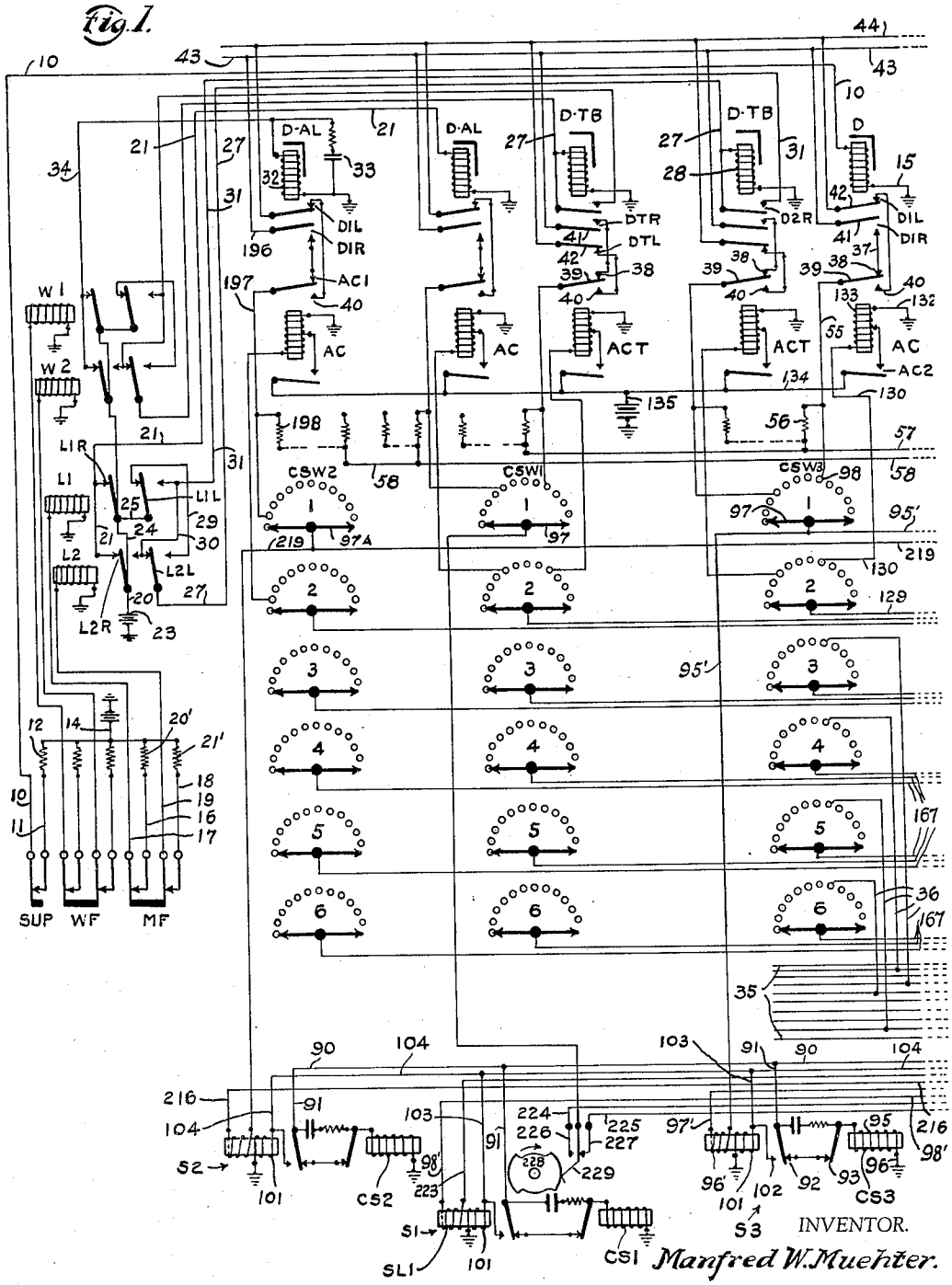
Aug. 9, 1938. M. W. MUEHTER 2,126,025

ANNUNCIATOR RECORDER SYSTEM

Filed May 22, 1935 4 Sheets-Sheet 1

Fig. 1.



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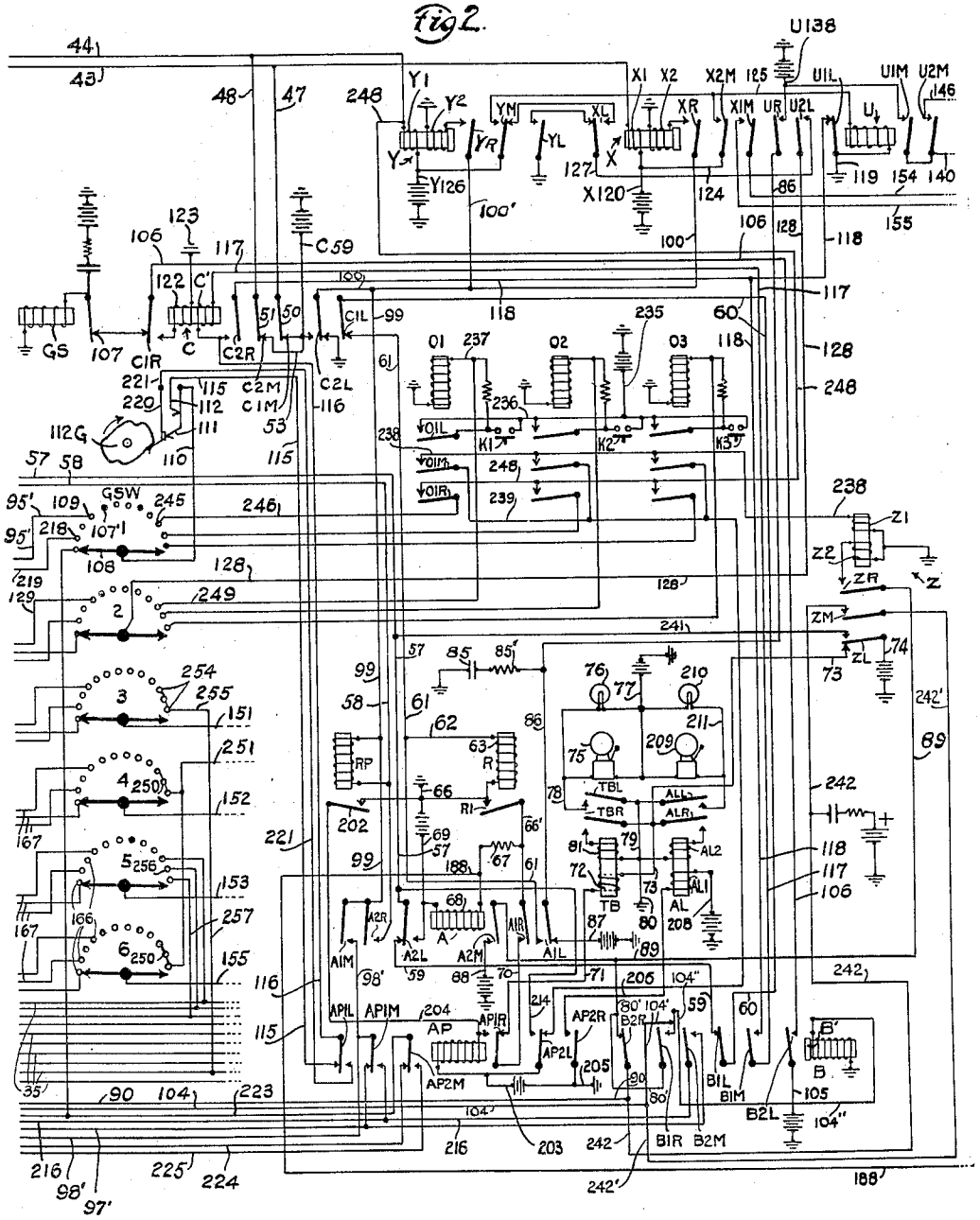
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ANNUNCIATOR RECORDER SYSTEM

Filed May 22, 1935 4 Sheets-Sheet 2

Fig 2.



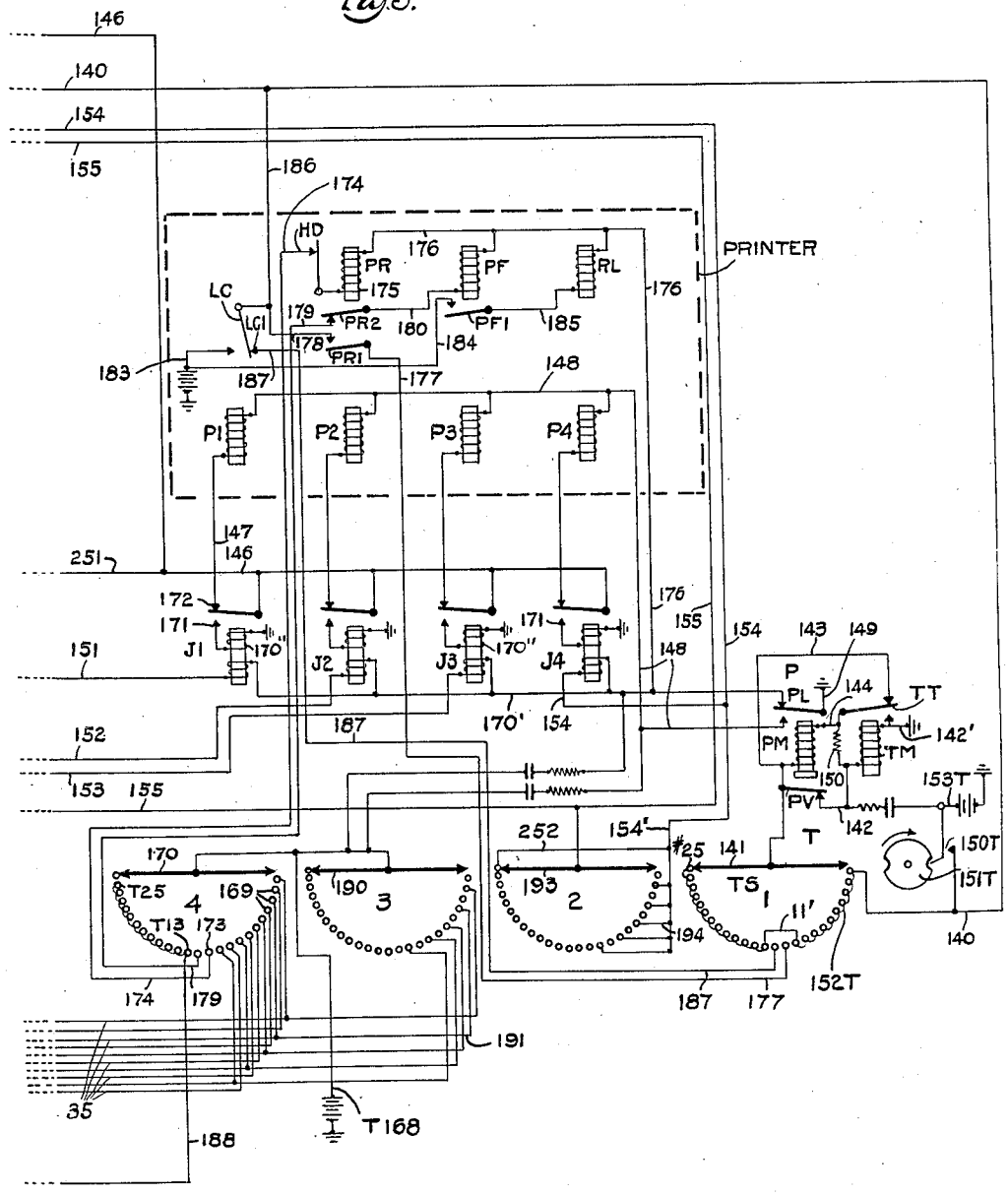
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ANNUNCIATOR RECORDER SYSTEM

Filed May 22, 1935 4 Sheets-Sheet 3

Fig. 3.



