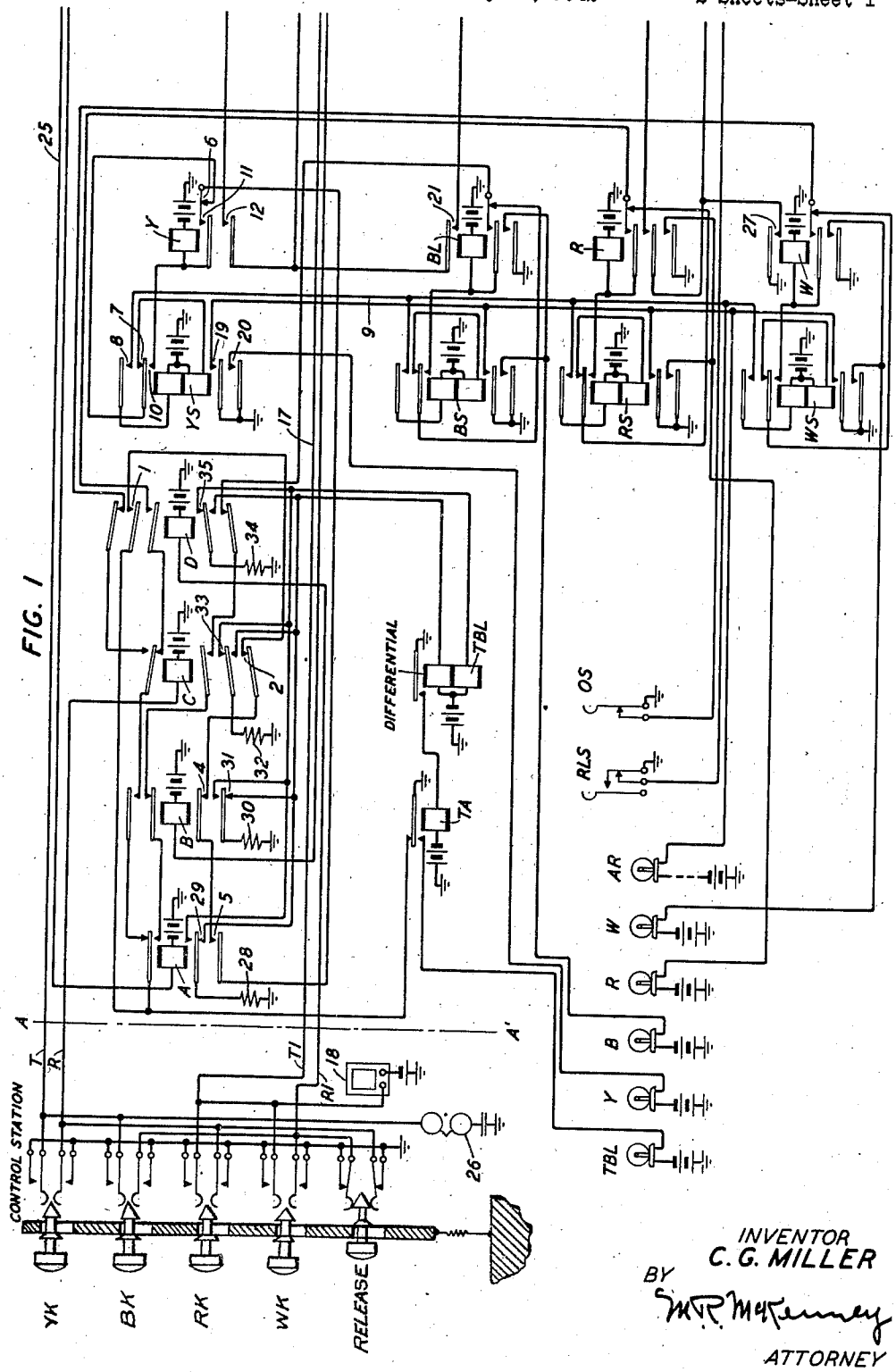
April 4, 1944. C. G. MILLER 2,345,825

SIGNALING SYSTEM

Filed July 29, 1942 2 Sheets-Sheet 1



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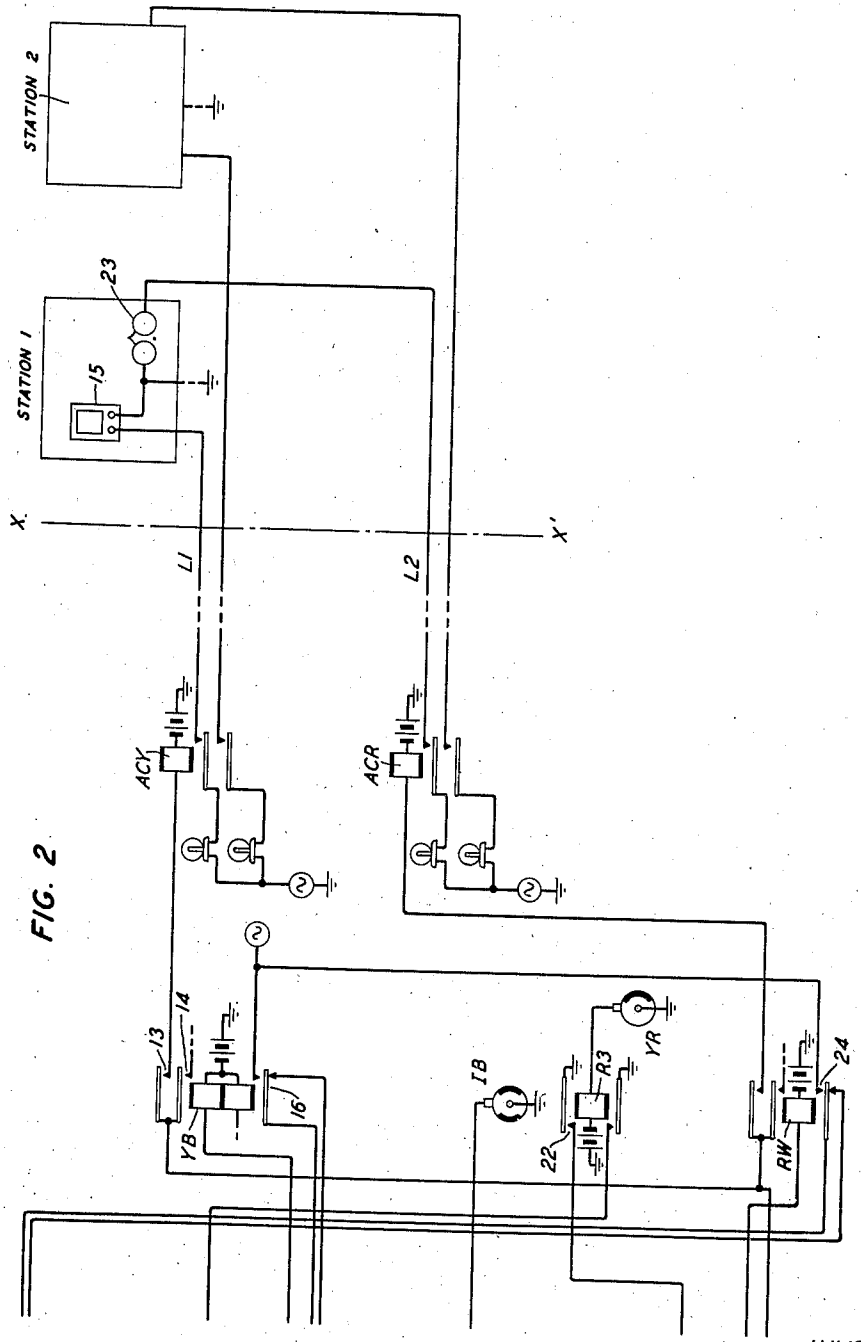

FIG. 2.

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SIGNALING SYSTEM

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6 Claims. (Cl. 177—353)

This invention relates to signaling systems and more particularly to systems for sending out from a central point, such as a telephone central office, four characteristic alarm signals under control of selective keys located at another point, remote therefrom, in which an answer-back signal of the character sent out from the central point is transmitted back to the control point.

