

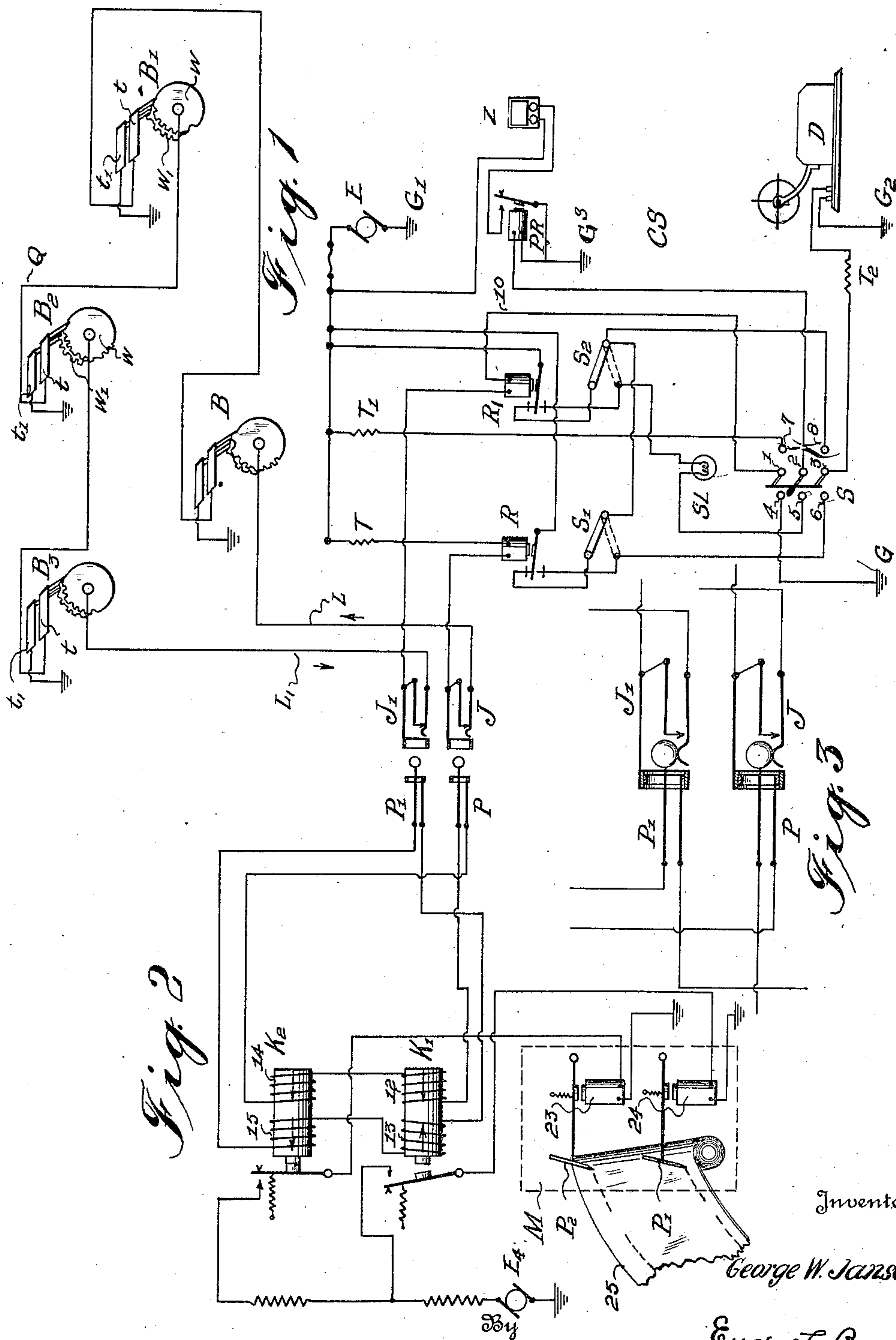
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CALL BOX TROUBLE DETECTOR

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CALL-BOX TROUBLE DETECTOR.

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This invention relates to messenger call circuits which include a number of call boxes in a loop circuit extending from a central office and particularly to means for testing the call boxes to determine whether the equipment is in proper operative condition.

When a signal or call is sent in from any call box, the code wheels in the box break the circuit and ground the line a number of times corresponding to the call number of the particular box. It is essential that the device for grounding the line in each box shall be tested periodically in order to ensure proper operation at all times. The main purpose of this invention is to provide means at the central station for testing the operation of the boxes and for detecting any that may be defective.

In the following description I shall refer to the accompanying drawings, in which Figure 1 is a diagram of the circuits of a messenger call system; Fig. 2 is a diagrammatic illustration of a testing equipment or trouble detector; and Fig. 3 is a detail view of the jacks for connecting the trouble detector with the call circuit.