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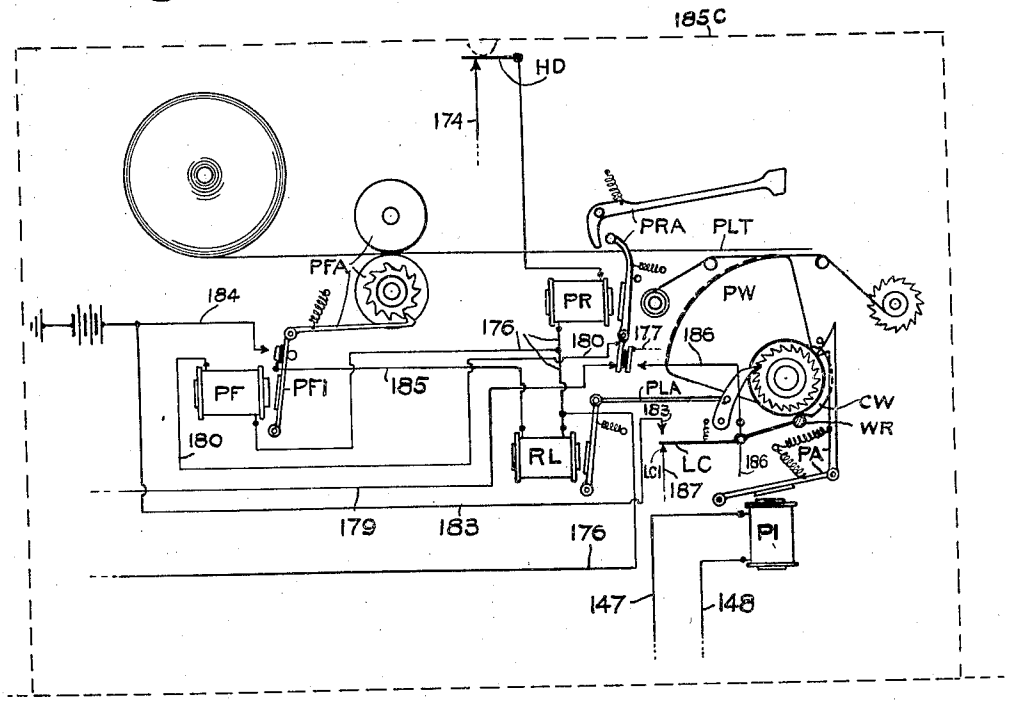
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ANNUNCIATOR RECORDER SYSTEM

Filed May 22, 1935 4 Sheets-Sheet 4

Fig. 4.



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Patented Aug. 9, 1938

2,126,025

UNITED STATES PATENT OFFICE

2,126,025

ANNUNCIATOR RECORDER SYSTEM

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Application May 22, 1935, Serial No. 22,680

45 Claims. (Cl. 234—27.5)

This invention relates to supervisory systems or apparatus for a plurality of annunciator drops, and more particularly to means for printing or recording changing conditions thereof.

Principal objects of the invention are to provide improved means for—

(1) Printing on tape indicia indicating changes, from normal to abnormal and vice versa, in said drops or other devices, and code numbers corresponding to the associated drops;

(2) Giving preference to alarm drops over supervisory drops so that when changes occur in both alarm and supervisory drops while another change is being recorded, the alarm drop change will be recorded before the change of said supervisory drop is recorded.

(3) Operating and locking-in supervisory or alarm audible signal devices, when such changes occur and holding said devices locked-in until one of several operators have operated means for printing the operator's acknowledgment of the signal on the tape;

(4) Supervising loops for the several signal initiating switches which cause said drops to change.

Additional objects of the invention are to improve generally the simplicity and efficiency of such apparatus and to provide a system of this kind which is reliable in operation, may be made of stock parts and is economical to manufacture and install.

Still other objects of the invention will appear as the description proceeds; and while herein details of the invention are described in the specification and some of the claims, 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.

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

Figs. 1 to 3 are complementary figures together showing a diagram of the system; and

Fig. 4 is a diagram of the printing means.

Briefly stated, the system includes supervisory devices SUP, manual alarm stations MF or water flow stations WF which originate the signals. By means of individual lines these are tied in to annunciator drops, such as fire alarm drops D—AL trouble drops D—TB and supervisory drops D. In case of the alarm stations, the connection is through intermediate relay equipment. The annunciator drops thus give an indication of the condition of all alarm and supervisory devices; and the system also causes a transmitter T to operate a printer every time a change takes place in a drop, this operation being in a non-interfering and successive manner, and records on tape the corresponding data, viz., the type of the service, the number of the device or circuit from which a signal has been received, the condition, normal or abnormal, and the time and date.

Also, as will be explained, a bell and light signal is given in each case. There are two different bells and lights, one light and bell for supervisory signals and another distinctive bell and light for alarm signals. The bell and light will remain in operation until the attendant has operated his individual acknowledgement key, thereby silencing the bell and putting out the light, and recording his code number on the tape to indicate that he has taken notice of the received signal. There may be three or more different attendant-operated key switches for each condition or apparatus to be observed by attendants, so that each of three different attendants working in shifts may record their own individual code number.

General description

The system consists of two units, the annunciator and the recording apparatus. The annunciator, consisting of a number of annunciator drops or relays, D—AL, D—TB and D gives individual indication over individual wires of the condition of the corresponding switches or contacts of the devices that are to be supervised. Special features of distinctive alarm and line trouble indication in connection with waterflow and fire alarm service are provided.

The recording apparatus (Fig. 4) associated with the annunciator provides for non-interfering successive recording of any change in the condition of the annunciator on a paper tape, giving the type of the service, the number of the device, the condition, "normal" or "abnormal", and the date and time of the day. A preferential feature is provided which, in case of a number of alarm and supervisory signals coming in at the same time, insures recording of the alarm signals before the supervisory signals in order that the former may receive quickest attention. Also, individual bell and light signals are given with these two classes of service.

Particular novelty resides in the fact that the equipment individually required for each annunciator drop is kept to a minimum, a single relay, AC or ACT, only being required for each drop, with but three contacts. Likewise, the number of contacts required to be operated by each drop is kept to a minimum; i. e., two, one for the "ab-

normal" or "alarm" and one for the "restored" or "normal" condition. The control of the recording and special features is accomplished by common equipment. This considerably reduces the cost of the system.

The common equipment consists of a 25 point telephone type selector switch CSW and auxiliary relay for each group of 25 drops and a unit common to the whole system, consisting of two such selectors GSW and T, and a number of relays.

The selector switches, CSW, associated one with each group of 25 drops act as finder switches. Each of their 25 positions being associated with one drop, they control the code or signal to be recorded on the printer and may thus be called code selectors (CS). Flexibility of codes is provided, as any drop may be arranged to record any of the four-digit codes used, depending on the connections of a set of four flexible wires attached to corresponding contacts of four banks of the code selectors to a common busbar unit of ten busbars.

One of the two selectors in the unit common to the whole system serves as a "group" selector (GSW) to connect the recording equipment to the various code selectors, of which three are shown on the drawings.

The second selector "T" in the common unit serves as the transmitting selector to control the transmission of the proper number of impulses to the four stepping magnets of the printer (P1–P4).

Other features and arrangements will be apparent from the detailed description.

Connection from supervisory stations to annunciator drops

As shown at the left of Fig. 1, the switches operated by the supervisory devices, marked SUP, are connected directly by conductors **10**, **11** in series with 120-ohm protective resistor **12** and the coil of a drop D in a normally closed circuit between the plus side of the battery as at **14** and the minus side as at the ground **15**. Opening of the switch SUP will release the armature of the drop D and initiate the recording of an alarm signal as will be explained. When the switch SUP is closed again the drop D will be reenergized and cause a restoration signal to be printed as will be explained. An open or ground on the line **10**, **11** has the same effect as an alarm, as the solenoid of the drop D is connected at **15** to the grounded side of the battery so that the solenoid D will be short circuited by a ground. Only one switch SUP and drop D are shown but it is understood that a large number of these are provided. Trouble on one circuit **10**, **11**, however, does not affect any of the others.

Connections from manual fire alarm stations

The external circuit through the fire alarm switch MF consists of two separate loops **16**, **17** and **18**, **19**, which extend from the resistors **20'**, **21'** connected to the plus side of the battery at **14**, and extend to line relays L1 and L2. The manual alarm switch MF is a normally closed double-pole switch, with its respective switches interposed in the loops **16**, **17** and **18**, **19** so that opening the double pole switch opens both loops. Each manual fire alarm circuit has associated with it two drops D—AL for alarms and D—TB for troubles, which are operated by the contacts of the two loop or line relays L1, L2.

