Oct. 4, 1955 A. E. BACHELET ET AL 2,719,960

ALARM SENDING SYSTEM

Filed April 30, 1954 2 Sheets-Sheet 1

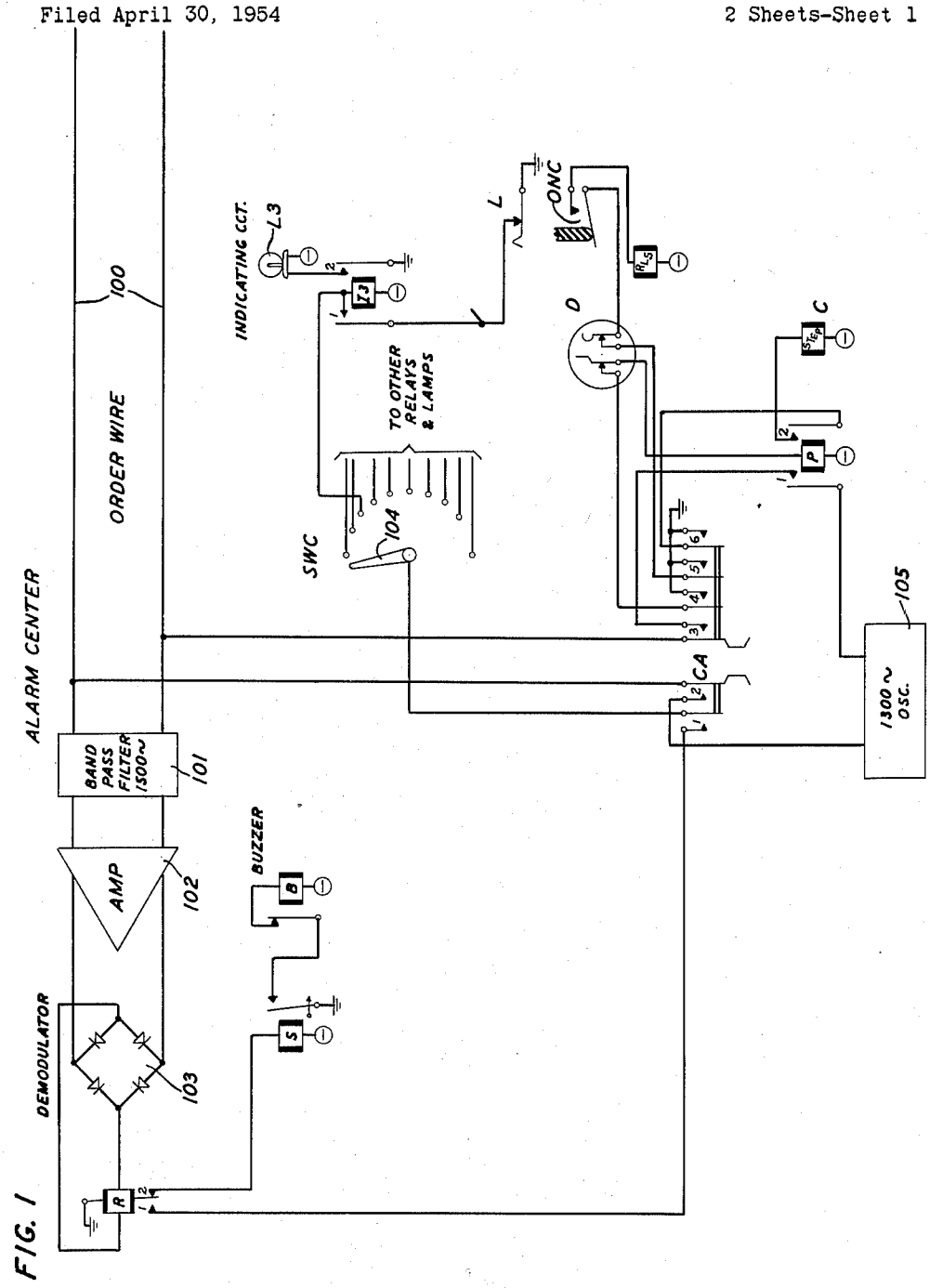

FIG. 1

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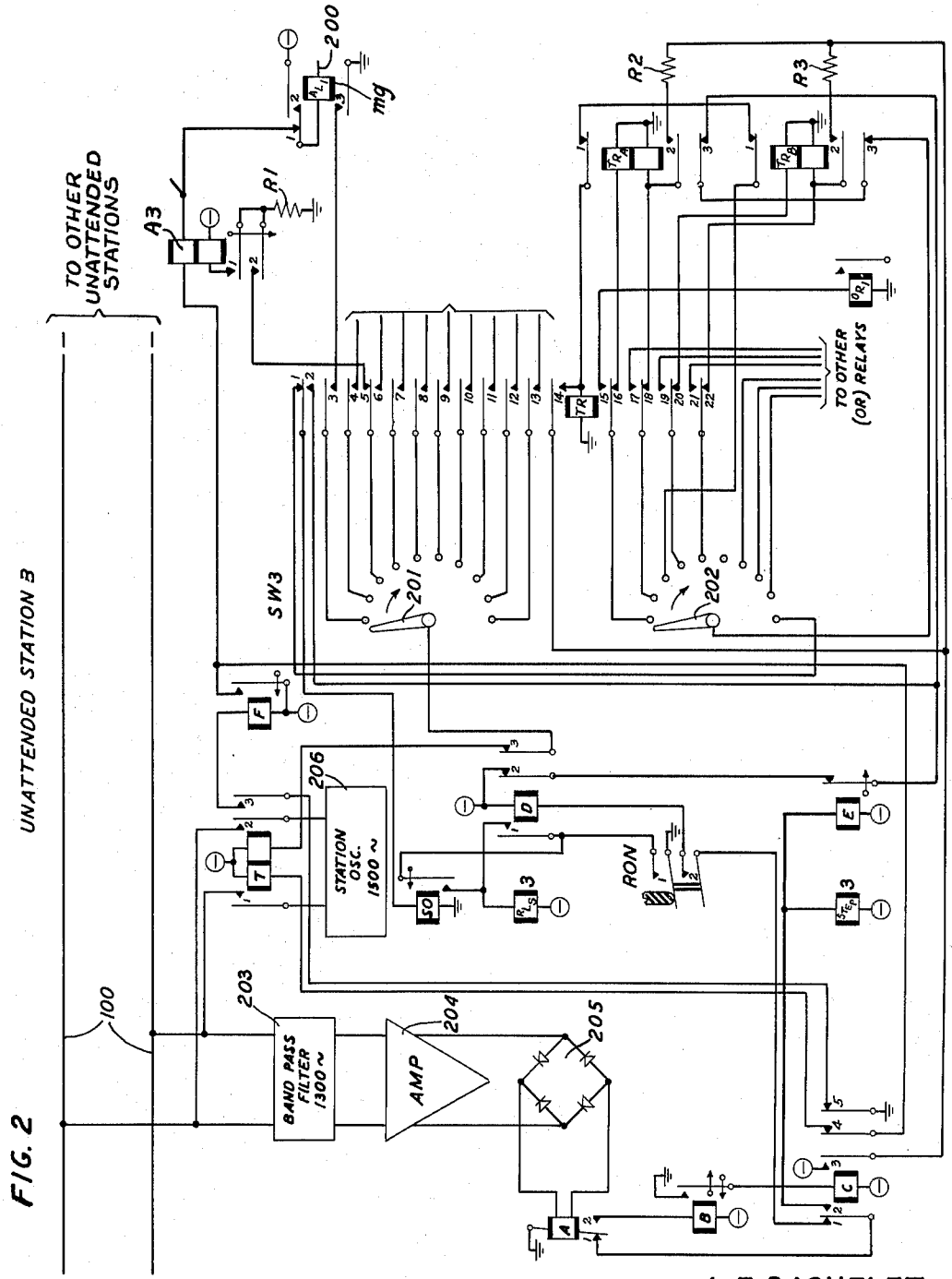

FIG. 2

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ALARM SENDING SYSTEM

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5 Claims. (Cl. 340—163)

This invention relates to alarm signaling and remote control systems and has for its object to facilitate the indication of alarm or other conditions at remote signalling stations and the transmission of orders to such stations.