Referring first to the messenger call circuits, the loop circuit or line L , L_1 , containing the subscribers call boxes B , B_1 , B_2 , etc., is connected at the central station CS at one end through the jack J , relay R and resistance T to a source of current supply E . The other end of the loop circuit is connected at the central station through the jack J_1 , relay R_1 , conductor 10, contacts 1 and 4 of switch S to ground. The contacts or relays R and R_1 are connected respectively to switches S_1 and S_2 in such manner that, by changing the position of the switch levers, either the front or the back contacts of the relays may be used to operate the local register D and the buzzer Z . The triple pole switch S is arranged to remove the ground G and substitute current source E when necessary to overcome a fault in the line. This switch also changes the connections of the register and buzzer circuits. The pilot relay PR is placed in the ground connection of the signal lamp SL and thereby controls the buzzer Z .

When the line is in normal condition, current flows from the current source E through the resistance T , relay R , jack J and the line containing the call boxes B , B_1 , B_2 , etc., returning through jack J_1 , relay R_1 , contact points 1 and 4 of switch S to ground at G .

The armatures of relays R and R_1 are thus held against their front contacts, thereby keeping the local buzzer and register circuits open. When any call box such as B is operated, the break or signal wheel W opens the line the number of times required to produce the signal of that particular box. Each break causes the armatures of both relays R and R_1 to fall against their back contacts, thus closing the circuits of the local signal lamp SL , the pilot relay PR , the buzzer Z and the register D . Current now flows from current source E through the armature and back contact of relay R , contacts 6 and 3 of switch S , resistance T_2 and register D to ground at G_2 , thus causing the register to record the signal or box number on the tape. Simultaneously current flows from the current source E through the armature and back contact of relay R_1 , signal lamp SL , contacts 5 and 2 of switch S , and the pilot relay PR to ground at G_3 . This causes the signal lamp SL to glow and the pilot relay PR to close the local circuit containing the buzzer Z .

Each signal box is provided with two "break" wheels W and W_1 , the former opening and closing the circuit as the spring tongue t moves across the gap between adjacent teeth on the wheel W ; and the other toothed wheel W_1 applying a ground connection through the tongue t_1 , after the opening of the circuit by the first wheel. The teeth of the two wheels are staggered so that the ground applied by the wheel W_1 and tongue t_1 is maintained for a time equal to that during which the wheel W had opened the circuit. It will be seen, therefore, that the relay R_1 will be deprived of current by the grounding at the tongue t_1 and thus allow its armature to remain on the back contact during the transmission of each digit of any signal, due to the fact as above explained, that a call box opens and thereafter both closes and grounds the line simultaneously, thereby shunting out the portion of the line containing the relay R_1 . When the signal has been completed, however, the line is again placed in its normal closed condition, so that the relay R_1 , again attracts its armature against its front contact as shown in Fig. 1.

Let us now assume that a break occurs in the line at some point Q . Relays R and R_1 will then be deprived of current, thus

allowing their armatures to fall against their back contacts and close the buzzer and register circuits. The signal lamp will glow and the register and buzzer will operate continuously until the trouble has been temporarily overcome. This may be done by changing the position of switch S from the left to the right. This changes the local circuit so that the register is connected to the front contacts of both relays R and R₁ and at the same time applies the current source to the end of the line which was formerly grounded at G. Now when any call box such as B₂ is operated, the break wheel applies a ground to line L₁ and causes current to flow in that particular portion of the line and through the relay R₁. The armature of relay R₁ is then drawn against its front contact, causing current to flow from the generator or source E, through the front contact and armature of the relay R₁, switch S₂, points 8 and 3 of switch S, and the register D, thus causing the register to record the signal on the tape. As either relay will now operate the local circuit it will be seen that the operation of a call box on the other side of the break will also repeat the signal into the register.

Now let us suppose that instead of breaking, the line had become accidentally grounded at the point Q. So long as the switch S remained in its left hand position, that portion of the line containing the call boxes B₂, B₃, and the relay R₁ would be deprived of current, thus causing the armature of relay R₁ to fall against its back contact and close the local signal lamp and buzzer circuits. Buzzer Z will then buzz continuously and signal lamp SL will remain lighted until the trouble has been temporarily overcome. This may be done by changing the position of the switch S from the left to the right and throwing switches S₁ and S₂ downward. The changing of these switches applies the current source to both ends of the line and at the same time changes the local circuit connections so that the front contacts of the relays R and R₁ are disconnected, while their back contacts are connected to the register. Each portion of the main line circuit and the relay included therein operate independently of the other, each relay responding only to signals sent from call boxes included in the portion of the line between that relay and the ground. Now when any call box is operated, that portion of the circuit is broken a number of times corresponding to the signal number of that box and the signal is repeated into the local circuit containing the register. It will be noted that the register D is controlled by the contacts of both relays R and R₁ and that the buzzer and signal lamp will not operate because the local circuit containing these instruments was

opened by changing the position of switch S.

Again let us suppose that a break occurs in the line on one side of the accidental ground which already exists at the point Q, leaving a portion of the line L₁ open, while the other portion L remained grounded. The switch S₂ should now be thrown in the upward position, in order to change local circuit connections from the back to the front contact. Each relay now responds only to such calls as are sent from call boxes included in that portion of line between that relay and the break or ground. The operation of the portion of the line L₁ is the same as explained above for a break at Q and the operation of the portion of the line L is the same as explained in the last paragraph. If the break had occurred on the other side of the ground, the switch S₁ would occupy the upward position and the switch S₂ would occupy the lower position. As soon as any trouble is discovered the switches should be thrown in such positions as to temporarily overcome that trouble, but as soon as the trouble has been cleared the switches should again be placed in their normal positions.