In case of an alarm, the alarm switch MF is opened and opens both loops **16**, **17** and **18**, **19**; and the armatures of relays L1 and L2 drop back. Front contacts L1R and L2R of both relays open and open the line **20**, **21** from the plus battery terminal as at **23**. Also as front contact L1R is open, the line **21** does not receive current from terminal **23** through conductor **24**. The normally closed alarm drop D—AL is therefore deenergized. The trouble drop, D—TB is not affected and remains deenergized, because the trouble line **27** from the solenoid **28** of the trouble drop does not receive current, because the armature of relay L1 is deenergized and its front contact L1L is open and does not give current through conductor **29** and the back contact of switch L2L to conductor **27**.

In case of an open or ground or both in only one loop **16**, **17** or **18**, **19**, only one corresponding loop relay L1 or L2 drops back. If the open or ground is in line **16**, **17**, relay L1 drops back, the trouble drop line **27** is energized through conductors **20**, **24**, **25**, back contact L1L conductor **30** and L2L front contact of the other loop relay L2 in series. If the open or ground is on line **18**, **19**, relay L2 drops back, and the trouble drop conductor **27** receives current through the L2L back contact, conductor **29** and the L1L front contact, and conductors **20**, **24**, **25**.

If a manual alarm is sent after this break and trouble alarm the other loop relay L1 or L2 drops back also so that both relays are back at the same time and the alarm drop D—AL is deenergized as above indicated for normal manual operation. The trouble drop D—TB stays energized as it has locked in through the end of conductor **27**, its own contact D2R, conductor **31** and back contact L1L or back contact L2R.

Drop D—TB can only drop back after both loop relays L1, L2 have picked up again as the locking circuit through conductor **31** is maintained through back contacts L2R and L1L of both loop relays. Restoration of the alarm switch under trouble condition will, however, immediately energize the loop relay of the unaffected loop and reenergize the alarm drop.

Connections from water flow stations

The water flow circuit connected to the water flow detector switch WF, is the same as for manual fire alarm except that the place of the solenoid of the alarm drop D—AL is taken by a condenser retarded solenoid **32**, shunted by a condenser **33**, which delays the deenergization of the solenoid **32**. The line **34** to the solenoid **32** is normally energized from the relay W1 or W2 as described of the line **21**. This charges the condenser **33**, and the slow discharge of the condenser, when the water flow switch WF opens, retards the drop D—AL and prevents operation of this drop by water hammer.

Annunciator and code selector assemblies of the annunciator printer

The annunciator drops D—AL, D—TB and D are usually assembled in units of 25 in a frame which also supports the code selector CSW and **25** "acknowledgment" relays AC and ACT associated with said 25 drops respectively. There are as many code selectors CSW1, CSW2, CSW3 as required, depending upon the size of the particular installation and each comprises a plurality of arcuate banks of 25 contacts engaged by wipers carried on a common shaft and generated step-by-step by stepping means operated by the associated operating magnets CS1, CS2 or CS3.

These code selectors being similar to similar selector means in automatic telephone systems, are shown only diagrammatically. The group selector GSW later to be mentioned is of similar construction as is also the selector means of the transmitter T later to be described.

At the bottom of each selector assembly is a series of ten bus bars 35 (lower right of Fig. 1 and left of Fig. 2). These serve to set up the desired code number for each drop, and each position of the selector switch CSW is associated with one drop as will be explained in greater detail later. The contacts of the four lower banks of all the selector switches SW have flexible wires 36 attached to them. The wires 36 are shown only for the selector switch drop D, but it is understood that the bus bars are extended and similar wires are provided for the other drops. Each set of four wires is brought through a vertical row of holes in a fanning strip (not shown) provided with numbers for proper identification. The other end of the wires 36 can be attached to any of the ten bus bars 35, thus (as will appear later) setting up the code for the corresponding drop. If the first wire 36, for instance, is attached to #4 bus bar, the second wire 36 to #2, the third to #9 and the fourth to #5, the code number will be 4295 for that drop. This means that the first type wheel of the printer (later to be described) will be stepped up 4 steps, and that the 2nd, 3rd and 4th wheels will be stepped by 2, 9 and 5 steps respectively.

Each annunciator assembly of 25 units is connected by a cable of wires 21, 27, 31, 34, 10 to the relays L1, L2, W1 or W2 or to the line terminals on the input side. When there are trouble drops D—TB, two wires are required for each, one wire 27 for each drop and one wire 31 for the holding circuit of the trouble drops.

Code selection

Each drop D, D—AL, has two contacts, one normally closed contact D1L and one normally open contact D1R. The normally open contact D1R is connected by conductor to the back contact spring 38 of the acknowledgment relay transfer contact 39; the normally closed contact D1L is connected to the front contact spring 40 of the relay AC. In case of the acknowledgment relay ACT of the trouble drops used for manual fire alarm and water flow circuits, these connections to DTL, DTR corresponding to D1L and D1R are reversed since the drops D—TB are normally deenergized, while drops D and DAL are normally energized. The movable elements 41 and 42 of the drop contacts D1R and D1L or DTR, DTL are respectively connected to two common wires 43, 44 leading to respective coils X1, Y1 (Fig. 2) of signal actuating and reset relays X and Y. Conductors 47, 48 connect conductors 43, 44, to the movable elements 50.51 of back contacts C1M and C2M (see group selector cut-off relay C) connected by conductor 53, whereby these relays are normally shunted.

The center spring 39 of the transfer-contact of relays AC is connected by a conductor 55 to a corresponding contact of the first bank of the code selector switch CSW of the particular unit and also to a small 4,000 ohm resistor 56 located at the back of the selector. The other side of these resistors is connected to a common 57 or 58, which also forms their support. There are two different types of common, one common 57 for supervisory and trouble drops, and one common 58 for alarm drops D—AL. An annunciator assembly having both of these drops has a split common connector strip, the one part being the common 58 for the alarm drops as will be explained, and the other part 57 for trouble or supervisory drops.

Assuming that a supervisory drop D has been deenergized as above explained, the operation will be as follows: Back contact D1R will close, completing a circuit from plus conductor at C59 (Fig. 2) through contact C1M, conductors 47, 43, contact D1R, conductor 37, back contact 38, conductor 55, 4,000 ohm resistor 56, common 57, back contact A2L of the main contactor relay A, conductor 59, back contact B1L of the group-selector starting-relay B, conductor 60, back contact C1L of relay C, conductors 61, 62 and the windings 63 of a starting relay R to ground 66. Relay R then pulls up, closes contact R1 and energizes the main contactor relay A through a path from minus at ground 66 through contact R1, conductor 66', 200 ohm resistor 67, and the winding 68 of relay A to plus current at 69.

This relay A then pulls up and completes a circuit in a path from ground 66, contact R1, conductor 66', contact A1R of relay A, conductor 70, back contact AP1R of alarm contactor relay AP, conductor 71, one winding 72 of trouble and supervisory relay TBL conductor 73 and back contact Z1 of the operator acknowledgment common relay Z to plus at 74. Relay TB then pulls up and energizes the supervisory trouble bell or buzzer 75, and the amber light 76 from plus source 77, through conductor 78, contact TBL, conductor 79, to ground at 80. At the same time a holding circuit is maintained from plus at 74, back contact ZL and conductor 73 its second make contact TBR and holding coil 81 and ground 80.

Before back contact A2L breaks the front contact A1L makes and connects the condenser 85 through resistor 85', conductor 86, front contact A1L and conductors 61, 62 across the coil of relay R, allowing this relay R to be energized by the charge which this condenser has formerly accumulated from plus at 87 through A1L back contact for holding its armature. This has the purpose of letting relay R release only after a short time interval and reenergizing relay A in case the drop should have released only momentarily sufficiently to energize R, but not long enough for relay R to be held energized from plus at U138, as will be explained, for operating the system.

When the starting relay R pulls up and energizes relay A as above described, front contact A2M also closes and current is supplied from plus at 83, through front contact A2M, conductor 89, 80', back contact B2R, conductors 90 (Fig. 2), 91 (Fig. 1) and normally closed back contacts 92 of relays S one of which is located in each annunciator assembly thereby to supply current through contact 93 to the operating magnets CS1, CS2, CS3 of the various code selector switches CSW, located in the annunciator assemblies. The windings 95 of these stepping magnets receive current from contacts 93, through the windings to ground 96, and repeatedly break contact 93 and thereby move their wipers 97 from point to point by means of ratchet mechanism in the well known manner.

When the wiper 97 of the top bank of the selector switch CSW, located in the unit in which the drop has been deenergized, reaches the contact point 98 to which the 4,000 ohm resistor 56 associated with that drop is connected by conductor 55, it will find plus potential at this point which was received, as explained, through conductors 55, 37, 43, 47, from source C59. The associated code

selector cut-out relay S, in this particular case relay S3, will be energized through wiper 97, conductor 95' one of its two windings 96', conductor 97', back contact AP1M, conductor 98', front contact A1M, conductor 99 and back contact C2L and ground. This opens contact 92 (Fig. 1), breaks the circuit for the stepping magnet coil 95 and locks in the relay S through its second winding 101 and its make contact 102, which is then connected to conductor 90, charged from plus at 88 as above explained.

This also energizes the other S relay coils 101, the coils of which are connected by conductors 103, 104, in multiple with the holding windings 101 of all S relays. This also energizes the coil of the group selector starting relay B which coil is connected to conductor 104, through conductor 104', back contact B1R, conductor 104'', coil of B to ground. The relay B has a copper slug B' on the armature end of its core to make it operate slowly in order that the current of the code selector magnets may be broken individually by the contacts of the associated S relay and not by back contact B2R of relay B. B1R being a make-before-break contact, relay B closes its holding circuit through conductors 80', 89 and contact A2M to source 88 before it breaks its operating circuit.