A feature of the invention resides in controlling the sending out of the characteristic alarm signals by the simultaneous energization of two different conductor combinations of a group of four conductors extending between the control point and the central point and in transmitting an answer-back signal over one of the remaining two idle conductors when the alarm signal is sent out. Another feature resides in means for giving an alarm responsive to the simultaneous energization of more or less than two of said four conductors.

The invention will be understood from the following description when read in connection with the accompanying drawings Figs. 1 and 2 of which, when placed together, with Fig. 2 at the right of Fig. 1, shows a control or transmitting station to the left of the broken line A—A' (Fig. 1), a central switching point between the broken lines A—A' and X—X' and to the right of the broken line X—X' a plurality of outlying signal stations.

Referring to the drawings, the equipment at the control station, to the left of the broken line A—A', consists of a set of five push-button keys of the so-called latch plate type, identified as YK, BK, RK and WK, wherein a depressed key is automatically locked in its operated or depressed condition until automatically released and restored by the depression of another key of the set. Also located at the control station are alternating current signal devices responsive to telephone ringing current each of which has a characteristically different sound, for example, in the present arrangement one of these devices is shown as a telephone bell or ringer and the other as a buzzer, i. e., a ringer mechanism not equipped with gongs. These devices will be referred to later.

Extending from the control station to the central switching point are four conductors identified as T, R, T1 and R1 which in practice may be two cable pairs. At the central switching point these four conductors are individually connected to battery in series with an individual relay identified as A, B, C and D, respectively.

At the control station line conductors T, R, T1 and R1 are so connected to the switch contacts of keys YK, BK, etc. that operation of any key simultaneously grounds two of the four conductors in different combinations, to operate two of the four relays, A, B, C and D depending on the key operated.

At the central switching point operation of any two of the relays A, B, C or D in different combinations, causes operation of other relays to finally cause alternating ringing current to be transmitted over line conductors such as L1 or L2 to a plurality of signal stations such as station 1 shown to the right of broken line X—X' on Fig. 2.

A further understanding of the arrangement of the present invention will be gained from the following description of the operation of the system in which it will be first assumed that the control station desires to cause the buzzers 15 at all signal stations, such as station 1, to be periodically sounded at a predetermined rate, as for example, sounding for four seconds followed by a two second silent interval and periodically repeated, which station signal, i. e., a signal of four second duration followed by a two second silent interval will be hereinafter called a "yellow" signal.

To transmit the yellow signal the attendant at the control station will depress the key identified as YK, thereby releasing the fifth or release key to remove ground from the conductors R and R1 and release relays C and D. It will be hereinafter understood that the release key and relays C and D are normally operated and serve to maintain a check on conductors T, T1, R and R1 whereby a trouble alarm will be given at the central switching point in case of a grounded or open condition thereof.

When key YK is fully depressed, ground will be connected to conductors T and R thereby operating relays A and C, the circuit for relay A, including conductor T and lower contacts of relay RW.

The combined operation of relays A and C and the release of relay D completes a circuit to operate relay YS which can be traced from ground, back contact of relay TA, contact 1 of relay D, contact 2 of relay C, contact 4 of relay B, contact 5 of relay A, contact 6 of relay Y, contact 7 and lower winding of relay YS to battery. Relay YS operates in this circuit and closes its contact 8 to complete a locking circuit for itself including its upper winding which can be traced from battery, upper winding of relay YS, contact 8, conductor 9 and contacts of key RLS to ground. Relay YS also closes its contact 10 thereby com-

pleting a circuit to operate relay Y which can be traced from battery, winding of relay Y, contact 10 of relay YS, contact 6 of relay Y, contact 5 of relay A, contact 4 of relay B, contact 2 of relay C and contact 1 of relay D to ground at the back contact of relay TA. Relay Y in operating locks at its contact 11 to ground over the operating circuit just traced. Relay Y in operating also closes its contact 12 thereby completing a circuit to cause relay YB to periodically operate and release in step with interrupter YR which interrupter causes relay R3 to alternately operate for four seconds and release for two seconds thereby connecting ground over contacts 12 of relay Y to relay YB at the same rate. Operation of relay YB closes its multiple contacts 13, 14, etc. thereby controlling the operation of a plurality of relays such as ACY which in turn connect ringing current to line wires such as L1 extending to buzzer signal devices such as 15 at the signal stations 1, 2, etc. Operation of relay YB also closes its contacts 16 thereby connecting ringing currents over wire 17 to conductor T1, idle at this time, which conductor is connected, at the control station, to a buzzer device 18 before referred to, which operates in synchronism with the buzzer signal at the signal stations as an indication to the control station attendant that the yellow signal is being sent out from the central switching point.