Elaborate systems have been designed for main signaling routes but such arrangements are not economical for small branch routes having relatively few stations thereon.

In accordance with the present invention a simple, relatively inexpensive, signaling system is provided, employing a rotary stepping switch at each station, with means controlled over the switches to identify a station in trouble and the nature of the trouble.

Further means is provided by the directive control of the station switches to select a particular station and to register a specific order at that station.

These and other features of the invention will be more clearly understood from a consideration of the following description read in connection with the attached drawing in which:

Fig. 1 shows the equipment at the alarm center; and

Fig. 2 shows the equipment at the unattended station.

In general, the system includes an alarm center (Fig. 1) and five unattended stations (Fig. 2) connected by order wire **100** which may be a physical line or may be a particular channel of the signaling system. Signals are transmitted by means of voice frequency alternating current, only two frequencies being employed, that is, one frequency, for example 1300 cycles, by the alarm center and the other frequency, for example 1500 cycles, by the unattended stations. As shown in Fig. 2, each unattended station has a plurality of alarm relays such as relay AL1 and a common alarm relay A3. When an alarm condition arises, a pulse of the 1500-cycle frequency is transmitted over the order wire causing an alarm indication at the alarm center. Each station also has a rotary switch, which may be operated under the control of the alarm center, and the common alarm relay marks one of five station identifying terminals in its associated switch to identify the unattended station.

Following the reception of an alarm indication, the attendant at the alarm center initiates a scanning operation by the switches at the alarm center and at all of the unattended stations. When the switches reach the position marked by the common alarm relay, a signal is transmitted which operates station identifying means at the alarm center. Having identified the station in trouble, the attendant will select that station by dialing a digit assigned to that station, advancing all of the station switches. A transfer relay is provided at each station but only the transfer relay of the station, whose identifying digit has been dialed, operates at the end of the digit, since this relay is, in each station, connected to the terminal assigned to that station. The terminals corresponding to those assigned to other stations are connected to the windings of a set of lockout relays which open the circuit of the transfer relay when a digit assigned to another station is dialed. The transfer equipment connects the individual alarm relays to terminals of the switch and the attendant now initiates another scanning operation to identify the nature of the trouble. The transfer equipment also prepares a plurality of order circuits and the attendant may transmit an order following the identiffication of the trouble or by first operating the transfer equipment and then dialing a digit corresponding to the desired order.

Assume now that an alarm condition at unattended station 3, shown in Fig. 2, causes the connection of ground to conductor **200**, completing a circuit from ground on conductor **200** through the winding of individual alarm relay AL1, contact **1** of relay AL1, upper winding of common alarm relay A3, contact **4** of relay C, left winding of relay T to battery. Relays A3 and T operate in this circuit, relay A3 locking in a circuit from battery through its lower winding and over its contact **1** to ground through resistance R1. At its contact **2**, relay A3 connects ground through resistance R1 to terminal **3** of brush **201** of the rotary switch SW3 to identify the station. Relay AL1 is marginal and cannot operate in series with the high resistance of the left winding of relay T. Relay T connects the station oscillator **206** over its contacts **1** and **2** to the order wire **100** and at its contact **3** closes a circuit from ground over contact **5** of relay C, contact **3** of relay T to battery through the winding of relay F. Relay F is slow to operate and after an interval connects battery to the upper winding of relay A3 in parallel with the left winding of relay T, thereby increasing the current flow through the winding of relay AL1 sufficiently to cause that relay to operate and lock to battery over its contact **2**. At its contact **1**, relay AL1 opens the circuit of relays A3 and T, relay T releasing to terminate the alarm signal but relay A3 remaining operated in its locking circuit. Relay T in releasing also releases relay F.