Front contact B2L of relay B now closes and supplies current from plus at 105 through conductor 106, the back contact C1R to break contact 107 of stepping magnet GS of the group selector GSW. This selector is provided with the usual stepping mechanism and serves to connect the transmitting apparatus to the code selector CSW of the particular annunciator drop which was actuated. For this purpose the bank contacts of the first or top bank of the group selector are connected to the first or top wiper 97 of the various code selector switches CSW. Upon reaching the contact to which the code selector located in the unit where the drop has previously released is connected, for instance the contact 109, the first bank wiper 108 of the group selector will at this point find plus potential over the previously charged conductor 95', and relay C will be energized (as will now be explained), current passing from wiper 108, through conductor 110 through the back contacts 111, 112 of the two cam contacts 111, 112 and 111, 220 operated by the cam 112G on the common shaft of the group selector GSW, the lobe of the cam 112G having just passed member 220 and the contact 111, 112 being in closed position when the wipers of the selector GSW rest on bank contacts, for instance, the contact 109 and the one adjacent contact 107', to which annunciator assemblies having supervisory drops D or trouble drops D—TB only are connected. Current passes from contact 112, through conductor 115, back contact AP1L, conductor 116, winding C1, conductor 117, make contact B1M, conductor 118 and back contact U1L of the transmitter starting relay U to ground 119. Relay C, being thus energized, pulls up, disengages back contact C1R, breaks the circuit of the stepping magnet GS of the group selector; and relay C locks in from conductor 106 through its front contact C1R and its second winding 122, to ground 123. Contact C1M breaks removing the shunt 53, so current is received from plus at X120, and not from plus at C59, so that winding X1 of the alarm signal relay X is inserted into the circuit through which relay C just was energized. Winding C1 is shunted out by the closing contacts C2R, so that winding X1 is connected directly across the battery from battery at X120, through coil X1, conductor 43, contact 41, conductor 37, contact 38, 39, conductor 55, contact 98, wiper 97, conductor 95', contact 109, wiper 108, conductor 110, contacts 111, 112, conductor 115, back contact AP1L, conductor 116, closed contact C2R, conductor 118, contact U1L to ground 119. Relay X locks in from ground through its second winding X2, make contact XR, conductor 100, front contact C2L to plus at C59. Relay X also closes X2M and energizes the transmitter starting relay U from plus at X120 conductor 124, contact X2M, conductor 125, winding of U to ground at 119. Make contact U2L closes and current passes from plus at Y126, back contact YM, front contact XL, conductor 127, contact U2L, conductor 128, to the wiper of the second bank of the group selector GSW, conductor 129, second bank of the code selector, conductor 130, winding of acknowledgment relay AC to ground 132. Relay AC locks in, current passing to ground 132, one half of its winding 133 its separate make contact AC2, conductor 134 to plus at 135. This relay breaking at the back transfer contact 38, breaks the original starting circuit through back contact D1R of the drop. At the same time UR closes and connects the R relay through conductor 86 directly to plus at U138 so as to make it independent of the condenser 85 for holding its armature during the rest of the operation.

Recording

Relay U starts the transmitter T. The transmitter T, comprises a stepping selector switch TS, similar to the code selector switches, and similarly operated, which in conjunction with a stepping magnet TM and a pulsing relay P, sends impulses to the four stepping magnets P1, P2, P3, P4 of the printer to set up the desired information, as will be explained. When contact U1M (Fig. 2) closes, current passes from plus at U138 through conductor 140, through contact #25 and wiper 141 (at the normal rest position) of the first bank of the transmitter selector switch TS and contact PV, conductor 142, coil TM to ground 142'. Coil PM is short circuited by conductor 143 and back contact TT until magnet TM closes its front contact TT and energizes relay magnet PM through conductor 144, front contact TT to ground. Front contact PL closes and admits current to all four stepping magnets P1, P2, P3, P4 from plus at U138 through contacts U1M, U2M, conductor 146 back contacts 172 of the associated impulse cut-off relays J, conductors 147, stepping magnets P, conductor 148, front contact PL, to ground 149, thus actuating the stepping means PA (Fig. 4), thus stepping the type wheels PW up one step. Also back contact PV breaks and magnet TM releases. Magnet PM, however, does not deenergize immediately when make contact TT breaks, as magnet PM stays energized through a 450-ohm resistor 150 and the coil of TM in series to ground 142'. As the armature of TT completes its back stroke it steps the wipers 141 and the other wipers of the transmitter one step forward, finally back contact TT closes, shunting out the coil PM of relay P which drops out with a slight delay. This arrangement assures positive operation of the transmitting stepper as well as sufficient duration of the impulses to the printer stepping magnets. When PV closes again the magnet TM is reenergized for a new cycle. When the wiper

141 moves one step, the off-normal contact 150T is closed by the cam 151T on the transmitter stepping shaft and current is received by the conductor 140 and contacts 152T direct from plus at 153 T, so that the transmitter steps its complete rotation after contact U2M opens.

One of the windings of the respective relays J1, J2, J3 is connected by conductors 151, 152, 153, to the 3rd, 4th and 5th wiper respectively of the group selector. The corresponding coil of relay J4 is connected to conductor 154, which is at times connected (as will be explained) to conductor 155 connected to the wiper of the sixth group selector bank. The bank contacts 166 of these wipers are connected by conductors 167 to the corresponding wipers of the code selectors corresponding to such contacts 166, from the banks of which code selectors, as previously explained, connections 36 are made to the various bus bars 35.

The transmitter stepping its wiper forward successively applies plus potential as at T168 to the ten bus bars through its fourth bank contacts 169 and the wiper 170. Relays J1–4 become energized through conductors 170', contact PL to ground 149 when plus potential is applied by wiper 170 to the bus bars to which the flexible wires 36 attached to the 3rd, 4th, 5th, and 6th bank of the code selector are connected. Thus, in the example given above for code number 4295, relay J1 (corresponding to the first digit) will be energized on the 4th step; relay J2 (corresponding to the second digit) will be energized on the 2nd step; relay J3 will be energized on the 9th step, and relay J4, on the 5th step, thus leaving the respective type wheels in these positions. It will be noticed that the operating coil J4 is not connected directly to the 6th wiper of the code selector but is connected through conductors 154, contact X1M and conductor 155. Contact X1M, however, is closed at this time. Relays J maintain a holding circuit to ground through a second coil 170'' and a make contact 171 charged from plus at U138 through contacts U1M, U2M and conductor 146.

As soon as relays J have become energized, contact 172 is disengaged and the circuit to the corresponding stepping magnets P1, P2, P3, P4 of the printer is broken so that the rest of the impulses from the transmitter T through conductor 148 will have no effect. After ten steps all relays J have been energized, as 10 is the maximum of steps the stepping magnets make. At the next position (position 11) of transmitter T, the printing magnet PR is energized from plus at T168, through the 11th bank-contact 173 of the 4th bank of the transmitter, conductor 174, head switch HD, coil 175 of the printing magnet PR, conductor 176 and back contact PL to minus. This actuates the printer hammer PRA (Fig. 4) and the number or indication set up by the four type wheels operated by the stepping magnets is thus recorded on the tape PLT. The transmitter comes to a stop at position 11 (because of the bridge 11' of the first bank), until the make contact PR1 of the printing magnet closes the circuit from plus at U138, conductors 140, 186, contact PR1, conductor 177, wiper 141, contact PV, magnet TM to ground, the wiper 141 then being on the 11th contact of the 1st bank.

The wipers then move forward to position #12. The printing magnet is released when back contact PL breaks the circuit through conductor 176 prior to the moving of the wiper arms. From plus at T168 through the 12th contact of the 4th bank, conductor 179, the back contact PR2 of the printing magnet, and conductor 180, the paper feed magnet PF is energized and operates the paper feed means PFA (Fig. 4) to move the paper tape one step forward. The make contact PF1 of the paper feed magnet energizes the release magnet RL from plus at 183, conductor 184 make contact PF1 conductor 185, coil of release magnet RL and conductor 176. This magnet withdraws the detent means PLA and resets all type wheels to the normal position and recloses back latch contact LC1 which was opened by the cam CW, Fig. 4, on the first step of the type wheels. Current then passes from conductors 140, 186, back contact LC1, conductor 187, 12th contact of bank 1, and wiper 141. The transmitter is thus permitted to leave the 12th position.

From steps 13, to 25, relay A is shunted out by the path extending from plus at T168 through the 4th bank wiper 170, contacts T13–25, and conductor 188. When relay A is thus shunted out and releases, relays S and B drop out because contacts A2M and A1M, open. Contact B2L opens and causes winding 122 to deenergize and relay C to drop out. Then make contact C2L opens and causes relay X to release. When relay X drops out, X2M opens and relay U drops out also. Likewise, contact UR opens and relay R is restored to its deenergized position unless there are other signals to come in.

As above explained, the release magnet RL can actuate to release the type wheels only after the printing magnet PR actuates the printing means. Therefore to prevent the loss of a set up number on the type carriers PW if the paper PLT should be removed, the switch HD is biased open, and is held in place by the cover 185C. When the cover is removed as for changing paper, the switch HD is biased open, and therefore prevents the energization of the magnet PR and consequent printing, and resetting of the type carriers.

Restoration signals

When the drop D or other drop falls it indicates an abnormal condition and the leads 36 and the type wheels may be arranged that one digit position of the type wheel indicates this abnormal condition. For instance, in the Example 4295, instead of printing the "5", the last digit type wheel may print "ABN" for abnormal or "5ABN".

When the supervisory drop D restores to its normal energized position it is desired that the last digit type wheel print for instance "OK". This will be explained later.

When the drop D restores to normal energized position, D1L make contact closes and energizes relay R similar to the above but through the make contact 49, contact D1L, conductors 44, 48, contact C2M, conductor 53 to plus at C59. In the case of the trouble drops D—TB which are normally deenergized, when the drop D—TB restores, this circuit is closed through the contact DTL.

The operation after relay R is energized will be the same as above described except that when relay C operates and breaks contacts C1M and C2M, current does not pass from plus at X120, through X1 and conductor 43, since contact 38 is disengaged. Instead, relay Y is energized from plus at Y126, winding Y1, conductor 44, contacts 42, D1L, 40, 39 and conductors 55, wiper 97, conductor 95', wiper 108, conductors 110, 115, contact APIL, conductor 116 contacts C2R, conduc-

tor 118, contact U1L to ground at 119. Relay Y locks in from ground through its winding Y2, contact YR, conductors 100', 100, make contact C2L to plus at C59 also energizes U through conductor 125 and the closing of front contact YM. When U2L closes, the two halves of the winding of relay AC1 are connected in multiple. One end is permanently connected to minus at 132, the other end is connected to minus through conductor 130, the second bank of the corresponding code selector, conductor 129 the second bank of the group selector, conductor 128 contact U2L, conductor 127 back contact XL and make contact YL to minus. The two halves set up opposing fields causing the relay AC to drop out, thus restoring the transfer contact 37 of relay AC to its normal position and opening the circuit through conductor 55, by which relay R has, as heretofore described, already started on the restoration signal.

