

G. W. KUHN.
 TESTING APPARATUS FOR TELEPHONE SWITCHBOARD CORDS.
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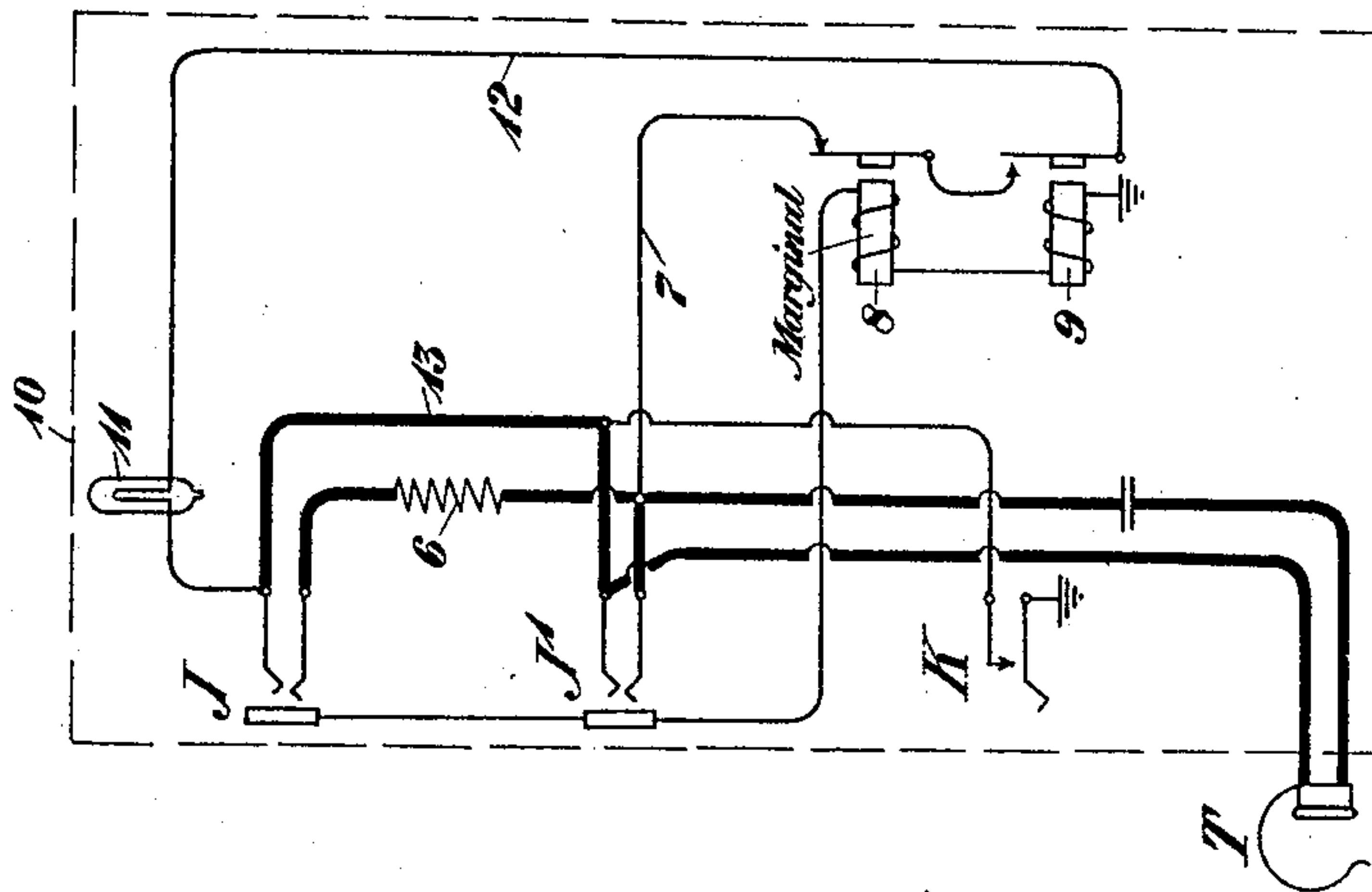