At the alarm center the alarm signal passes through band-pass filter **101**, which is tuned to the 1500-cycle frequency, amplifier **102** and demodulator **103** to the winding of relay R. Relay R, when deenergized, holds its contact **2** closed, holding relay S operated. When relay R operates, it opens the circuit of relay S, but relay S is slow to release and does not close its contact unless the signal continues for a sufficient length of time to indicate an alarm signal, thus preventing alarm indications due to noise and other transient conditions. When relay S releases, it operates buzzer B to indicate the arrival of an alarm.

The attendant at the alarm center now operates key CA to prepare for identifying the station and the alarm condition. At contact **4** of key CA a circuit from ground is closed over the pulsing contact of dial D to the winding of pulsing relay P, operating relay P. Relay P at its contact **2** closes a circuit for the magnet Step C which controls the rotary switch SWC. With key CA and relay P operated, the 1300-cycle oscillator **105** is connected over contacts **2** and **3** of key CA and contact **1** of the pulsing relay P to the order wire **100**.

Each of the unattended stations responds to the 1300-cycle current in the same manner as station **3** of Fig. 2, where the current passes through the band-pass filter **203**, which is tuned to the 1300-cycle frequency, amplifier **204** and demodulator **205** to the winding of relay A. Relay A operates in this circuit closing at its contact **2** an obvious circuit for relay B. Relay B is slow to operate so that it will not operate from transient conditions. After a period, say of two or three seconds, relay B closes an obvious circuit for relay C. Relay C at its contact **4** opens the circuit through the left winding of relay T and at its contact **5** opens the circuit of relay F to prevent the transmission of alarm signals during the time the unattended

station is receiving pulses from the alarm center. Alarms which originate at this time also cannot be locked in.

After waiting the necessary two or three seconds to permit the conditions at the unattended stations to become stabilized, the attendant will dial the digit **0** to initiate a scanning operation to determine the station which originated the alarm. At each opening of the dial contact, relay P releases, disconnecting the 1300-cycle current from the order wire and releasing magnet Step C to advance switch SWC one step. While the dial operation has been shown as a simple interruption of the signaling current it will be understood that any other well-known method of removing the signaling current from the order wire may be employed.

The disconnection of the 1300-cycle current at each opening of the dial contact causes relay A to release, completing a circuit over its contact **1** and contact **2** of relay C to battery through the windings of magnet Step **3** and relay E. Magnet Step **3** is energized to prepare switch SW3 to step and relay E opens a circuit which will be traced hereinafter. In response to the dial pulses, switches SWC and SW3 will advance in synchronism to position **10**. When brush **201** is advanced to its third contact, a circuit is closed from ground through resistance R1, contact **2** of relay A3, contact **5** of relay TR, terminal **3** and brush **201**, contact **3** of relay D through the right winding of relay T to battery. Relay T operates and, in the manner previously described, connects the station oscillator **206** to the order wire **100**, operating relay R at the alarm center. With key CA operated, the operation of relay R closes a circuit from ground over contact **1** of relay R, contact **1** of key CA, brush **104** of switch SWC, which at this time will also be engaging its third contact, winding of indicating relay I3 to battery. Relay I3 operates and locks over its contact **1** to ground over locking key L and at its contact **2** lights indicating lamp L3 thereby indicating to the attendant the identity of the station which originated the alarm.

At station **3** the connection of battery through the winding of relay T to resistance **R1** in parallel with the lower winding of relay **A3** reduces the current flow in the locking winding of relay **A3** sufficiently to cause relay **A3** to release. At the end of the digit, switch SW3 will be left off-normal in position **10** but with relay A held operated the circuit of relay E is opened and when that relay releases, after an interval, it closes a circuit from battery over contact **2** of relay D, back contact of relay E, contact **3** of relay TRA, contact **3** of relay TRB, brush **202** and its tenth terminal, contact **1** of relay TR to ground through the winding of slow-to-operate relay SO. Relay SO operates and closes a circuit from battery through the winding of release magnet RLS3 to ground over off-normal contact RON. Magnet RLS3 operates in this circuit to restore switch SW3 to normal. As soon as switch SW3 leaves its terminal **10**, relay SO releases. The switches at all of the unattended stations will be returned to normal in a similar manner.