In order that the system shall be reliable it is necessary to test the call boxes of each loop circuit periodically to promptly detect any box that may have become defective. It is especially important that the grounding devices of the boxes shall be in working order. I have devised a testing apparatus or equipment which may be connected with a call circuit at any time and may remain in the circuit until the signals from all of the boxes have been recorded at least once on the test tape. It may be necessary to have some of the boxes operated purposely for this test in case no calls are received from them during the time allotted for the test.

The trouble detector or call box testing equipment is illustrated diagrammatically in Fig. 2, and comprises a double pen register or recorder M controlled by relays or electro-responsive devices K₁ and K₂. This testing equipment is connected by flexible conductors with plugs P and P₁ so that it may be readily connected to the call circuit by inserting the plugs in the jacks J and J₁ as indicated in Fig. 3. It will be observed that the coil 12 of relay K₁ and the coil 14 of relay K₂ are in the circuit of the outgoing line L of the call circuit loop while the coil 13 of relay K₁ and coil 15 of relay K₂ are in the incoming or return line L₁ of the loop circuit. Furthermore, the coils 14 and 15 of relay K₂ assist in attracting its armature while the coils 12 and 13 of relay K₁ oppose or neutralize each other. Hence the armature of relay K₂ is normally attracted while the armature of relay K₁ is normally retracted against its back stop. Accordingly, if a box having its tongue t₁

properly grounded is operated, both relays K_1 and K_2 will operate. The relay K_2 will release its armature each time the tongue t of the box moves across a gap between adjacent teeth of the code wheel W , thereby opening the line and deenergizing the windings. The armature closes a circuit from the local current source E_1 through the magnet 23, thereby causing the pen P_2 of the recorder to indicate on the recording tape 25.

Likewise the relay K_1 will attract its armature each time the grounding tongue t_1 touches the code wheel W_1 , thereby short-circuiting one of the windings on the relay K_1 . This closes a circuit from local current source E_1 through magnet 24, armature of relay K_1 and magnet 24 of the recorder, thereby causing the pen P_1 to make a record on the tape 26. Hence in case of a properly grounded box, both pens P_1 and P_2 of the recorder will record the signal.

On the other hand, if the grounding tongue t_1 of the operated box has become ungrounded, the opening of the circuit by the line tongue t deenergizes the relay K_2 and releases its armature, the same as for a grounded box, but the relay K_1 does not attract its armature and hence is not operated because no ground is applied by the tongue t_1 and the currents which flow through its windings oppose and neutralize each other.

Now suppose a short circuit should occur between the line conductors and thus by shunting out a portion of the call boxes prevent them from interrupting the flow of current through relays K_1 and K_2 . Relay K_2 would remain energized when any of these boxes were operated and hence pen P_2 would make no record. The operation of the boxes would however, by applying grounds, cause relay K_1 to respond to the signal and operate pen P_1 .

It is apparent, therefore, that the pen P_2 of the recorder will register signals from the line tongues t of the call boxes and the pen P_1 will register signals from the grounding tongues t_1 of the call boxes. Comparison of the records of pens P_1 and P_2 will indicate the accuracy of the tongues t and t_1 .

The system would be operative if one of the coils, as 15, were omitted from relay K_2 , but in that case the plugs P and P_1 must always be inserted in the jacks J and J_1 as shown, but by winding the relay with

two coils 14 and 15 as shown, it is immaterial in which order the plugs are inserted in the jacks.

I claim:—

1. In combination with a messenger signaling system having signal call boxes, each being provided with two break wheels having their teeth arranged in staggered relation, one of which is connected through a contacting brush in the line and the other cooperating with a grounded brush, whereby upon the operation of a box the line is first momentarily opened and then momentarily grounded for each signal impulse of the code signal, of a testing equipment for determining whether the call boxes are in normal operative condition, comprising an electro-responsive device having two windings which magnetically assist each other, and an electro-responsive device having two windings which magnetically oppose and neutralize each other, one winding of each device being connected in the outgoing lead of said system and the other windings of said devices being connected in the return lead of said system, and indicating elements controlled respectively by said devices.

2. In combination with a messenger signaling system having signal call boxes, each being provided with two break wheels having their teeth arranged in staggered relation, one of which is connected through a contacting brush in the line and the other cooperating with a grounded brush, whereby upon the operation of a box the line is first momentarily opened and then momentarily grounded for each signal impulse of the code signal, of a testing equipment for determining whether the call boxes are in normal operative condition, comprising an electro-responsive device having two windings which magnetically assist each other, and an electro-responsive device having two windings which magnetically oppose and neutralize each other, one winding of each device being connected in the outgoing lead of said system and the other windings of said devices being connected in the return lead of said system, a source of current, a pair of recording elements and means actuated by said devices for respectively connecting said recording elements to said source of current.

In testimony whereof I affix my signature.

GEORGE W. JANSON.