

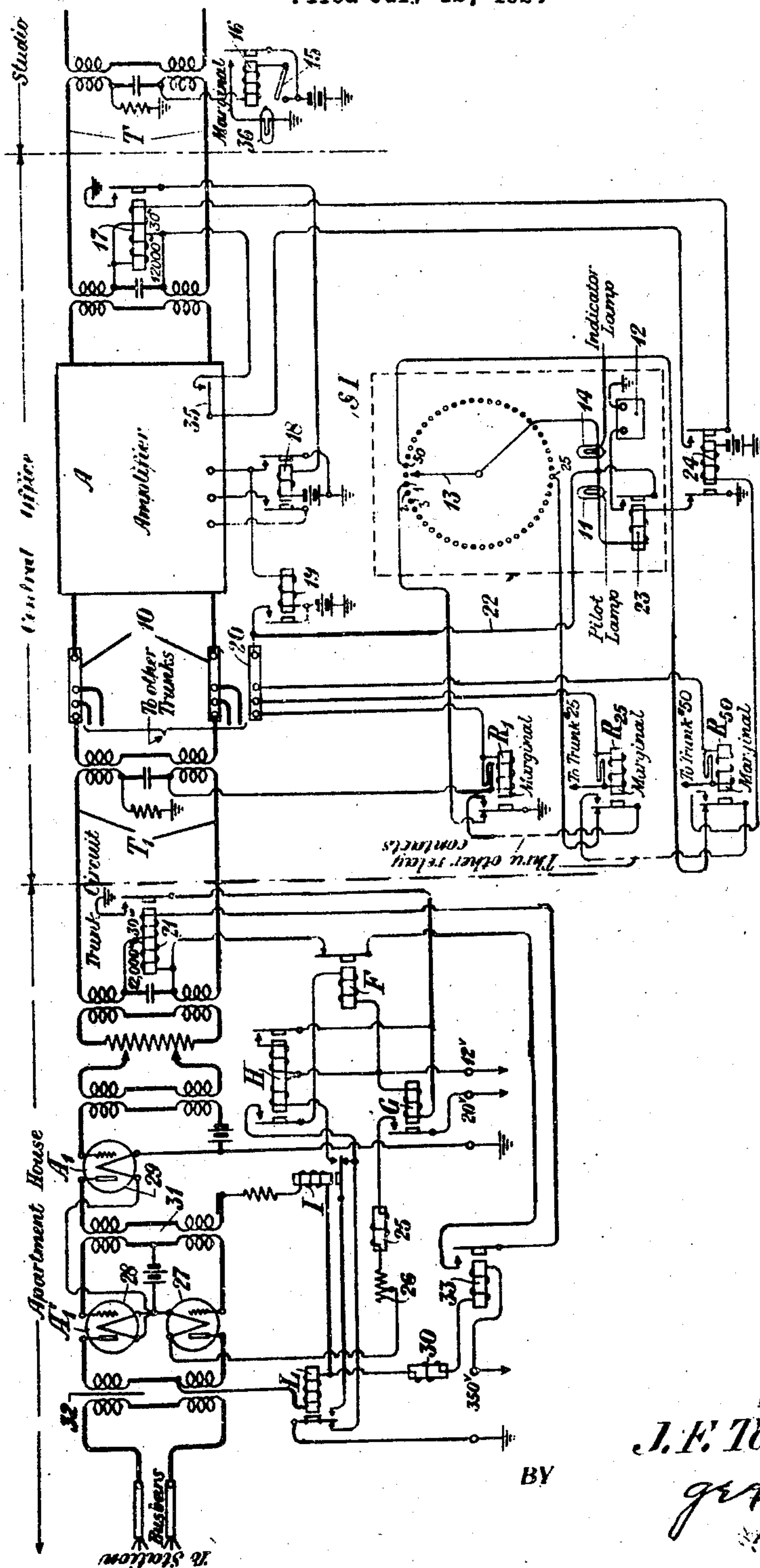
Aug. 18, 1925.

1,549,817

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TROUBLE INDICATING ARRANGEMENT

Filed July 12, 1924



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TROUBLE-INDICATING ARRANGEMENT.

Application filed July 12, 1924. Serial No. 725,644.

To all whom it may concern:

Be it known that I, JOHN F. TOOMEY, residing at New York, in the county of New York and State of New York, and a citizen of the United States, have invented certain Improvements in Trouble-Indicating Arrangements, of which the following is a specification.

