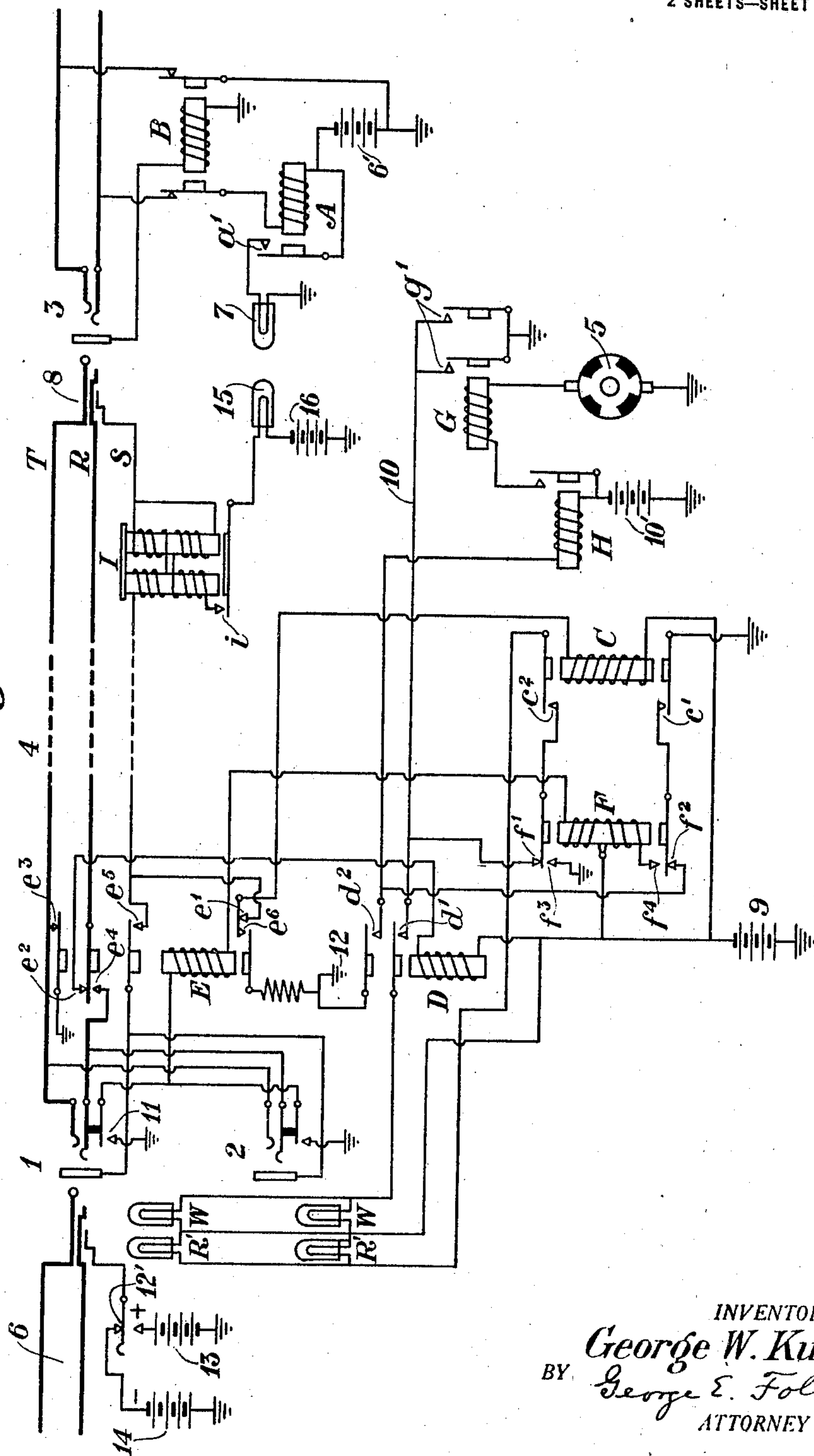


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TELEPHONE TRUNK CIRCUITS.
APPLICATION FILED JULY 12, 1917.

1,358,758.

Patented Nov. 16, 1920.
2 SHEETS—SHEET 1.