The operation of the transmitting stepper is the same as before while the first three type wheels are set to the positions "429" for the initial part of the signal. But when the transmitter wipers reach the position of the last digit (for example position #5 in the code number 4295), which as previously described printed "ABN", relay J4 is not energized through conductor 154 because relay X is not energized and contact X1M is open. On the following step, plus potential is again applied from plus at T168, through wiper 190 to the 5th bus bar 35—5. This applies plus potential to conductor 155 as before described, but the open contact X1M is now shunted by sixth contact of the 2nd bank and wiper 193 of the transmitter at this point, and conductors 154', 154 to relay J4, which will now operate. This means that the 4th stepping magnet P4 of the printer will get an additional impulse for restoration signals and will not print "ABN", but will print "OK". The lettering of the 4th wheel is such that an OK will be printed in this case, and at all even numbers of impulses thus indicating restoration, odd number positions of the 4th wheel print ABN, indicating abnormal condition.

Alarm signals

When an alarm drop D—AL releases as, for instance, the drop D—A1 at the left of the diagram, the operation will be as follows: D1R back contact closing completes a circuit from plus at C59 through C1M, conductors 47, 43, 196 back contact D1R, back contact AC1 of the transfer contact of the associated relay AC, conductor 197, 4,000 ohm resistor 198, the common 58 of all resistors associated with alarm drops as mentioned above, winding of alarm starting relay RP (Fig. 2) conductors 99, 100 and back contact C2L to ground. Relay RP operates and, closing its contact 202, energizes relay AP from plus at 203, through winding of AP, conductor 204, contact 202 to ground 66. Contact AP2R closes and energizes winding AL1 of relay AL by current finding a path from ground 205, contact AP2R, conductor 206, winding AL1, to plus at 208. Relay AL then pulls up and energizes the alarm bell 209 and red pilot lamp 210 by current from plus at 77, conductor 211, contact ALL, conductor 79 to ground; and relay AL locks in from ground 80, conductor 79, second winding AL2, contact ALR, conductor 73, contact ZL to plus at 74.

Make contact AP2L also closes and current flows from plus at 203 through contact AP2L conductor 214, back contact A2L, conductor 59 contact B1L conductor 60, contact C1L conductors 61, 62 winding 63, to ground 66 and energizes relay R. Relay R closes its contact and energizes relay A from plus at 69 to minus at 66 as described above for a supervisory drop. Contact A1R, however, does not energize relay TB through conductor 70 and back contact AP1R since relay AP is already energized and back contact AP1R is open. The holding circuit for relay AP is maintained from plus at 203, through AP1R make contact, conductor 70, contact A1R and R contact to minus at 66, since relay RP is shunted out by the closing of contact A2R and opens its contact 202 when A operates.

The operation of the code selectors is started from plus at 88 through front contact A2M, back contact B2R conductors 90, 91 to contact 92, and is the same as before, up to the point where the group selector is started, except that relay S (S2 in this case) is energized through conductor 216 and make contact AP1M instead of through conductor 97' and break contact AP1M as described hereinbefore of the supervisory drop control. When the first wiper 108 of the group selector GSW reaches the point 218 (in this case) connected by conductor 219 to the annunicator assembly in which the alarm drop D—AL we have just considered is located, it finds plus potential as before described, and relay C is energized through conductor 110, cam contacts 111, 220 operated by the cam 112G of the code selector, which contacts are closed together when the wipers are resting on bank contacts 218 to which annunicator units having alarm drops are connected. Current passes through contact 220, conductor 221, make contact of AP1L, conductor 116, winding C1, conductor 117, contact B1M, conductor 118 and back contact U1L to ground 119 as before. The rest of the operation is the same as before described for drop D.

Preferential arrangement

In case supervisory and alarm signals come in at the same time, the system is so arranged that the alarm signals will be recorded first. It is noted that as above described relay AP is not energized when supervisory signals come in and that relay AP is energized in case of alarm signals. As just described, in case of alarm signals, back contact AP1M is open and a code selector will not stop when its wiper 97 finds plus current at contact 98 since conductor 97' is connected to the open back contact AP1M, but the wiper 97A will stop when a point associated with an alarm drop has been reached, in which case, plus current passes to the relay S2 and through conductor 216 which is connected to closed front contact AP1M, in which case as mentioned above, the associated S relay will pick up through AP1M front contact. In like manner, since the back contact AP1L is open, the group selector cannot stop on points associated with supervisory drops, if an alarm signal is waiting to come in. Thus, the alarm signals will always be picked up in preference to a supervisory signal. The same is true for restoration signals of alarms, since the energizing current passes through contact 40 of the relay AC of drop D—AL, and conductors 197, 58 as before described.

If the associated drops include both alarm drops and supervisory drops the code selector is arranged differently, the code-selector CS1 being an example.

It will be noted that winding SL1 of the S1 relay is connected at one end by conductor 98' directly to contact A1M and at the other end

by conductor 223 to the transfer element of contact AP2M of which the fixed elements are connected by conductors 224, 225 to elements 226, 227 of a cam contact 229 operated by a cam 228 on the shaft of the code selector CS1. If an alarm drop operates in that unit, back contact AP2M opens and relay S can only pick up through AP2M make contact conductor 225 and element 227. The outer portion of the cam 228 is so designed and located that the element 229 engages the element 227 when the wipers of code selector CS1 are resting on bank contacts associated with alarm drops. When the wipers of code selector CS1 are on contacts associated with supervisory drops, the cam 228 separates elements 227, 229 and engages elements 226, 229, so that if a supervisory drop operates, the code selector may pick up through back contact AP2M and conductor 224. When the group selector wipers are resting on the point associated with this annunicator assembly, all cam contact elements 111, 112, 220 of the group selector GS are closed so that relay C can pick up through conductors 115 or 221 no matter whether contact AP1L is closed on the back or front, or whether the signal is initiated by an alarm drop or a supervisory drop.

The object of the 4,000 ohm resistors 56 and 198 is to allow the utilization of the same set of contacts of the drops and associated relays AC, ACT for three different purposes. From the description it will be noted that it is first necessary to give a starting impulse to energize relay A. This starting impulse has to be obtained when any one of the drops changes its position. This would ordinarily require that a set of transfer contacts of each drop and associated A. C. acknowledgment relay be connected in series with each other. It would then be necessary to have another separate set of contacts to apply plus potential to the first bank of the respective code selector at the corresponding point in order to control it. It is the use of the 4,000 ohm resistors which enables me to use the same contacts for the double purpose. It will be noted that the contacts of the various drops and associated A. C. acknowledgment relays are connected in multiple by means of the 4,000 ohm resistors to relays R or RP respectively, which gives the common starting circuit. By transferring the common of the 4,000 ohm resistors from the relays to the battery, I am then able to obtain individual circuits through the contacts to operate our code selectors. A third function using the same set of contacts of the drop and associated acknowledgment relay is to control the distinctive recording of an alarm or restoration signal, which as has been explained, is obtained in conjunction with relays X and Y respectively.

Operator acknowledgment signals

At the supervisory station, a convenient member of operator key switches K1, K2, K3 (Fig. 2) are provided, one for each operator who is to acknowledge the signals. Each one of the three key switches, when operated, closes a momentary contact which energizes one of the three operator acknowledgment relays O1, O2, O3. For instance, when the switch K1 is operated, current passes from plus at 235, through conductor 236, switch K1, conductor 237 coil of relay O1 to minus. This relay then locks in through conductor 236, contact O1L and conductor 237 and winding O1 to minus. This relay also energizes relay Z from minus through winding Z1 conductor 238 contact O1M, conductors 239, back contact AP2L to plus at 203. Relay Z then operates and opens contact ZL. This contact opens the locking circuit 73, 72, 71 for relay TB, and also opens locking circuit 73, ALR, AL2, 80 of relay AL. Relay TB will drop back, immediately, silencing the trouble buzzer 75 and turning off the amber light 76 in case of an acknowledgment of a supervisory or trouble signal. In case of an alarm signal, relay AL will drop back as soon as the alarm has been recorded on the printer, and relay AP has released, breaking circuit 208, AL1, 206, AP2R, 205, thus silencing the alarm bell and turning out the red light 210. Front contact ZL closes and energizes relay R from plus at 74 through contact ZL, conductors 241, 57, back contact A2L, conductor 59, contact B1L, conductor 60 contact C1L and conductors 61, 62, starting the mechanism as described before. However, when this operation of relay R energizes relay A and closes contact A1R, relay TB will not be energized as ZL back contact is open. Contact ZM closes and energizes relay B from plus at 88, contact A2M, conductors 89, 89', contact B2R, conductors 90, 242, contact ZM, conductor 242', 104', back contact B1R, conductor 104'', coil of relay B to ground. This also energizes all relays S through conductor 90 as previously explained. Relay Z locks in from conductor 89 through contact ZR and its second winding Z2 to ground. When relay B is thus energized and pulls up current passes from plus at 105, through 106 to contacts C1R, 107, whereupon the group selector starts and comes to a stop when the first wiper 108 reaches the point 245 (in this case) which is connected by conductor 246 to closed contact O1R. This causes relay C to be energized from plus at C59, through conductor 53, contact C2M conductors 43, 44, 248, contact O1R, conductor 246, contact 245, wiper 108, conductors 110, 115 (the break contact assembly 111, 112, being closed in this position), back contact AP1L, conductor 116, coil C', conductor 117, contact B1M, conductor 118, contact U1L to ground 119. Y is thus energized and energizes relay U. Contact U2L closes and shunts out the winding of relay O (O1 in this case) from minus (to which one side of the O relay coils is connected), through make contact YL, back contact XL, conductor 127, contact U2L, conductor 128, the second wiper and bank of the group selector, conductor 249 (in this case) to the other side of the coil of relay O1. This relay is now restored to the normally de-energized position.

Relay U starts the transmitter in the usual way. The code to be transmitted to the stepping magnets of the printer as a result of the closure of switch K1, K2 or K3 is set up by making the proper connections to the 3rd and 5th banks of the group selector switch GSW at the points associated with the OR contacts. The contacts 250 of the 4th and 6th banks of the switch GSW are connected by conductor 251 to the common 146 of the J relay contacts, so that relays J2 and J4 will be energized through the common 146 from plus at U139 as soon as contact U2M closes; and no impulses will be then transmitted to the 2d and 4th stepping magnets P2, P4. It will be noted that although contact X1M is open at this time, relay J4 can pick up through conductor 155, wiper 193, the 25th bank contact of the 3rd bank of the transmitter and conductors 252, 154', 154 to one winding of the relay J4, conductor 170' and ground 149. The bank contact 254 in the 3rd bank of GS is connected by conductor 255

to bus bar #9 so that the first type wheel will step up nine steps to the 9th position, where the abbreviation "ACK" for the acknowledgment signal is engraved on the type wheel. The bank contacts **256** on the 5th bank are connected by conductors **257** to the 1st, 2nd, or 3rd bus bar for relays O1, O2, O3 respectively to record one, two or three on the tape, depending on which key has been operated.