This invention relates to indicating arrangements for indicating abnormal circuit conditions, and more particularly to an indicating arrangement for indicating which one of a group of similar circuit arrangements or elements is in an abnormal condition.

In signaling systems involving large networks of similar transmission circuits or involving large groups of similar translating devices, it frequently happens that when a particular circuit or translating device is out of order the abnormal condition of the system may readily be indicated, but it is difficult to determine what particular piece of apparatus or what particular circuit of the system is in trouble unless very complicated and expensive signaling or indicating equipment is employed. This is particularly true in a wire network for the distribution of programs, such systems involving a number of branch trunks branching from a common trunk at some distributing point. At the terminals of the branch trunks amplifying or other translating equipment may be provided. If any trunk should fail because of an abnormal condition of its amplifier or other translating equipment, it is highly desirable not only that a signal should be given indicating trouble at some part of the system, but it is also desirable that the troubleman be enabled to readily determine what particular piece of apparatus is out of order from the central point without being compelled to go to each outlying point and inspect each unit of apparatus.

The present invention contemplates, therefore, so arranging the apparatus associated with the various trunks of a system for the distribution of a program that if any amplifier or associated equipment of a particular trunk should fail not only will a general signal be given at a central point indicating that there is trouble in the system but an auxiliary signal will be provided whereby

the particular piece of apparatus which is in trouble may be identified at the central point.

The invention will now be more fully understood from the detailed description thereof when read in connection with the accompanying drawing, the figure of which illustrates a circuit arrangement embodying the principles of the present invention.

Referring to the drawing, T designates a trunk extending from a studio or other point at which programs originate to a central office from which a plurality of trunks radiate to different local distributing stations, such as apartment houses. At each apartment house the trunk incoming to the apartment house will be provided with branches leading to the individual receiving stations. Amplifying equipment is provided at each distributing point. For example, an amplifier A, schematically indicated in the figure, is associated with the trunk T at the central office for stepping up the energy to the desired level for the various trunks radiating from the central office. This amplifying equipment may be of any well known type, and as it forms no part of the present invention is not illustrated in detail. To the output bus-bars 10 of the amplifier A at the central office a number of trunks leading to different apartment houses or other local distributing points are connected. Only one of these trunks T_1 is illustrated, and, as shown, this trunk is provided with amplifying equipment comprising a first-stage vacuum tube amplifier A_1 and a second-stage push-pull amplifier A'_1 . The amplifier at the apartment house or the local distributing point is provided with filament and plate supply circuits of a well known type.

At the central office a signal or indicating arrangement SI is provided for indicating the failure of the amplifying equipment associated with any trunk such as T_1 . The signal indicator comprises a pilot lamp 11 and buzzer 12 adapted to give an indication calling the attention of an attendant to the fact that there is a failure of some piece of equipment at some outlying point. A switch 13 may then be rotated by the attendant over a plurality of contacts, one corresponding to each trunk, such as T_1 . Upon

making contact with the segment corresponding to the trunk upon which trouble has developed, the indicator lamp 14 would be caused to glow. The attendant may thus
 5 identify the trunk upon which the trouble has developed, and by going to the corresponding apartment house may rectify the trouble.

Further details of the apparatus will be
 10 clear from the description of the operation, which is as follows: Whenever it is desired to put the system in operation for the transmission of programs, a switch 15 may be
 15 closed at the studio thereby completing a circuit from battery, over the switch 15, through the winding of marginal relay 16, over the ring side of the trunk T, through the high resistance winding of relay 17, and
 20 over the tip side of the trunk T to ground. The relay 16, being marginal, is not energized by the relatively small current flowing through the high resistance winding of the relay 17. Relay 17, however, is energized, and at its front contact completes a circuit
 25 from ground through the winding of the amplifier control relay 18. The amplifier control relay closes circuits (not shown) for putting the amplifier A into operating condition in a manner well understood in the
 30 art. At its right-hand front contact relay 18 completes a circuit for the relay 19. The relay 19, upon being energized, connects battery to the common bus-bar 20 associated with the bus-bars 10 of the output circuit of
 35 the amplifier A. A circuit is therefore completed from battery, over the front contact of the relay 19, over the bus-bar 20, and thence through the windings of marginal relays, such as R₁, R₂₅, etc., individual to each
 40 trunk. The circuit for the marginal relay R₁ extends from the bus-bar 20, through the winding of said relay, over the ring side of the trunk T₁, through the high resistance winding of relay 21, and over the tip side
 45 of the trunk T₁ to ground. The circuits for the marginal relays of the other trunks are similar to that for the trunk T₁. The energization of the relay 19 also completes a circuit from battery, over its front contact,
 50 over conductor 22, through the pilot lamp 11, winding of relay 23, and over the left-hand back contact of relay 24 to ground. This circuit is only closed momentarily and will be interrupted by the energization of
 55 the relay 24, as will be described later.