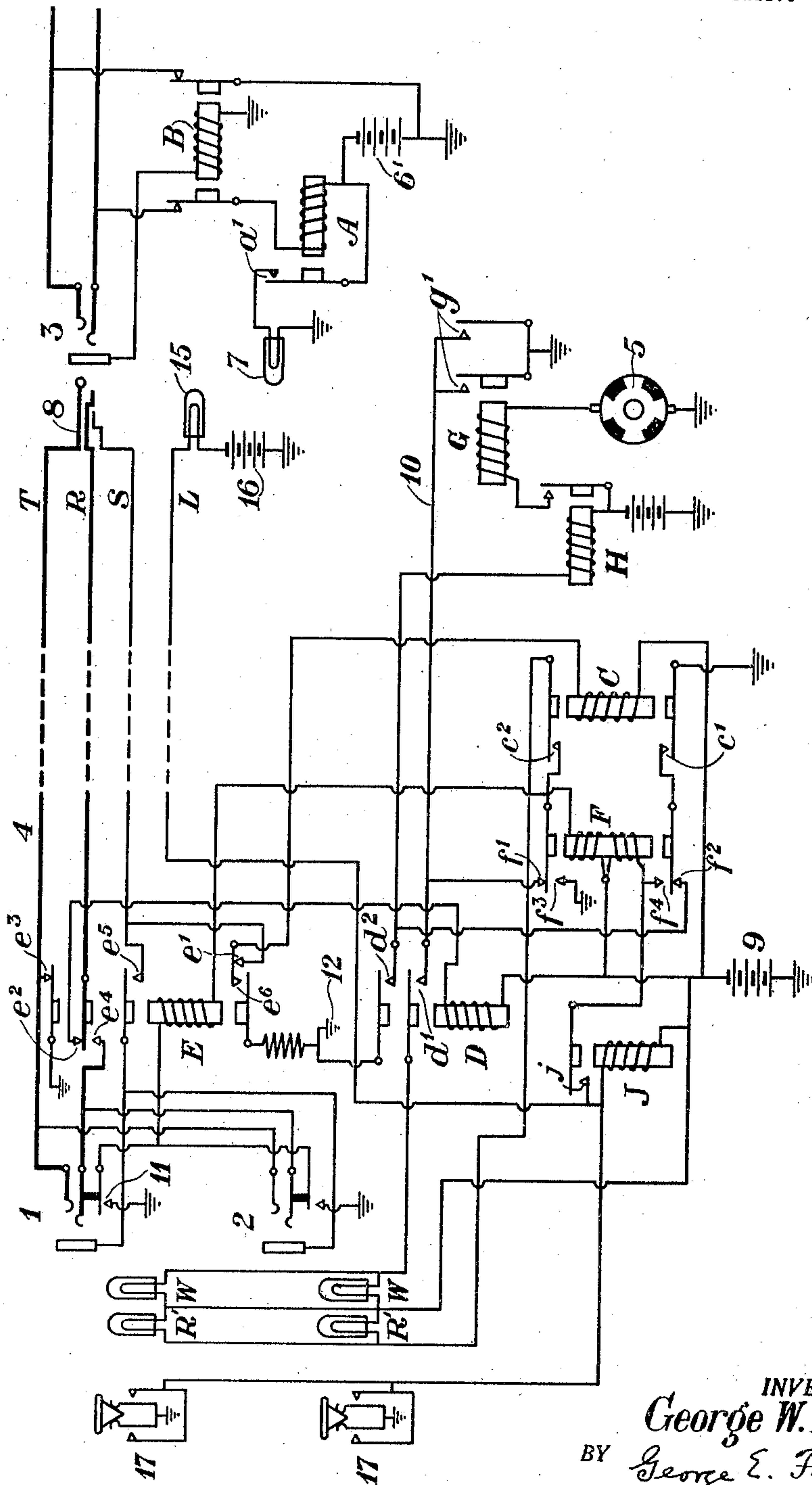
Fig. 1



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Fig. 2



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TELEPHONE TRUNK-CIRCUITS.

1,358,758.

Specification of Letters Patent.

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Application filed July 12, 1917. Serial No. 180,173.

To all whom it may concern:

Be it known that I, GEORGE W. KUHN, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Telephone Trunk-Circuits, of which the following is a specification.

This invention relates to telephone systems and more especially to signaling apparatus for use with talking or testing circuits extending between operators' positions at a central station or stations; but certain features of the invention have a more general applicability as will be apparent from the description and claims below.