Fig. 3

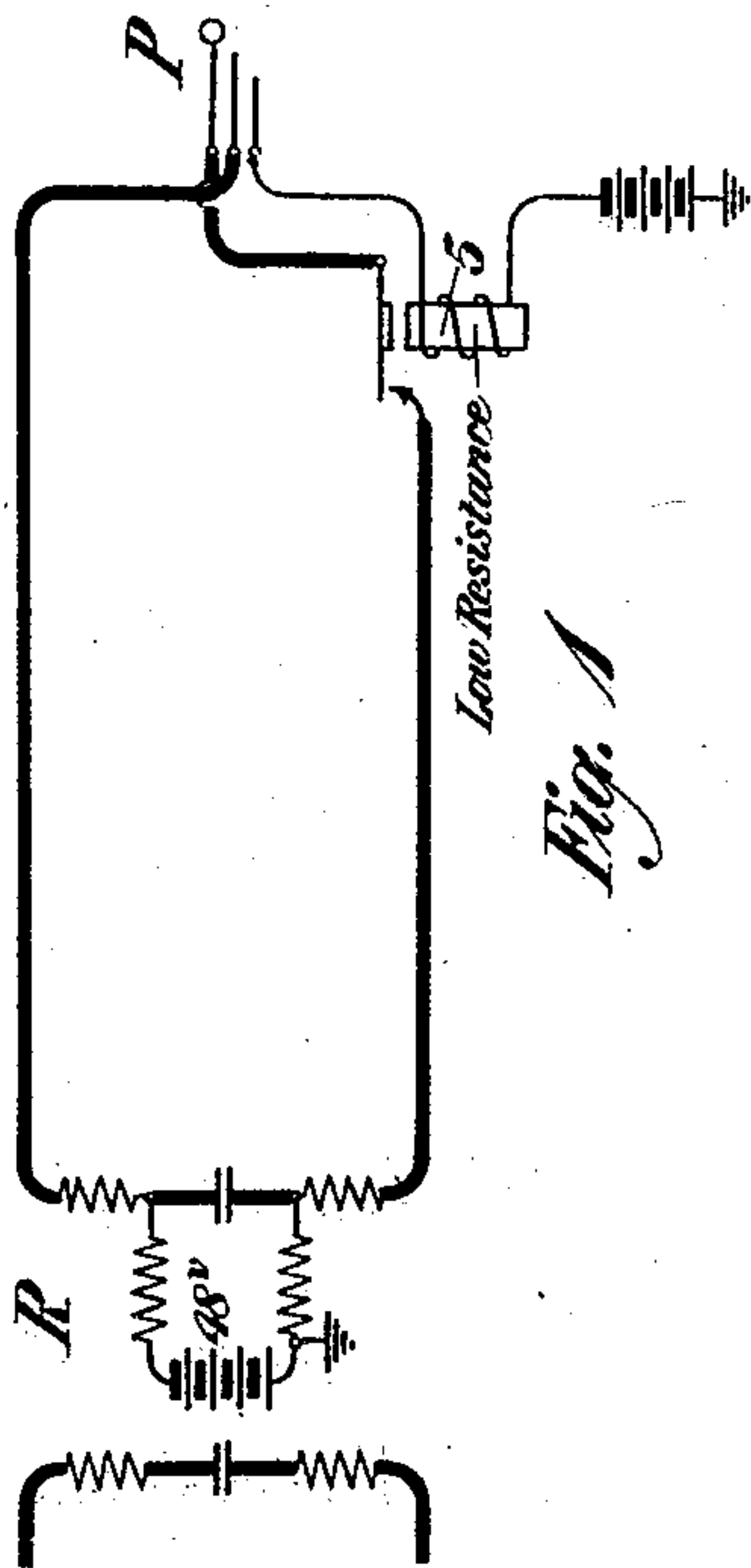


Fig. 1

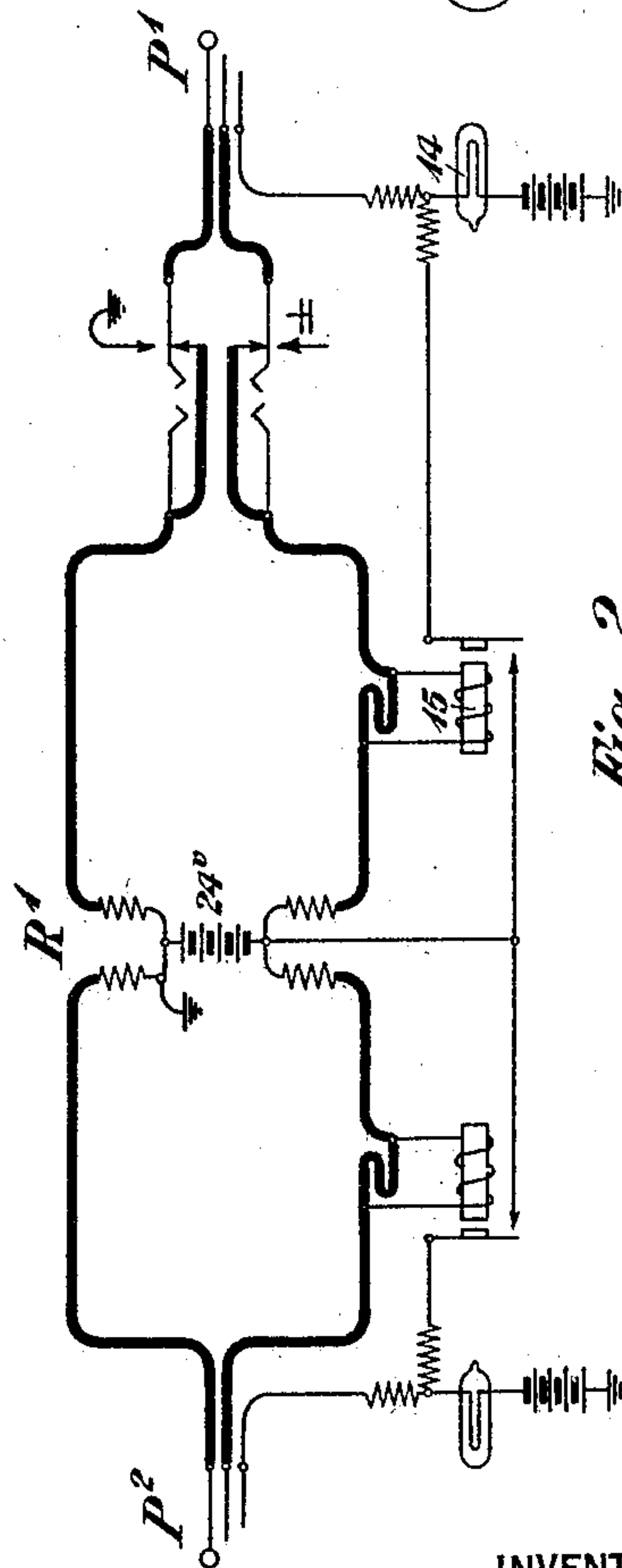


Fig. 2

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TESTING APPARATUS FOR TELEPHONE-SWITCHBOARD CORDS.

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Specification of Letters Patent.

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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 Testing Apparatus for Telephone-Switchboard Cords, of which the following is a specification.

This invention relates to testing arrangements, and more particularly to portable test boxes for testing cord or link circuits of telephone switchboards.

In maintenance work at telephone switchboards where it is necessary to change the plugs on cords, it is highly desirable that testing means shall be provided for the purpose of indicating whether the connections have been properly made in the cords or link circuits in order to determine whether or not open, crossed or reversed connections, short circuits or other defects exist between the conductors or their connecting points in said circuits. Accordingly, it is one of the principal objects of this invention to provide a portable testing arrangement whereby any of the above mentioned defects in a telephone link circuit is readily detected. Another object consists in the provision of a signaling equipment in connection with the testing arrangement for indicating the existence of said defects. Other and further objects of the invention will be apparent from the following description, when considered in connection with the appended drawing in which is illustrated an embodiment thereof.

In the drawing, in which is shown by way of illustration, certain types of link circuits with which the testing arrangement of this invention is adapted to be used, Figure 1 represents diagrammatically a toll switching trunk, Fig. 2 an ordinary cord circuit, and Fig. 3 an arrangement for testing the circuits of Figs. 1 and 2, or other link circuits.

Referring to the drawing, P Fig. 1, represents a terminating plug of a toll switching trunk. In Fig. 2, P¹ P² represent the terminating plugs of a cord circuit. In Fig. 3, which represents diagrammatically a test set 10, J illustrates a jack with which plug P is adapted to be associated, J¹, a jack with which either plug P¹ or P² may be associated, and T a telephone receiver.

The details of the testing arrangement may now be more sufficiently understood

from the following description of its operation.

The equipment of the testing arrangement of Fig. 3 may be mounted in a small box, and located on a portable repair table, which is moved from one position to the next in repairing cords directly at the switchboard.