When the dial D returns to normal, switch SWC will be restored to its normal position by release magnet RLS which is operated in a circuit from battery through its winding over off-normal contact ONC, normal contact of dial D and contact **5** of key CA.

As previously stated, the common alarm relay such as relay **A3** connects resistance ground to a particular terminal of its station switch which will identify the station. That is, in station **1**, the resistance ground would be connected over a normal contact of the associated transfer relay to terminal **1** of the switch at that station. In station **2**, the resistance ground would be connected to terminal **2** of the switch, etc. In the remote event that alarms from more than one station overlap, the signaling operation above described would cause the corresponding plurality of indicating relays to operate and lock.

In order to identify the particular alarm condition, the attendant will select the station identified by the indicating lamp, in this case station **3**, by dialing the corresponding digit. As a result switches SWC, SW3 and all of the other station switches will be advanced simultaneously to their positions **3** in the manner previously described.

At station **3**, when relay E releases at the end of this digit a circuit will be closed from battery over contact **2** of relay D, contact of relay E, contact **3** of relay TRA, contact **3** of relay TRB, brush **202** in position **3**, contact **1** of relay TRB, contact **1** of relay TRA to ground through the winding of transfer relay TR. Relay TR operates in this circuit and locks over its contact **14** to battery over contact **3** of relay C. Relay TR closes a circuit for slow-to-operate relay SO from battery over contact **2** of relay D, contact of relay E, contact **2** of relay TR to ground through the winding of relay SO. Relay SO closes the previously traced circuit for operating release magnet RLS3 which restores switch SW3 to normal. Relay SO remains operated under the control of relay E. At the other unattended stations, since their relays TR are not operated, relay SO is not operated and the switch is not restored to normal at this time.

With relay TR operated, the front contacts of a maximum of ten individual alarm relays, such as relay **AL1**, are connected to the corresponding terminals of brush **201**. The operated one or ones of the alarm relays connect ground to their front contacts and thence to the corresponding terminals of brush **201**. Assuming that relay **AL1** is operated alone, ground is connected to terminal **1** of brush **201**. At the alarm center, switch SWC was restored to normal by the return of the dial and the attendant, having identified and selected the station which originated the trouble, will momentarily operate locking key L to release indicating relay I3 and extinguish lamp L3 to prepare for identifying the individual alarm or alarms. He will then dial the digit **0** causing switches SWC and SW3 to advance to position **10**. As soon as relay E operates in response to the first pulse, the circuit of relay SO is opened and that relay releases. When brush **201** engages its first terminal ground is connected over contact **3** of relay AL1, contact **3** of relay TR, terminal **1** and brush **201**, contact **3** of relay D to battery through the right winding of relay T, operating relay T to transmit a pulse of 1500-cycle current over the order wire in the manner previously described. At the alarm center relay R operates and closes a circuit from ground over its contact **1**, contact **1** of key CA and brush **104** to the winding of the relay, like relay I3, which is connected to terminal **1** of brush **104**. This relay operates, locking under the control of key L and lighting the corresponding lamp. At the end of the digit, relay E releases, reclosing the circuit of relay SO to restore the switch SW3 to normal.

Relay TR also prepares station **3** to receive orders. If the attendant wishes to transmit an order following the identification of the trouble, he will then proceed to dial the digit corresponding to the necessary order. Switches SWC and SW3 advance in response to this digit, any indications received over switch SWC being disregarded at this time. Assuming that the digit **1** is dialed, switch SW3 advances brush **202** to its first terminal. When relay E releases at the end of the digit, a circuit is closed from battery over contact **2** of relay D, contact of relay E, contact **3** of relay TRA, contact **3** of relay TRB, brush **202** and its first terminal, contact **15** of relay TR to ground through the winding of order relay OR1. Relay OR1 operates in this circuit to perform the required function. After an interval measured by the operating time of relay SO, switch SW3 will restore to normal.