The invention will be found especially useful in connection with the trunk circuits used at central offices, primarily for testing purposes, and will be here illustrated as applied to such a circuit. Heretofore when a trouble man on the line or at a subscriber's station for instance, wanted a test made of a certain circuit, it has been necessary for him to communicate with an operator at the central station and get a talking connection put through to the test desk over which he could inform the testing operator or test man, which circuit was to be tested. The test man thereupon informed the trouble man that he would "meet him." This talking connection was then taken down and the test man informed the switchboard operator over a talking trunk what connection to put up in order that the desired test might be made, thus putting the test desk and the trouble man again in connection over a testing circuit.

One of the objects of the present invention is to avoid complication such as above described in putting up connections between different positions, stations or lines in a telephone equipment. Another object is to provide signaling apparatus for such connecting circuits or trunks which will reduce the danger of a connection being left up after it has served its purpose. A further object is to provide trunks for testing and like purposes having means for indicating at all positions of a test desk, which of the trunks are in use; having signals whereby a test man may be recalled by a trouble man on the line should the former have disconnected from the trunk, and having means to enable the test man to give the switchboard

operator a disconnect signal over the trunk circuit.

The invention will be more fully understood from the following detailed description of the embodiment illustrated in the accompanying drawings in which Figure 1 illustrates a form of the invention using three conductors in the trunk proper, and Fig. 2 illustrates a modification in which a four conductor trunk is used.

Referring to Fig. 1, 1 and 2 indicate two positions of a test desk. 3 represents one of the multiple jacks in which a subscriber's line terminates at the switchboard. This line is provided with the usual line relay A and the cut-off relay B. 4 indicates generally the test trunk connecting the test desk and the central switchboard which has the usual tip ring and sleeve conductors indicated by T, R and S, respectively, on the drawing. These conductors, as will be seen, are multipled through the various positions of the test desk, only two positions being shown. The test trunk is provided with relays C, D, E and F for operating the signals and for clearing the trunk for testing, the operation of which will be clearly pointed out hereinafter. Each position of the testing desk is supplied with a red and a white signal lamp, indicated at R' and W, respectively. G is an interrupting relay used for flashing the signals, as hereinafter described, the circuit of which is controlled by the relay H which closes it through the constantly rotating interrupter 5. The plug terminal of a testing apparatus is shown at 6. The apparatus itself being unnecessary to an understanding of the present invention, is omitted.

With the circuit arrangement shown in Fig. 1 let it be supposed that a trouble man is at work upon a subscriber's line, either at the subscriber's substation or at some other point along the line, and wishes to have a test of that line made. He bridges his head set across the circuit in the usual manner, or, if at the subscriber's station, may accomplish the same end by removing the receiver of the subscriber's set. This gives the central operator the usual line signal by closing the circuit from the battery 6' over the line through relay A and back to battery, thus closing the circuit of the lamp 7 through the contact a'. The operator answer-

ing the call is advised by the trouble man that he desires a test of the line upon which he is working, and the plug 8 of one the test trunks is thereupon inserted into a multiple jack of the line in question. This will result in flashing both the red and white signals at the test desk until the call is answered by the test man. The circuits by which this result is accomplished may be traced as follows: from the ungrounded side of battery 9, through the winding of relay C, contact e' to the sleeve side of the line; thence to ground, through the winding of the polarized relay I and the cut-off relay B of the subscriber's line. This operates the cut-off relay extinguishing the line lamp 7 and disconnecting the line from battery 6' in the usual manner. It also operates the relay C which closes both of its contacts c' and c^2 . The closure at c^2 completes the circuit of the red lamps R' from battery 9 through the lamps, contact c^2 , contact f' and circuit 10 to the interrupting contacts g' of relay G. At the same time the operating circuit of the interrupting relay is closed by the relay H, whose circuit is completed from battery 10' through the back contact f^2 and the contact c' . A plurality of contacts g' are provided in order to avoid objectionable sparking, since the current may be considerable if there is a large number of positions at the test desk.

Since the subscriber's line is also bridged by the instrument of the trouble man, a circuit will be closed from battery 9 through the relay D by way of back contact e^2 , the line R, through the instrument, the line T and contact e^3 to ground. This closes both contacts of relay D and lights the white signals by a circuit traceable from the battery 9 through the lamps W, contact d' to the interrupter and ground. The contact d^2 being closed, completes the circuit of the relay H to ground and will start the operation of the interrupter if it is not already in operation by reason of the completion of the circuit above described, as will be the case under certain circumstances hereinafter referred to.