The relay 21, upon being energized, completes a circuit from ground, over its front contact, and through the winding of relay G to battery. Relay G completes the energizing circuit for the filament of the apartment
 60 house amplifier from the 20 volt battery, over the front contact of the relay G, through the choke coil 25 and resistance 26, and through the filaments of tubes 27, 28
 65 and 29 in series and thence to ground. The

filaments of the tubes 27, 28 and 29 of the amplifiers A'₁ and A₁, respectively, are now caused to glow, so that the space current passes from the filament of the plate of each
 70 tube. The space current is supplied from the 350 volt source, through a choke coil 30, and thence in parallel through the winding of relay I, primary winding of transformer 31 to the plate of the tube 29 and also
 75 through the winding of the relay L to the midpoint of the primary winding of the transformer 32 and thence to the plates of the tubes 27 and 28.

The space current flowing to the several
 80 amplifying tubes energizes the relays I and L thereby completing a circuit from ground, over the front contact of the relay L and the front contact of the relay I, through the left-hand winding of the relay H to battery. Relay H is energized and locked up through
 85 its right-hand winding and right-hand front contact to ground over the front contact of relay 21.

A relay 33 is included in circuit with the
 90 350 volt battery so that when the plate current begins to flow to the various tubes, said relay will be energized and will complete a low resistance shunt path through the low resistance winding of the relay 21. This
 95 shunt path includes the back contact of relay F which is deenergized as long as the amplifying circuits function properly. The closing of the low resistance shunt path of the relay 21 causes the marginal relay R₁ to
 100 be energized at the central office.

It will be understood that similar operations take place in connection with all the
 105 other trunks similar to T₁ with the result that the relays, such as R₂₅ and R₅₀ individual to the various trunks, are energized. As soon as all of the relays are energized a circuit is completed from ground, over the front contact of relay R₁, over the similar
 110 contacts of successive relays (not shown), over the front contact of relay R₂₅, over the similar contacts of successive relays (not shown), over the front contact of relay R₅₀, and through the winding of relay 24 to battery. Relay 24 is energized and at its left-hand
 115 contact opens the circuit of the relay 23 and the pilot lamp 11 which had been operated during the brief interval required for the operations above described to take place. The extinguishing of the pilot lamp
 120 indicates to an attendant at the central office that the apparatus of the trunks, such as T₁, is normal and in operating condition. Relay 24 at its right-hand front contact completes the circuit for the low resistance shunt
 125 winding of the relay 17, the contact 35 having previously been closed in a manner well understood in the art when the apparatus associated with the amplifier A was rendered operative by the relay 18. The closing of the shunt path through the low re-
 130

sistance winding of the relay 17 causes an increased current to flow through the winding of the marginal relay 16 which is thereupon energized and causes the lamp 36 to glow to indicate to the attendant at the studio that the transmission circuit is in operative condition throughout.

The manner in which the failure of the amplifying apparatus associated with the trunk T_1 may be indicated at the central office will now be described. Failure of the amplifying apparatus might occur in a number of different ways, for example, the filament of one of the tubes 27, 28 or 29 might burn out or the 350 volt supply source might fail. If the filament of the tube 27 or 28 should burn out, relay L will be released and complete a circuit from ground, over its back contact, over the left-hand front contact of lock-up relay H, through the winding of the relay F to battery. If the filament of the tube 29 should burn out, relay I would be released thereby completing a circuit from ground, over the front contact of relay L and back contact of relay I, and thence over the left-hand front contact of relay H, through the winding of relay F to battery. In case the 350 volt plate source should fail, both relays I and L would be deenergized thereby completing a circuit from ground, over the back contact of relay L and over the left-hand front contact of relay H, through the winding of relay F to battery. Upon the relay F being energized by the closure of any of the circuits above described, the shunt through the low resistance winding of the relay 21 will be opened and the current decreased over the trunk circuit thereby causing the marginal relay R_1 to be deenergized. The circuit previously traced through the relay 24 will accordingly be open and relay 24 at its right-hand contact will open the shunt path through the low resistance winding of the relay 17 thereby causing the relay 16 to be released and the lamp 36 to be extinguished. The attendant at the studio is therefore notified that there is trouble at some point in the distribution circuit.