The rest of the operation of printing and restoration is the same as for the alarm and other signals.

The switch LC, shown diagrammatically in side elevation in Fig. 4 is a single switch operated by the cam CW of any carrier by engagement with a universal rod WR connected to the transfer member of the switch LC. Without the switch LC, if any carrier PW be accidently manually moved (as when the cover **185**C is removed), the detent means PLA would not allow the carriers to restore, and the next signal would misprint. To avoid this, the switch LC is provided; and whenever the carriers are accidently moved, plus is applied to the transmitter from plus at **183**, through contact LC, conductors **186** and **140** to contact **152**T, whereupon transmission is initiated and the transmitter operates and the printer prints and zeroizes as previously described, except that the relays J do not operate. After the printer thus zeroizes, it is in proper position to print the next signal correctly when the latter comes in.

I claim as my invention:

1. In combination a code selector switch settable to different positions; a plurality of character carriers; a stepping means for each carrier for stepping the carriers one step at a time; a cut-off relay for each carrier stepping means adapted when energized to stop the stepping of the carrier; a plurality of bus bars corresponding to carrier positions; digit banks and wipers on the code selector switch, means for connecting the wipers to respective cut off relays; flexible conductors each connecting one contact of one digit bank, corresponding to a selector switch position, to the bus bars corresponding to the predetermined carrier position for such selector switch positions; and means for applying potential to the bus bars successively as each carrier is successively stepped to its position determined by the bus bar to which the flexible conductor of the associated bank is connected.

2. In combination a plurality of normally open drop switches; a settable code selector switch having a wiper and fixed contacts the fixed contacts being respectively connected to the drop switches; a transmitter comprising an advancing means; a plurality of character carriers; a stepping means for each carrier for stepping the carriers one step at a time; means operated by the transmitter advancing means for supplying stepping impulses to all the carrier stepping magnets; means including a cut-off relay for each carrier stepping means adapted when the relay is energized to stop the stepping of the carrier; a plurality of bus bars corresponding to carrier positions; digit banks and wipers on the code selector switch, the wipers being connected to the respective impulse cut off relays; flexible conductors connecting contacts of the digit banks, corresponding to each drop switch, to the respective bus bars corresponding to predetermined carrier positions for such drop; means operated by the transmitter advancing means for applying potential to the bus bars successively as the carriers are successively stepped.

3. In combination a plurality of normally open drop switches; a code selector switch having a wiper and fixed contacts respectively connected to the drop switches; means set in operation by a closed switch for causing the wiper to selectively stop in position to engage the contact connected to such switch; a transmitter comprising an advancing means; transmitter starting means set in operation by the code selector switch when in said position for supplying current to the transmitter advancing means; a plurality of type carriers; a stepping means for each carrier for stepping the carriers one step at a time; means operated by the transmitter advancing means for supplying stepping impulses to all the carrier stepping magnets; means including a cut-off relay for each carrier stepping means adapted when the relay is energized to stop the stepping of the carrier; a plurality of bus bars corresponding to carrier positions; digit banks and wipers on the code selector switch, the wipers being connected to the respective impuse cut off relays; flexible conductors connecting contacts of the digit banks, corresponding to each drop switch, to the respective bus bars corresponding to predetermined carrier positions for such drop; means operated by the transmitter advancing means for applying potential to the bus bars successively as the carriers are successively stepped up to the position corresponding to the bus bar to which the flexible conductor of the associated bank is connected.

4. In combination, a source of current; a code selector switch having a wiper and fixed contacts; a signal conductor and a restoration conductor connected to said source; a plurality of signal drops for connecting the signal conductor to a contact; means actuated by the restoration of a drop for connecting the restoration conductor to such contact, means set in operation by the connection of such contact by the wiper for causing the wiper to stop on such contact; a signal relay and a restoration relay selectively energized by the cooperation of said engagement of the stopping means and current in one of said conductors respectively; a plurality of character carriers; a transmitter set in operation by said signal relay for setting said carriers in one position in accordance with the selector-switch position; and means controlled by the restoration relay for causing said transmitter to set said carriers in a different position in accordance with said selector switch position.

5. In combination, a selector switch; a signal conductor and a restoration conductor; a plurality of character carriers; means cooperating with said selector switch set in operation by current in said signal conductor for normally setting said carriers in one position in accordance with the selector-switch position and adjunctive means set in operation in response to the energization of the restoration conductor for changing the normal setting of the carrier.

6. In combination, a code selector switch having a wiper and fixed contacts; a signal conductor and a restoration conductor; means for selectively connecting each conductor to one of said contacts; a current source; means set in operation by the connection of such contact to the source for causing the wiper to stop on such contact; a signal relay and a restoration relay connected to said conductors respectively and

each set in operation by current in the conductor to which it is connected; a character carrier; and means cooperating with said selector switch and one or the other of said relays for setting said carrier at different times in different positions for the same selector-switch position.

7. In combination, a plurality of drops each having a normally closed switch and a normally open switch; an actuating relay associated with each drop having a double-throw switch having make, break and transfer contacts; a resistor having one end connected to each transfer contact; a source of current; signal conductors connecting the normally open switch between the source and the break contact; restoration conductors connecting the normally open switch between the source and make contact; a code selector switch having a wiper and fixed contacts respectively connected to the resistors at said end; cut off means connected to the other end of the resistor and set in operation by the connection of the resistor to the source for causing the wiper to move to and stop on the contact connected therewith; an alarm signal relay interposed, by the operation of the cut-off means into the signal conductor when conducting and thereby energized; a restoration signal relay interposed, by the operation of the cut off relay, into the restoration conductor; a plurality of character carriers; and means set in operation by said signal and restoration relays respectively for setting said carriers in different positions for the same position of the selector switch.

8. In combination, a source of current; a code selector switch having a selector wiper and fixed selector contacts; a signal conductor and a restoration conductor connected to said source; drop means for selectively connecting each conductor to a contact; a plurality of character carriers; a stepping means for each carrier for stepping the carriers one step at a time; operating means for the stepping means set in operation by current in either of said conductors; and a cut-off means for each carrier stepping means adapted when energized to stop the stepping of the carrier; a plurality of bus bars corresponding to carrier positions; digit banks and wipers on the code selector switch corresponding to the carriers respectively; each digit bank contact corresponding to a drop means; cut-off conductors connecting the wipers to the respective cut off means; a flexible conductor connecting each digit bank corresponding to a bus bar; means for successively applying potential to the bus bars as the carriers are stepped to successive positions, means set in operation by current in the restoration conductor for opening one of said cut off conductors to cause the stepping means to continue to step after the associated code switch wiper is energized; and means operated by the transmitter for applying potential to the associated bus bar after such stepping means has stepped an additional step.

9. In combination, a transmitter comprising a bank of fixed contacts, a wiper for the bank, and stepping means for the wiper; means for supplying current to the transmitter stepping means; a plurality of character carriers; means including stepping magnets, one for each carrier for stepping the carriers one step at a time; means operated by the transmitter stepping means for supplying simultaneously stepping impulses to all the stepping magnets; an impulse cut-off means for each stepping magnet adapted when energized to stop the stepping of the magnet; a plurality of bus bars each corresponding to a carrier position; means for selectively connecting the bus bars to the respective impulse cut off means; means for supplying potential to the wiper of said bank whereby potential is successively applied to the bus-bars as the carriers are stepped up whereby potential is supplied to each cut-off relay as soon as its carrier reaches the position corresponding to the bus bar to which the associated cut-off means is connected.

10. In combination, a transmitter comprising a switch bank of fixed contacts, a wiper for the bank, and stepping means for the wiper; means for supplying initial current to the transmitter and stepping means when in normal condition of rest, normally inoperative means for supplying operating current to the transmitter and stepping means after initial starting and during the rest of the switch cycle and cutting off the operating current after the cycle is complete; a plurality of type carriers; means including stepping magnets, one for each carrier for stepping the carriers one step at a time; means operated by the transmitter stepper for supplying simultaneously stepping impulses to all the stepping magnets; an impulse cut-off means for each stepping magnet adapted when eregized to stop the stepping of the magnet; a plurality of bus bars corresponding to carrier positions respectively; means for selectively connecting the bus bars to the respective impulse cut off means; means for supplying potential to the wiper of said bank whereby potential is successively applied to the bus-bars as the carriers are stepped up.

11. In combination, a transmitter comprising a printer control bank of contacts, a wiper for said bank, and stepping means for the wiper; a plurality of settable type carriers; printing means and paper feed means cooperating with said type carriers; a printing magnet for operating the printing means; and means for supplying current to the printing magnet at printing position through an intermediate contact of the printer control bank and its wiper.

12. In combination, a transmitter comprising a control bank of fixed contacts, a wiper for said bank, and stepping means for the wipers; a plurality of type carriers; stepping magnets, one for each carrier; means operated by the transmitter stepping means for supplying simultaneously stepping impulses to all the stepping magnets; means for selectively stopping the stepping of the magnets; Printing means cooperating with said type carriers for printing and including a printing magnet for operating the printing means; means for supplying current to the printing magnet through an intermediate contact of the printer control bank and its wiper, such contact being positioned to be engaged by its wiper after the carriers have been set.

13. In combination, a transmitter comprising a stepper-control bank and a printer-control bank of fixed contacts, a wiper for each bank, and stepping means for the wipers; type carriers; means for supplying current through fixed contacts and the wiper of the first bank to the transmitter stepping means until the carriers are set; means including stepping magnets, one for each carrier, for stepping the carriers; means operated by said stepping means for supplying impulses to the stepping magnets; a cut-

off means for each stepping magnet adapted when energized to stop the stepping of the magnet; a plurality of bus bars corresponding to carrier positions and connected to successive contacts of printer control bank; means for connecting bus bars to respective impulse cut-off means; means for supplying potential to the wiper of the printer control bank whereby potential is successively applied to the bus-bars as the carriers are stepped up whereby potential is supplied to each cut-off relay as soon as its carrier reaches the position corresponding to the bus bar to which the associated relay is connected, thereby setting the type carriers; printing means including a platen for said type carriers and a magnet to operate the platen; and means for connecting the printing magnet to a printer bank contact succeeding the bus bar associated contacts.