When relay YS operated, it also closed its contacts 19 and 20 to light the master pilot lamp AR, and lamp Y individual to relay YS, which lamps serve as an indication at the switching point that an alarm signal is being sent out and that it is a yellow signal.

If, after a predetermined interval of time during which the yellow signal is transmitted, two minutes for example, the control station attendant desires to terminate the signal, he will operate the release key of the key set thereby releasing key YK and removing ground from relays A and C which thereupon release. Relay A in releasing opens its contact 5 thereby opening the previously traced locking circuit for relay Y which releases thereby stopping the transmission of the alarm. Relay YS, however, which locks up to key RLS, remains operated and lamps Y and AR remain lighted until an attendant at the central switching point manually operates the key RLS. This is a guard feature to insure the presence of an attendant during the transmission of an alarm. In practice the attendant at the control switching point upon noting the lighted lamps Y and AR will immediately operate key RLS to open the locking circuit of relay YS and permit that relay to restore to normal as its continued operation performs no useful function.

The operation of the release key at the control station for the purpose of restoring key YK, grounds conductors R and R1 thereby reoperating relays C and D at the central switching point.

If the attendant at the control station later desires to operate the buzzers at the signal stations, at a more rapid rate, i. e., at one half second interval, which will be hereinafter called a "Blue" signal, key BK at the control station will be operated thereby connecting ground to conductors T and R1 and unlocking the release key which restores to normal whereupon relay C will release but relay D will remain operated and relay A operates thereby completing a circuit to operate relay BS, which locks to ground at key RLS and completes a circuit to operate relay BL, which locks to ground at relay TA. Relay BS at its lower contacts lights lamps B and AR. Relay BL closes its contact 21 thereby connecting interrupter IB to relay YB, which alternately operates and releases every half second thereby controlling relay ACY to actuate the buzzers at stations 1, 2, etc., at this same rate.

Operation of relay YB closes its contacts 16 thereby connecting ringing current every half second to lead 17, and conductor T1 (now idle), to actuate the buzzer 18 at the control station in step with the buzzers at the signal stations.

As before the attendant at the central switching point upon noting lamps B and AR, actuates the key RLS thereby opening the locking circuit for relay BS which releases.

In a like manner when the attendant at the control station desires to repeatedly operate, the bells at the signal station for four seconds followed by two second silent intervals which signal will be called the "Red" signal, he will operate the key RK which restores key BK, if operated, and grounds conductors T1 and R thereby operating relays B and C at the central switching point and restoring the other relays to normal to successively operate relays RS and R, light lamps R and AR, and connects ground at contacts 22 of relay R3, which relay is controlled by interrupter YR, to relay RW which in turn controls relay ACR to operate the ringers (bells) such as 23 at the signal stations.

Relay RW at its contacts 24, connects ringing current over lead 25 to idle conductor T to which is connected, at the control station, a telephone ringer 26 which responds in step with the ringers such as 23 in the signal station.

In a similar manner operation of key WK at the control station causes ground to be connected to conductors T1 and R1 to operate relays B and D in combination to successively operate relays WS and W and light lamps W and AR. Relay W, in operating, connects ground at its contacts 27 to steadily operate relay RW which in turn operates relay ACR to cause the ringers or bells such as 23 at the signal station to operate as long as the key W at the control station is held operated. This signal is called the "white" or all-clear signal. Ringer 26 at the control station will operate as long as relay RW is operated.

When the control station desires to discontinue a signal initiated by the operation of one of the four keys YK, BK, RK or WK, operation of the release key will restore the previously operated key and, by grounding conductors R1 and R, will operate relays C and D.