Relay 24 at the same time completes a circuit over its left-hand contact from ground, through the winding of the relay 23 and through the pilot lamp 11, over the conductor 22 and front contact of the relay 19 to battery. The relay 23 is energized and causes the buzzer 12 to be actuated and the pilot lamp 11 at the same time begins to glow. The glowing of the pilot lamp and the actuation of the buzzer notify the attendant at the central office that there is trouble upon one of the trunks. The attendant then moves the switch arm 13 over the various contacts, and upon moving the switch arm to the contact 1 ground will appear on said contact due to the deenergization of the relay R_1 , and a circuit will be completed from ground,

over back contact of relay R_1 , over the contact numbered 1, over the switch arm 13, and through the indicator lamp 14, over conductor 22, and front contact of relay 19 to battery. The glowing of the indicator lamp 14 indicates to the attendant that the trouble is on trunk T_1 , and the attendant may then go to the apartment house at which the trunk T_1 terminates and repair the trouble. If the trouble should occur on one of the other trunks, as, for example, the trunk T_{25} (not shown), the relay R_{25} will be deenergized thereby opening the circuit of the relay 25 with the results previously described. The attendant, upon moving the switch arm to contact 25, causes a circuit to be completed from ground, over the front contacts of relay R_1 and succeeding relays of other trunks, over the back contact of relay R_{25} , over the contact 25, switch arm 13, through the indicator lamp 14, over conductor 22, and front contact of relay 19 to battery. The glowing of the indicator lamp 14 informs the attendant that the trouble is on trunk T_{25} .

As soon as the circuit trouble at the amplifier is repaired, the relays I and L will again be energized, and the circuit through the relay F will be opened so that the apparatus will be restored to normal, the relays R_1 and 16 being again energized to extinguish the pilot lamp 11 in the one case and to cause the lamp 36 to glow in the other, thereby indicating to the attendant that the apparatus is in operative condition.

It will be obvious that the general principles herein described may be embodied in other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a signaling system, a plurality of similar translating arrangements, means to render each translating arrangement operative or inoperative at will, an indicating switch having a plurality of contacts, one corresponding to each translating arrangement, and means whereby when any translating arrangement fails a change will be produced in the potential of the corresponding contact of the indicating switch, means to cause said switch to close a circuit over the contact whose potential has been changed, and an indicator operated by the closing of said circuit.

2. In a signaling system, a plurality of similar translating arrangements, means to render said translating arrangements operative or inoperative at will, a relay individual to each transmitting arrangement, each relay being energized when the corresponding translating arrangement is operated, means whereby when a given translating arrangement is in abnormal condition the corresponding relay is deenergized, an

indicating switch having a plurality of contacts, one corresponding to each relay, an indicator associated with said switch, and means to complete a circuit for said indicator when said switch is moved over successive contacts to the contact controlled by the relay which was deenergized.

3. In a signaling system, a plurality of trunks extending from a central station to outlying stations, means to render said trunks operative or inoperative at will, an indicating switch at the central station having a plurality of contacts, one corresponding to each trunk, means to change the potential condition of the contact corresponding to a particular trunk upon failure of that trunk, and an indicator associated with said switch having its circuit closed when the switch is moved over successive contacts to the contact corresponding to the trunk which failed.

4. In a signaling system, a plurality of trunks extending from a central station to a plurality of outlying stations, means to render said trunks operative or inoperative at will, a relay associated with each trunk at the central station, a circuit from which said relay is energized when the trunk is in normal operative condition, means to deenergize the relay corresponding to a particular trunk on failure of that trunk, an indicating switch at the central office having a plurality of contacts, one corresponding to each relay, means controlled by said relay for determining the potential of said contacts, an indicator associated with said switch, and means to actuate said indicator when said switch is moved over successive contacts to the contact corresponding to the trunk of the relay which has failed.