Having transmitted the order the attendant will release key CA to restore the alarm center and the unattended stations to normal.

The release of key CA disconnects oscillator **105** from the order wire and permits relays A to release in all stations followed by relays B and C. Relay C at its

contact 3 opens the circuit of relay TR causing that relay to release in turn releasing relay SO. With relays A and C released, a circuit is closed from ground over contact 1 of relay A, contact 1 of relay C, contact 2 of off-normal springs RON to battery through the winding of relay D. Relay D operates and in the non-selected stations closes a circuit from battery through release magnet RLS3, contact of relay D to ground over contact 1 of off-normal springs RON. The release magnet operates to restore the switch, like switch SW3, to normal at which time the off-normal springs open. Relay D at its contact 2 disconnects battery from brush 202 and at its contact 3 disconnects relay T from brush 201 to prevent any false operations during the return of these two brushes.

Relays TRA and TRB are furnished to positively prevent the false selection of more than one station. At each station, the relay which corresponds to relay TR is connected to the terminal of brush 202 which corresponds to the station number and the windings of relays TRA and TRB are connected to the other four of the station identifying terminals of brush 202.

To illustrate the function of relays TRA and TRB, assume that the attendant at the alarm center wishes to select some station other than station 3, for example station 2. The connection of the 1300-cycle current to the order wire causes the operation of relays A, B and C as previously described and relay A responds to the dial pulses to operate magnet Step 3 and advance switch SW3 to position 2. At the end of the digit, relay E releases and a circuit is closed from battery over contact 2 of relay D, contact of relay E, contact 3 of relay TRA, contact 3 of relay TRB, brush 202 and its second terminal, over contact 18 of relay TR to ground through the lower winding of relay TRA. Relay TRA at its contact 1 opens the circuit of relay TR preventing the operation of that relay if brush 202 is brought to rest on terminal 3 as a result of an order sent to station 2. At its contact 2 relay TRA locks in a circuit from ground through its lower winding over its contact 2 through resistance R2 to battery at contact 3 of relay C. With relay C operated, the circuits of relays T, A3 and F are opened so that none of these relays can operate while the alarm center is associated with station 2. Therefore terminal 3 of brush 201 cannot be grounded by relay A3 and, since relay TR is not operated, none of the terminals of brush 201 can be grounded by an alarm relay such as relay AL1. This will also be true of stations 1, 4 and 5 so that no alarm signals can be transmitted by other than the selected station.

What is claimed is:

1. In an alarm sending system, a main station, a plurality of subsidiary stations, a channel connecting said stations, a stepping switch at each station, each of said switches having station identifying sets of terminals individual to each of said subsidiary stations and a plurality of other sets of terminals, a plurality of trouble registering devices at each of said subsidiary stations, means under the control of any one of said trouble registering devices to mark the set of terminals individual to that station in the switch at that station, means under the control of the main station to step all of said switches simultaneously any desired number of steps, means operated when a switch is stepped over a marked one of said terminals to identify the marking station to said main station, a transfer relay at each subsidiary station connected to one terminal of the set individual to that station, means to operate said transfer relay when said switches are stepped to the set of terminals individual to a station, means under the control of said transfer relay to connect said trouble registering devices to said station identifying terminals and to said other terminals, trouble identifying devices at said main station, and means under the control of an operated trouble registering device to operate the corresponding trouble identifying device at said main station.