14. In combination, a transmitter comprising stepper-control and printing banks of contacts, a wiper for each bank, and stepping means for the wipers electrically connected to the stepping control wiper; a plurality of settable type carriers; printing means cooperating with said type carriers; paper feed means for supplying paper to the type carriers; means for supplying current to contacts of the stepper control bank; said printing means including a printing magnet for operating the printing means; and means for supplying current to the printing magnet through an intermediate contact of the printer control bank and its wiper.

15. In combination, a transmitter comprising stepper-control bank and a printer-control bank of fixed contacts, a wiper for each bank, and stepping means for the wipers operative when current is supplied; a plurality of settable type carriers; the stepper control bank including a printer contact and stepper contacts; means for supplying potential through the stepper contacts of the stepper control bank and the wiper thereof to said stepping means for operating the stepper means; printing means cooperating with said type carriers for printing and including a printing magnet for operating the printing means; means for supplying current to the printing magnet through an intermediate contact of the printer control bank and its wiper after the carriers have been set; the printer contact of the stepper control bank corresponding to said intermediate contact and being isolated from said supply means, whereby the stepping means is temporarily stopped; and means controlled by the printing magnet when energized for supplying potential to said printer contact of the stepper-control bank, to step the stepping means another step.

16. In combination, a transmitter comprising a stepper-control bank and a printer-control bank of fixed contacts, a wiper for each bank, and stepping means for the wipers; operative to step when supplied with current; a plurality of settable type carriers; said stepper bank including a printer contact and stepper contacts; means for supplying current through the stepper contacts of the stepper control bank and the wiper thereof to said stepping means; printing means cooperating with said type carriers for printing and including a printing magnet for operating the printing means; means for supplying current to the printing magnet through an intermediate contact of the printer control bank and its wiper after the carriers have been set; said feeder contact of the stepper control bank corresponding to said intermediate contact being isolated from said supply means, whereby the stepping means is temporarily stopped; means controlled by the printing magnet when energized for supplying potential to said corresponding contact of the first bank, to step the stepping means another step; a paper feed means having a paper feed magnet; and means including a circuit controlled by the next subsequent contact of the printer-control bank and the printing magnet when deenergized, for supplying current to the paper feed magnet.

17. In combination, a transmitter comprising a stepper-control and printing banks of contacts, a wiper for each bank, and stepping means for stepping the wipers electrically connected to the stepping control wiper; a plurality of settable type carriers; printing means and paper feed means, cooperating with said type carriers, for printing and feeding the paper; the stepper control bank having a printer contact and a feeder contact at the wiper position at which printing is to take place; means for supplying current to contacts of the stepper control bank except the printer and feeder contacts; a printing magnet for operating the printing means; means for supplying current to the printing magnet at printing position of the wipers through an intermediate contact of the printer control bank and its wiper; means controlled by the printing magnet when energized for supplying potential to the contact of the stepper bank corresponding to printing position, to step the stepping means another step; a paper feed means having a paper feed magnet; means including a circuit controlled by the next subsequent contact of the printer-control bank and the printing magnet when deenergized, for supplying current to the paper feed magnet.

18. In combination, a transmitter comprising a stepper-control and printing banks of contacts, a wiper for each bank, and stepping means for the wipers electrically connected to the stepping control wiper; a plurality of settable type carriers; printing means and paper feed means, cooperating with said type carriers, for printing on paper and feeding the paper; the stepper control bank including a printer contact and a feeder contact; means for supplying potential to the contacts of the stepper control bank except the printer and feeder contacts; a printing magnet for operating the printing means; means for supplying current to the printing magnet at printing position of the wipers through the printer contact; means controlled by the printing magnet when energized for supplying potential to the printer contact of the stepper control bank, to step the stepper control wiper to the feeder contact; a paper feed means having a paper feed magnet; means including a circuit controlled by the next subsequent contact of the printer-control bank and the printing magnet when deenergized, for supplying current to the paper feed magnet; a restoring means including a release magnet for restoring the carriers; means operated by the paper feed magnet for energizing the release magnet; and means set in operation by the operation of the release magnet for conducting current to the feeder contact of the stepper control bank for causing the stepping means to continue.

19. In combination, supervisory and alarm drop switches; code selector switches associated with alarm drop switches and supervisory drop switches respectively, and each having a wiper, fixed contacts respectively connected to the associated drop switches and energized when such switch is closed, and mechanism including wiper-

stepping means responsive to the closure of a drop switch for stepping the wiper; a cut-off means for stopping the stepping means when connected to a charged selector contact; means responsive to the closure of a drop switch for connecting the cut-off means with alarm-associated wiper when the alarm drop switch is closed, and with supervisory-associated wipers when the supervisory drop switch is closed.

20. In combination, supervisory and alarm drop switches; an alarm contactor relay; means responsive to any alarm drop switch closure for energizing said alarm contactor relay; a main contactor relay energized when the alarm contactor relay is energized or a supervisory drop switch is closed; code selector switches associated with alarm drop switches and supervisory drop switches respectively, and each having a wiper, fixed contacts respectively connected to the associated drop switches and energized when such switch is closed, and mechanism including wiper-stepping means responsive to the operation of the main contactor relay when energized; for stepping the wiper; a cut-off means for stopping the stepping means when connected to a charged selector contact; and means responsive to the alarm contactor relay for connecting the cut-off means with alarm-associated wiper when the alarm contactor relay is energized, and with supervisory-associated wipers when the alarm contactor relay is deenergized; a transmitter; and means responsive to operation of the cut-off means whereby the transmitter is set in operation.

21. In combination, supervisory and alarm drop switches; code selector switches associated with alarm drop switches and supervisory drop switches respectively, and each having a wiper, fixed contacts respectively connected to the associated drop switches and energized when such switch is closed, and mechanism including wiper-stepping means responsive to the closure of a drop switch for stepping the wiper; a cut-off means for stopping the stepping means when connected to an energized selector contact; means responsive to the closure of a drop switch for connecting the cut-off means with alarm-associated wiper when the alarm drop switch is closed, and with supervisory-associated wipers when the supervisory drop switch is closed; a group selector, having a wiper, fixed contacts connected to the respective wipers of the code selector switches, and mechanism including a wiper stepping means responsive to the operation of said cut-off means for stepping the wiper; a group selector cut-off relay; means for connecting the group selector cut-off to the group selector wiper while such wiper is engaged with alarm-associated contacts, and to such wiper when an alarm drop switch is not closed and such wiper is engaged with supervisory-associated contacts; and means including a transmitter responsive to the operation of the group selector cut-off relay.

22. In combination, supervisory and alarm drop switches; an alarm contactor relay; means responsive to any alarm drop switch closure for energizing said alarm contactor relay; code selector switches associated with alarm drop switches and supervisory drop switches respectively, and each having a wiper, fixed contacts respectively connected to the associated drop switches and energized when such switch is closed, and mechanism including wiper-stepping means set in operation by the closure of a drop switch for stepping the wiper; a cut-off means for stopping the stepping means when connected to an energized selector contact; means responsive to the operation of the alarm contactor relay for connecting the cut-off means with alarm-associated wipers when the alarm contactor relay is energized, and with supervisory-associated wipers when the alarm contact relay is deenergized; a group selector, having a wiper, fixed contacts connected to the respective wipers of the code selector switches, and mechanism including a wiper stepping means responsive to the operation of said cut-off means for stepping the wiper; a group selector cut-off relay for stopping the last named stepping means; means for connecting the group selector cut-off to the group selector wiper only when the alarm contactor is energized while such wiper is engaged with alarm-associated contacts, and to such wiper when the alarm contactor is deenergized only while such wiper is engaged with supervisory-associated contacts; and means including a transmitter responsive to the operation of the group selector cut-off relay.

23. In combination, supervisory and alarm drop switches; a code selector switch associated with both alarm drop switches and supervisory drop switches, and having a wiper, fixed contacts respectively connected to the drop switches, and mechanism including wiper-stepping means responsive to closure of a drop switch; means including a code selector cut-off relay for cutting off the stepping means; means for connecting the cut-off relay to the selector wiper when such wiper is engaged with alarm-associated contacts, and to said wiper when an alarm drop is not closed and said wiper is engaged with supervisory associated contacts.

24. In combination, supervisory and alarm drop switches; an alarm contactor relay; means whereby the contactor is energized when any alarm drop switch is closed; a main contactor relay, means whereby the main contactor relay is energized when the alarm contactor relay is energized or a supervisory drop switch is closed; a code selector switch associated with both alarm drop switches and supervisory drop switches, and having a wiper, fixed contacts respectively connected to the associated drop switches, and wiper-stepping means set in operation by the operation of the main contactor relay; a code selector transfer switch operated by the alarm contactor relay when energized; a code selector cut-off relay electrically connected to the transfer element of the code selector transfer switch; and means operated by the selector switch for connecting the code selector wiper to the make contact of the code selector transfer switch when such wiper is engaged with alarm-associated contacts, and with the break contact when said wiper is engaged with supervisory contacts.

25. In combination, supervisory and alarm drop switches; a code selector switch associated with both alarm drop switches and supervisory drop switches, and having a wiper, fixed contacts respectively connected to the drop switches, and means including wiper-stepping means set in operation responsive to the closure of a drop switch for stepping the wiper; a code selector cut-off relay element of the code selector transfer switch; means for connecting the cut-off relay to the selector wiper while such wiper is engaged with alarm-associated contacts, and said wiper is engaged with supervisory contacts and an alarm drop has been opened; a group selector, having a wiper, fixed contacts connected to the respective wipers of the code selec-

tor switches, and a wiper stepping means set in operation by the operation of said cut-off relay; a group selector transfer switch operated responsive to the closure of an alarm drop switch; a group selector cut-off relay electrically connected to the transfer element of the group selector transfer switch; means for connecting the group selector wiper to the make contact of the group transfer switch when such wiper is engaged with alarm-associated contacts, and with the break contact when said wiper is engaged with supervisory contacts; and a transmitter set in operation by the group selector cut-off relay when energized.