5. In a signaling system, a plurality of trunks extending from a central station to outlying stations, means to render said amplifier operative or inoperative at will, an indicator switch at the central station having a plurality of contacts, one corresponding to each trunk, means operative upon the failure of the amplifying arrangement associated with a trunk to change the potential of the contact corresponding to the trunk, and an indicator associated with said indicating switch, and means to operate said indicator when the switch is moved over successive contacts to the contact whose potential has been changed.

6. In a signaling system, a plurality of trunks extending from a central station to a plurality of outlying stations, amplifying arrangements associated with each trunk, means to render said amplifying arrangements operative or inoperative at will, a relay corresponding to each trunk at the central office, means to energize said relays when the corresponding amplifying arrangements are operative, means to deenergize

the relay corresponding to a particular trunk when the amplifying arrangement associated with that trunk fails, an indicating switch at the central office having a plurality of contacts, one corresponding to each relay, an indicator associated with said switch, and means to complete a circuit for said indicator when said switch is moved over successive contacts to the contact corresponding to the deenergized relay.

7. In a signaling system, a plurality of trunks extending from a central station to a plurality of outlying stations, means to render said trunks operative or inoperative at will, an indicating switch at the central office having a plurality of contacts, one corresponding to each trunk, a pilot indicator and a trouble indicator associated with said indicating switch, means actuated when all of the trunks are in normal operative condition to prevent the operation of said pilot indicator, means operative upon the failure of any trunk to cause said pilot indicator to be actuated and to change the potential of the contact of said indicating switch corresponding to the trunk which fails, and means to cause the actuation of said trouble indicator when said switch is moved over successive contacts to the contact whose potential has been changed.

8. In a signaling system, a plurality of trunks extending from a central station to a plurality of outlying stations, means to render said trunks operative or inoperative at will, a relay associated with each trunk and means to energize said relays when said trunks are in operative condition, an indicating switch at said central station having a plurality of contacts, one corresponding to each relay, a pilot indicator and a trouble indicator associated with said indicating switch, means controlled by said relays to prevent the operation of said pilot indicator when all of said relays are energized, means to deenergize the relay corresponding to the particular trunk upon failure of that trunk, means to actuate said pilot indicator upon the deenergization of the relay corresponding to any trunk, and means to actuate said trouble indicator when said switch is moved over the successive contacts to the contact corresponding to the relay which is deenergized.

9. In a signaling system, a plurality of similar translating devices, an indicator switch having a plurality of contacts, one corresponding to each translating device, means to change the potential of the corresponding contact of said switch when a translating device is in abnormal condition, and an indicator associated with said switch arranged to produce an indication when the switch is moved over successive contacts to a contact whose potential has been changed.

10. In a signaling system, a plurality of

similar translating devices, a relay corresponding to each translating device, means to energize each relay when the corresponding translating device is in normal operative condition, an indicating switch having a plurality of contacts, one corresponding to each relay, means to deenergize the relay corresponding to a given translating device when said translating device is in an abnormal condition, an indicator associated with said switch, and means to actuate said indicator when said switch is moved over successive contacts to the contact corresponding to the relay which is deenergized.

11. In a signaling system, a translating device, an indicator switch having a plurality of contacts, one corresponding to each translating device, a pilot indicator and a trouble indicator associated with said switching means operating when all of said translating devices are in normal condition to prevent the actuation of said pilot indicator, means to actuate said pilot indicator and to change the potential of the contact corresponding to a given translating device when said translating device is in abnormal condition, and means to actuate said trouble indicator when said switch is moved over

successive contacts to a contact whose potential has been changed.

12. In a signaling system, a plurality of similar translating devices, a relay individual to each translating device, means to energize each relay when the corresponding translating device is in normal operating condition, an indicator switch having a plurality of contacts, one corresponding to each relay, a pilot indicator and a trouble indicator associated with said switching means whereby when said relays are all energized the actuation of said pilot indicator is prevented, means whereby when one of said translating devices is in abnormal condition the corresponding relay is deenergized, means operative upon the deenergization of one of said relays to cause said pilot indicator to be actuated and to change the potential of the contact corresponding to said relay, and means to operate said trouble indicator when said switch is moved over successive contacts to a contact whose potential has been changed.

In testimony whereof I have signed my name to this specification this 11th day of July, 1924.

JOHN F. TOOMEY.