With relays C and D operated and relays A and B released, a circuit condition is established to maintain a trouble check on the four conductors T, T1, R and R1 as follows: Relay A in its released condition completes a circuit from ground, resistance 28, contacts 29 of relay A and upper winding of differentially wound relay TBL to battery. A parallel circuit is also established through this same winding from ground, resistance 30 and contact 31 of relay B, also released. With relays C and D operated, two parallel circuits are completed through the lower winding of relay TBL as follows: ground, resistance 32 and contact 33 of relay C, to the lower winding of relay TBL and from ground, resistance 34 and contact 35 of relay D to this same lower winding. Resistances 28, 30, 32 and 34 are of equal value as are the two windings of relay TBL and therefore under normal conditions currents of equal value flow in the relay

windings and, due to the connection of the windings, neutralize each other and have no effect on the relay. If, however, a short circuit occurs between T and R or T1 and R1, if either R or R1 should become open, or T or T1 should be grounded, the before-described balance will be disturbed and relay TBL will operate which in turn will operate relay TA to light the trouble pilot lamp TBL as an alarm signal.

It will be obvious that in the event no one of said relays is in an operated condition, or a different number than two are operated, i. e., 1, 3 or 4, an unbalanced condition will exist with respect to current flowing in the two windings of relay TBL, thus causing its operation and giving an alarm. It will be noted from the preceding description of the operation of relays YS, etc. that the circuits therefor include a ground connection supplied at the back contacts of relay TA, and consequently in the case just described wherein the trouble relay TBL operates in response to an unbalance in the current flowing in its two windings due to a non-standard condition of relays A, B, C and D, relay TA will be operated which closes a circuit at its front contact to light the trouble lamp TBL and at the same time disconnects ground at its back contact to prevent operation of any one of the four relays YS, BS, RS or WS.

In case of a trouble condition, operation of key OS will disconnect ground from the upper contacts of relay YB and RW thereby preventing any false relay operation at the switching point from sending out a false alarm.

What is claimed is:

1. In a signaling system, a control station and a switching station, four transmission channels connecting said control and switching stations, means at the control station for selectively and simultaneously energizing different combinations of two of said four channels, a relay at the switching station individual to each channel and operated by the energization thereof, a signal station comprising two characteristically different alternating current signal devices, translating means selectively controlled by the simultaneous operation of different combinations of said channel relays for selectively operating either of said station signals in either of two different manners and other means controlled by said translating means for transmitting a signal to said control station over an idle one of said channels of the same characteristic as, and simultaneous with, the signal being transmitted to the signal station.

2. A system in accordance with claim 1 characterized in this that means are provided for giving an alarm, said means being responsive to the operation of a different number than two of said channel relays.

3. A system in accordance with claim 1 characterized in this that means are provided, responsive to the operation of a different number than two of said channel relays, for giving an alarm, and for preventing control of said translating means.

4. In a selective signaling system, a sending station, a translating station, and a signal receiving station, four signaling channels between said sending and translating stations, means at the sending station for selectively and simultaneously energizing different two channel combinations of said four channels, a relay at the translating station individual to each channel and operated by the energization thereof, translating means individual and responsive to each operated combination of said channel relays for causing the transmission of a characteristically different signal to said signal station and means responsive to the transmission of a signal to said signal station to simultaneously transmit a similar signal to said sending station over an idle one of said channels.

5. A system in accordance with claim 1 characterized by means for giving an alarm responsive to any condition of said channel relays other than the simultaneous operation of two to the exclusion of the others.

6. In a signaling system, a control point, a switching station, and a signal station, a pair of characteristically different signal devices at said signal station, switching means at said switching station for selectively operating either one of said station signal devices in a plurality of characteristically different manners, a plurality of conductors connecting said control point and switching station, means at the control point for selectively controlling said switching means over different equal-number combinations of said conductors, a pair of signaling device at said control point of similar characteristics to the devices at the signal station and means controlled by said switching means when operating a station signal device for simultaneously operating the corresponding signal device at the control point over an idle one of said plurality of conductors in the same characteristic manner as that of the station device being operated.

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