All positions of the test desk are now given a white and a red signal, both of which continue to flash until one of the operators at that desk plugs into the multiple of the trunk in question. When this is done, the trunk is entirely disconnected from the associated relays in the following manner, to facilitate the testing operation: the insertion of the plug of the testing circuit closes the contact 11 which energizes relays E and F by a circuit which may be traced from the battery through the upper coil of relay F to relay E, then through contact 11 and to ground. Relay E thereupon moves all four of the armature switches shown breaking the circuit of relay D at e^2 and at e^3

while closing the ring and sleeve conductors of the trunk at contacts e^4 and e^5 , respectively. The ground connection for the relay C is simultaneously shifted from the line S to a ground connection 12 by closure of the contact e^6 . This contact it will be observed is closed before the previous connection is broken at e' so that the relay C is not permitted to fall back.

The relay F being energized at the same time, breaks the connection between the red signals and the interrupter at the point f' and grounds them instead at contact f^3 . At the same time this relay locks itself by a connection from the battery 9 through the lower winding thereof and to ground through contacts f^4 and c' . The subscriber's cut-off relay is kept energized after the insertion of plug 6, by the customary battery in the sleeve side of the testing circuit, indicated in Fig. 1 at 14.

The testing trunk is now cleared of all connections and is ready for use. The white signals have been extinguished and the red signals changed from a flashing to a steady signal. They continue in this condition until the operator withdraws the plug from the subscriber's circuit, as will appear hereinafter.

It will be noted that the connection to the trunk by the test man causes the flashing apparatus for the signal lamps to be de-energized by breaking the ground connection therefor at both contacts d^2 of relay D and f^2 of relay F. Should it happen, however, that after plugging in he withdrew his plug either accidentally or to await further notice from the trouble man, the relay E would be deenergized and the circuit of relay D again closed at e^2 so that when the trouble man again bridged the subscriber's line the white signals would renew their flashing and recall the test man. Since contact f^2 remains open during such an interval the necessity for the separate ground connection for the flashing apparatus through contact d^2 will now be apparent.

If the connection has been set up at the instance of the test man, the white signals will not be lighted since he will have plugged into the test trunk jack and open circuited relay D to begin with. If the switchboard operator plugs in first, at her own initiative or otherwise the white signals will light only if the subscriber's line is shortcircuited or grounded.

When the test has been completed, the operator at the test desk may signal the operator at the switchboard to remove the plug from the subscriber's line by depressing the key 12'. This sends a current from the positive side of the battery 13 over the sleeve side of the line through the polarized relay I and to ground through the winding of the relay B. The battery 14 used in

testing, and all battery current flowing through this relay from any other connection is of the opposite polarity and does not affect the relay. The depression of the key 12' causes the relay to operate and close the circuit of the lamp 15 through the contact *i*. This at the same time locks the relay closed so that the lamp 15 will burn until the operator withdraws the plug from the subscriber's line, which will extinguish the lamp and release the relay by reason of the disconnection from the ground through relay B.

When the operator at the test desk withdraws the plug of the testing circuit from the trunk jack, the contact 11 is broken. If the plug 8 at the switchboard has been previously withdrawn this deenergizes the relay C by breaking the circuit of the relay E, thus unlocking the relay F at contact *c'*, and the apparatus is thereby restored to the original condition. It will be noted, however, that the withdrawal of the test man's plug from the trunk jack will, alone, have no effect upon the red signal, which will continue to burn at all positions of the test desk until the subscriber's line is released by the withdrawal of plug 8 from the subscriber's jack. This is because the relay C, and consequently relay F, will remain energized, due to the ground connection either at 12 or over the line S and through winding of relay B, until the plug 8 is withdrawn.

In the modification illustrated in Fig. 2, all parts of the apparatus correspond to those bearing similar reference characters in Fig. 1. The difference is in the circuit for the disconnect signal 15. In Fig. 2 this is an independent circuit which requires a fourth conductor L in the testing trunk. A key 17 is provided at each position of the test desk which, when depressed by the operator, closes the circuit of the relay J thereby completing a circuit from the battery 16 through the signal lamp 15, the contact *j*, contact *f*⁴, contact *c'* to ground. At the same time the relay is locked by the completion of an energizing circuit from battery 9 through its winding and contact *j* to ground which will remain closed until plug 8 is withdrawn. Except for this, the operation of the circuit is the same as that shown in Fig. 1.

The form of the invention shown in Fig. 1 is especially suitable for connection between operators' positions or stations located at a considerable distance apart because, however long the connection may be, there are but three through conductors necessary. The form shown in Fig. 2 may be found preferable where the circuit is intended for local use, in which case the cost of the extra conductors in the trunk would probably be less than that of the polarized relay necessary for the other arrangement.