2. In an alarm sending system, a main station, a plurality of subsidiary stations, a channel connecting said stations, a stepping switch at each station, each of said switches having station identifying sets of terminals individual to each of said subsidiary stations and a plurality of other sets of terminals, a plurality of trouble registering devices at each of said subsidiary stations, means under the control of any one of said trouble registering devices to mark the set of terminals individual to that station in the switch at that station, means under the control of the main station to step all of said switches simultaneously any desired number of steps, means operated when a switch is stepped over a marked one of said terminals to identify the marking station to said main station, a transfer relay at each subsidiary station connected to one terminal of the set individual to that station, means to operate said transfer relay when said switches are stepped to the set of terminals individual to a station, means under the control of said transfer relay to connect said trouble registering devices to said station identifying terminals and to said other terminals, trouble identifying devices at said main station, and means operated during a subsequent stepping operation of said switches under the control of an operated trouble registering device to operate the corresponding trouble identifying device at said main station.

3. In an alarm sending system, a main station, a plurality of subsidiary stations, a channel connecting said stations, a stepping switch at each subsidiary station, each of said switches having station identifying sets of terminals individual to each of said subsidiary stations and a plurality of other sets of terminals, a plurality of trouble registering devices at each of said subsidiary stations, means under the control of any one of said trouble registering devices to mark the set of terminals individual to that station in the switch at that station, a stepping switch at said main station, trouble identifying devices connected to the terminals of said main station switch, means under the control of the main station to step said main station switch and all of said subsidiary station switches simultaneously any desired number of steps, means operated when a switch is stepped over a marked one of said terminals to transmit a signal to said main station to operate the trouble identifying device connected to the corresponding terminal of said main station switch to identify the marking station to said main station, a transfer relay at each subsidiary station connected to one terminal of the set individual to that station, means to operate said transfer relay when said switches are stepped to the set of terminals individual to a station, means under the control of said transfer relay to connect said trouble registering devices to said station identifying terminals and to said other terminals, and means under the control of an operated trouble registering device when said subsidiary station switch passes over the terminal to which said operated trouble registering device is connected to transmit a signal to said main station to operate the trouble identifying device connected to the corresponding terminal of said main station switch.

4. In an alarm sending system, a main station, a plurality of subsidiary stations, a channel connecting said stations, a stepping switch at each station, each of said switches having station identifying sets of terminals individual to each of said subsidiary stations and a plurality of other sets of terminals, a plurality of trouble registering devices at each of said subsidiary stations, means under the control of any one of said trouble registering devices to mark the set of terminals individual to that station in the switch at that station, means under the control of the main station to step all of said switches simultaneously any desired number of steps, means operated over a marked one of said terminals to identify the marking station to said main station, a transfer relay at each subsidiary

station connected to one terminal of the set individual to that station, means to operate said transfer relay when said switches are stepped to the set of terminals individual to a station, means under the control of said transfer relay to connect said trouble registering devices to said station identifying terminals and to said other terminals, trouble identifying devices at said main station, means under the control of an operated trouble registering device to operate the corresponding trouble identifying device at said main station, lockout means at each station connected to the station identifying terminals individual to other stations, and means under the control of said lockout means to prevent the operation of the transfer relay at more than one station.

5. In an alarm sending system, a main station, a plurality of subsidiary stations, a channel connecting said stations, a stepping switch at each station, each of said switches having station identifying sets of terminals individual to each of said subsidiary stations and a plurality of other sets of terminals, a plurality of trouble registering devices at each of said subsidiary stations, means under the control of any one of said trouble registering devices to mark the set of terminals individual to that station in the switch at that station, means under the control of the main station to step all of said switches simultaneously any desired number of steps, means operated over a marked one of said terminals to identify the marking station to said main station, a transfer relay at each subsidiary station connected to one terminal of the set individual to that station, means to operate said transfer relay when said switches are stepped to the set of terminals individual to a station, means under the control of said transfer relay to connect said trouble registering devices to said station identifying terminals and to said other terminals, trouble identifying devices at said main station, means under the control of an operated trouble registering device to operate the corresponding trouble identifying device at said main station, lockout means at each station connected to the station identifying terminals individual to other stations, means to operate said lockout means when a subsidiary station switch is stopped on one of said terminals individual to other stations, and means responsive to the operation of said lockout means to prevent the operation of the transfer relay at that station.

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