26. In combination, supervisory and alarm drop switches; an alarm contactor relay; means whereby the alarm contactor relay is energized in response to closure of an energized alarm drop switch; a code selector switch associated with both alarm drop switches and supervisory drop switches, and having a wiper, fixed contacts each connected to a drop switch, and means including wiper-stepping means set in operation responsive to the closure of a drop switch for stepping the wiper; a code selector transfer switch operated by the alarm contactor relay when energized; a code selector cut-off relay electrically connected to the transfer element of the code selector transfer switch; means for connecting the code selector wiper to the make contact of the code selector transfer switch while such wiper is engaged with alarm-associated contacts, and with the break contact when said wiper is engaged with supervisory contacts; a group selector, having a wiper, fixed contacts connected to the respective wipers of the code selector switches, and a wiper stepping means set in operation responsive to the operation of said cut-off relay; a group selector transfer switch operated by the alarm contactor relay when energized; a group selector cut-off relay electrically connected to the transfer element of the group selector transfer switch; and means for connecting the group selector wiper to the make contact of the group transfer switch when such wiper is engaged with alarm-associated contacts, and with the break contact when said wiper is engaged with supervisory contacts.

27. In combination, a plurality of alarm and supervisory drops; an audible supervisory signal device; an audible alarm signal device; means set in operation responsive to the operation of any one of said drops for printing code indicia corresponding thereto, and means for operating and locking-in an operated supervisory or alarm signal device depending on whether the operated drop is a supervisory or alarm drop; and operator acknowledgment means adapted when operated to unlock the locked-in signal device.

28. In combination, a plurality of drops; an alarm signal device; means set in operation responsive to actuation of any one of said drops for printing code indicia corresponding thereto, and operating and locking-in the signal device; and a plurality of operator acknowledgment means, each adapted when operated to cooperate with the first named means to cause the printing of code indicia corresponding thereto, and to unlock the locked-in signal device.

29. In combination, a plurality of alarm and supervisory drops; a supervisory signal device; an alarm signal device; means set in operation responsive to actuation of any one of said drops for printing code indicia corresponding thereto, and operating and locking-in a supervisory or alarm signal device depending on whether the actuated drop is a supervisory or alarm drop; and a plurality of operator acknowledgment means, each adapted when operated to cooperate with the first named means to cause the printing of code indicia corresponding thereto, and to unlock the locked-in signal device.

30. In combination, a plurality of drops; a signal device; a plurality of character carriers; a stepping means for each carrier for stepping the carriers to successive positions; a selector switch settable to different positions; means including selectively settable means cooperating with the selector switch for disabling the stepping means as the carriers reach a predetermined position determined by the position of the selector switch and the setting of the settable means; means set in operation responsive to actuation of any one of said drops to set the selector switch in accordance with the actuated drop and operate the signal device; printing means set in operation by the setting of the selector switch for causing the character carriers to print and restore; operator acknowledgment keys; and mean cooperating with said first and second named means and controlled by each operator key for positioning the selector switch in accordance with the key thereby to position carriers and operate the printing means to print in accordance with the key.

31. In combination, a plurality of drops; a signal device; a common relay; a plurality of character carriers; a stepping means for each carrier for stepping the carriers to successive positions; a selector switch settable to different positions; means cooperating with the selector switch for disabling the stepping means as the carriers reach a predetermined position determined by the position of the selector switch; means set in operation responsive to actuation of any one of said drops to set the selector switch in accordance with the actuated drop and operate the signal device and cooperating with the common relay for locking in the signal device; printing means set in operation responsive to the setting of the selector switch for causing the character carriers to print and restore; operator acknowledgement keys; and means controlled by each operator key for energizing the common relay to unlock said signal device, and for positioning the selector switch in a position determined by the operated key, thereby to position the carriers and operate printing means.

32. In combination, supervisory drop switches; a main contactor relay energized responsive to closure of a supervisory drop switch; a printer having settable character elements; a transmitter; means responsive to operation of said relay and drop switches respectively, to cause said transmitter to set said elements in accordance with actuated drop switches; a supervisory signal relay; a common relay; means cooperating with the main contactor relay when energized and the common relay when deenergized, for operating the supervisory signal relay; means cooperating with the common relay when deenergized for locking in said signal relay when the latter is energized and for unlocking said signal relay when the common relay is energized; individual operator acknowledgment keys; and means controlled by each operator key for energizing the common relay, thereby to unlock said signal relay.

33. In combination, an alarm drop switch; a main contactor relay; an alarm contactor relay;

means responsive to closure of an alarm drop switch, for energizing said alarm contactor relay; means responsive to energization of said alarm contactor relay for energizing the main contactor relay; a printer having settable character elements; a transmitter; means cooperating with said relays and drop switches respectively, to cause said transmitter to set said elements in accordance with actuated drop switches; an alarm signal relay; a common relay; means controlled by the alarm contactor relay when energized for operating and locking in the alarm signal relay; means controlled by the common relay when deenergized for locking in said signals relay when the latter are energized and for unlocking said signal relay when the common relay is energized; individual operator acknowledgment keys; and means controlled by each operator key when energized for energizing the common relay.

34. An apparatus comprising a plurality of drops; a signal device; a common relay; three or more character carriers; a stepping means for each carrier for stepping the carriers to successive positions; a selector switch settable to different positions; selectively settable means; means including the settable means and cooperating with the selector switch for disabling the stepping means as the three or more carriers all reach predetermined positions corresponding to the position of the selector switch and the setting of the settable means; means set in operation by actuation of any one of said drops to set the selector switch in accordance with the actuated drop and operate the signal device; printing means set in operation by the setting of the selector switch for causing the character carriers to print and restore; operator acknowledgment keys associated with one of the carriers and setting means controlled by each operator key for positioning the selector switch in accordance with the keys; another of the carriers having an acknowledgment symbol thereon to be printed; and means controlled by the setting of the settable means and the setting of the selector switch by said setting means to position said last named carrier to print said symbol.

35. Apparatus as in claim 34 including means operated by the selector switch when set to energize immediately the disabling means of the remaining carrier or carriers to prevent the latter from being set to print.

36. In combination, a plurality of drops; a signal device; a common relay; a plurality of character carriers; a stepping means for each carrier for stepping the carriers to successive positions; a selector switch settable to different positions; means controlled by the selector switch for disabling the stepping means as the carriers reach a predetermined position corresponding to the position of the selector switch; means set in operation by actuation of any one of said drops to set the selector switch in accordance with the actuated drop and operate the signal device; printing means set in operation by the setting of the selector switch for causing the character carriers to print and restore; operator acknowledgement keys; individual operator acknowledgement relays; operator key switch controlled means for energizing each operator relay; means for locking in each operator relay when energized; means controlled by each operator key for positioning the selector switch in accordance with the key thereby to position carriers and operate the printing means; means controlled by the selector switch when positioned for short circuiting the magnet coil of the corresponding operator relay thereby to unlock the relay.

37. In combination, a normally closed double pole alarm switch; a pair of normally energized relays in circuit with the respective poles of the double pole switch; a normally energized alarm drop; a normally deenergized trouble drop; means for deenergizing the alarm drop if both relays are deenergized, and energizing the trouble drop when only one relay is deenergized.

38. In combination, a pair of operating devices; a normally energized drop; a normally deenergized drop; means for deenergizing the first drop if both devices are operated, and energizing the second drop when only one device is operated.

39. In combination, a pair of normally energized relays; a normally energized alarm drop; a normally deenergized trouble drop; means for deenergizing the alarm drop if both relays are deenergized, and energizing the trouble drop when only one relay is deenergized.

40. In combination, a normally closed double pole alarm switch; a pair of normally energized relays in circuit with the respective poles of the double pole switch; a normally energized alarm drop; a normally deenergized trouble drop; means for deenergizing the alarm drop if both relays are deenergized, and energizing and locking in the trouble drop when only one relay is deenergized and unlocking the trouble drop only after both relays are again energized.

41. In combination, a settable value exhibiting means; operating means initiated by a signal for selectively setting the value exhibiting means and then restoring it; and means set in operation by accidental manual movement of the exhibiting means for causing the restoration of the exhibiting means.

42. In combination, a pair of normally energized relays; an alarm drop relays; an alarm drop relay including a normally energized alarm drop magnet and a normally open alarm drop switch; a supervisory relay including a normally deenergized trouble drop magnet and a normally open supervisory trouble drop switch; means for deenergizing the alarm drop if both relays are deenergized, and energizing the trouble drop when only one relay is deenergized; selector means having a movable part having alarm and trouble positions; means for moving said part to successive positions; and means cooperating with said part and switches, to stop said selector means when it is in alarm position when both normally energized relays are deenergized, or in trouble position when one only of the normally deenergized relays is energized.

43. In combination, a pair of normally energized relays; an alarm drop relay including a normally energized alarm drop magnet and a normally open alarm drop switch; a supervisory relay including a normally deenergized trouble drop magnet and a normally open supervisory trouble drop switch; means for deenergizing the alarm drop if both relays are deenergized, and energizing the trouble drop when only one relay is deenergized; a selector switch having a movable part having alarm and trouble positions; means for moving said part to successive positions; and means cooperating with said drop switches for stopping the selector switch movable part when it is in alarm position when the alarm drop switch is closed, or when it is in

trouble position when the alarm drop switch is open and the trouble drop switch closed; whereby said selector switch movable part is stopped when the selector switch movable part is in alarm position when both normally energized relays are deenergized, or in trouble position when one only of the normally deenergized relays is energized.

44. In combination, a pair of normally energized relays; a code selector switch having alarm and trouble positions and having a wiper and wiper-stepping means set in operation responsive to the energization of either or both relays; means for disabling the stepping means whenever both normally energized relays are deenergized and the wiper is in alarm position, or whenever said wiper is in trouble position when only one normally deenergized relay is energized, whereby said selector switch is stopped when the wiper is in alarm position when both normally energized relays are deenergized, or in trouble position when one only of the normally deenergized relays is energized.

45. In combination, a pair of normally energized relays; an alarm drop relay including a normally energized alarm drop magnet and a normally open alarm drop switch; a supervisory relay including a normally deenergized trouble drop magnet and a normally open supervisory trouble drop switch; means for deenergizing the alarm drop if both said normally energized relays are deenergized, and energizing the trouble drop when only one relay is deenergized; a code selector switch having a wiper, fixed contacts respectively connected to the drop switches, and wiper-stepping means set in operation by closure of either drop switch; the selector switch being in alarm and trouble positions when the wiper is engaged with alarm switch-associated and trouble-switch-associated contacts respectively; a code selector cut-off relay for cutting off the stepping means; means for connecting the cut-off relay to the selector wiper whenever the wiper is engaged with closed-alarm-switch associated contacts, or to said wiper whenever said alarm-associated-switch is open and said wiper is engaged with closed trouble-drop-switch-associated contacts; whereby said cut-off relay is operated whenever the wiper is in alarm position and engages with an alarm-associated contact or when the wiper is in trouble position and engages with the energized trouble-switch-associated contact.

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