It will be seen from the foregoing that this invention provides means whereby an operator at a test desk for instance may be notified directly and without difficulty that a response by him over a given trunk is desired, and that it provides a signal of a special character at all positions of the test desk when such a test is desired which continues until answer is made. This enables anyone in charge of the desk in a supervisory capacity to ascertain whether calls are being answered and whether they are promptly answered, which was not possible with the old system. It also provides against the likelihood of a test trunk being inadvertently left in a subscriber's jack, making the line busy and preventing calls, since the steady burning of the red lamps at the test desk and the disconnect signal lamp at the switchboard, will continue until the plug is withdrawn from the subscriber's line jack. If the operator at the test desk neglects to give the disconnect signal, the steadily glowing red lamp will remind him to do so, and if the switchboard operator fails to obey the disconnect signal the test man will know the fact by the continued burning of the red lamp and will call her attention thereto.

Manifestly the invention is applicable to circuits over which talking or operations other than testing are to be carried on, and various modifications of the details herein specifically described may obviously be made without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. In combination, a trunk for connecting two stations, a signal located at one station, means for operating the signal to indicate when a connection has been made with the trunk at the other station and means actuated in response to a connection with the trunk at the first named station for altering the character of said signal without discontinuing the same.

2. In combination, a trunk for connecting two stations, a signal located at one station, means for operating the signal to indicate when a connection has been made with the trunk at the other station and means for altering the character of said signal without discontinuing the same when connection is made with the trunk at the first named station, said operating means and said altering means coöperating to continue the signal in its altered condition until the connection to said trunk is broken at said other station.

3. In a telephone circuit a trunk for connecting two stations, a signal at the first station, means put into operation when a connection is made to the trunk at either station for operating said signal, means controlled by the connection at the first station for

changing the character of the signal if it has been initiated by a connection at the second station, a signal at the second station, means under the control of an operator at the first station for initiating said second named signal and means for causing the continuance of both signals after once initiated until the connection with the trunk at the second station is broken.

10 4. In a telephone circuit, a trunk for connecting two operators' positions, means associated therewith for giving the operator at one position a signal whenever the trunk is plugged into a line at the other position, 15 means for giving said operator an additional signal if said line is bridged or grounded, means for altering the character of the first mentioned signal and extinguishing the second mentioned signal when said operator 20 makes connection to the trunk, and means under control of said operator for giving an operator at the other station a disconnect signal.

5. In a telephone circuit, a trunk for connecting two operators' positions, means associated therewith for giving the operator at one position a signal whenever the trunk is plugged into a line at the other position, means for giving said operator an additional 30 signal if said line is bridged or grounded, means for altering the character of the first mentioned signal and extinguishing the second mentioned signal when said operator makes connection to the trunk, means under 35 control of said operator for giving an operator at the other station a disconnect signal, and means for causing the continuance of said altered signal and said disconnect signal after they are once initiated until the 40 connection with the trunk at said other station is broken.

6. In a telephone circuit, a trunk for con-

necting two positions, means associated therewith for giving the operator at one position a signal whenever the trunk is plugged 45 into a line at the other position, means for changing the character of said signal upon connection to the trunk by said operator and for continuing it in its altered character until the trunk is disconnected from the line 50 at said other position, a second signal at said operator's position and means for operating said second signal whenever said trunk is connected to said line but disconnected at said operator's position. 55

7. In telephone exchange apparatus, a trunk connecting the test desk with positions at the switchboard, subscribers' lines terminating at the switchboard with which the trunk is adapted for connection, a relay for 60 lighting a signal at the test desk energized upon connection being made with either end of the trunk, means associated with said relay for causing the signal to flash while the trunk is disconnected from the test desk, 65 means for lighting a second signal at the test desk when connection to the trunk is made at the switchboard and the subscriber's line is bridged, switching mechanism energized upon connection with the trunk at the test 70 desk, for extinguishing said second signal and for causing the first named signal to burn steadily, a disconnect signal at the switchboard, means at the test desk for causing the disconnect signal to light and means 75 associated with the controlling mechanism of the first named signal and of the disconnect signal to insure their continuance until the trunk is disconnected from the subscriber's line. 80

In testimony whereof, I have signed my name to this specification this eleventh day of July, 1917.

GEORGE W. KUHN.