When it is desired to test a cord or trunk, for instance, the trunk shown in Fig. 1, plug P is inserted in jack J, and the following circuit is closed: from battery, winding of relay 5, sleeve contacts of plug P and jack J, windings of marginal relay 8 and relay 9 to ground. The closing of this circuit operates relays 5 and 9, but the marginal relay 8 is so adjusted that it will not operate at this time. The operation of relay 9 will close a circuit from battery at repeating coil R over the ring conductor, and ring contacts of plug P and jack J, resistance 6, conductor 7, normal contact of marginal relay 8, closed contact of relay 9, conductor 12, filament of lamp 11, tip contacts of jack J and plug P closed contact of relay 5, winding of repeating coil R to ground. The closing of this circuit causes the lamp 11 to light. The key K of the test set is now operated, and shunts the repeating coil winding on the tip side of the cord: The operation of the key K closes a circuit through its contact from ground, conductor 13, filament of lamp 11, conductor 12, closed contact of relay 9, normal contact of marginal relay 8, conductor 7, resistance 6, ring contacts of jack J and plug P, ring conductor of the cord, through one side of repeating coil R to battery. If the lamp 11 remains lighted as indicated under the conditions above outlined, the conductors of the cord may be considered properly connected and in satisfactory operative relation with respect to each other and in a state of continuity.

To test the cord illustrated in Fig. 2, plug P¹ is inserted in jack J¹, and the following circuit closed: from battery, filament of lamp 14, sleeve contacts of plug P¹ and jack J¹, windings of relays 8 and 9 to ground. The closing of this circuit causes the supervisory lamp 14 to light. As previously outlined in connection with description of the circuit shown in Fig. 1, relay 8 being marginal should not operate at this time, but relay 9 will operate, and close a circuit from battery at repeating coil R¹, winding of supervisory relay 15, ring contacts of plug P¹ and jack

J¹, normal contact of relay 8, closed contact of relay 9, conductor 12, filament of lamp 11, conductor 13, tip contacts of jack J¹ and plug P¹ through one side of repeating coil R¹ to ground. This circuit provides for the lighting of lamp 11 and also energizes supervisory relay 15 which causes supervisory lamp 14 to be extinguished. Key K is now operated and closes a circuit through its contact from ground, conductor 13, filament of lamp 11, conductor 12, closed contact of relay 9, normal contact of relay 8, conductor 7, ring contacts of jack J¹, and plug P¹, winding of relay 15 to battery. It will thus be seen that the operation of key K short circuits the winding of repeating coil R¹ on the tip side of the cord. If the lamp remains lighted, as indicated under the conditions above outlined, the conductors of the cord may be considered properly connected and in satisfactory operative relation with respect to each other and in a state of continuity.

The insertion of plug P² in jack J¹ will result in the circuit operating similarly to that described in connection with the insertion of plug P¹ in said jack.

From the foregoing, it will be seen that in order to test the conductors of a cord to determine if they are properly connected and continuous, it is merely necessary to insert the plug attached to the cord in the proper jack of the test set. If thereupon the lamp lights then remains lighted upon depression of the key K, the cord is in proper operative condition, otherwise there is some defect.

Upon testing a link circuit the conditions which will occur if the conductors thereof are not properly connected and continuous will now be taken up under the following headings:

Tip open.

Under this condition the association of the plug P with jack J, plug P¹ or P² with jack J¹ will close a circuit through the sleeve of said plugs and jacks as previously outlined, and operate relay 9. The operation of said relay, however, will perform no useful function because of the broken or open conductor which exists in the tip conductor of the cord, the continuity of which is necessary to complete a circuit to ground whereby the lamp 11 is lighted. The operation of key K under these conditions will cause the lighting of said lamp over a circuit previously traced.

Ring open.

The association of said plugs with said jacks when the ring conductor is open will cause relay 9 to operate over the sleeve circuit of said jack and plugs as previously described, but the lamp 11 will not light be-

cause of the open or broken conductor in the ring side of the cord over which battery is supplied. The operation of the key K at this time will not cause lamp 11 to be lighted, because no battery will be supplied from the ring side of the circuit and therefore no circuit will be closed.

Sleeve open.

When the sleeve conductor of the link circuits is open the relay 9 will not operate, and therefore the circuit whereby lamp 11 is lighted cannot be completed because of open contact of said relay. The operation of the key K will not change the condition of the circuit.

Tip crossed with ring.

When the circuits are in this state, relay 9 will operate over the sleeve side of the cords, but the lamp is shunted out by the "cross" between the tip and ring conductors. The operation of the key K shunts the lamp directly to ground.

Tip crossed with sleeve.

Under this condition relay 9 operates, and causes lamp 11 to be lighted. When the key K is operated, the relay 9 is shunted by the ground at the key, and therefore releases, opens the lamp circuit and causes the lamp 11 to be extinguished.

Ring crossed with sleeve.

The relay 9 operates when the ring conductor is crossed with the sleeve conductor and the marginal relay 8 also operates due to the decreased resistance of the combined ring and sleeve conductors of the cord in parallel, and, while the lamp circuit is closed through the operation of relay 9, it is opened by the operation of relay 8 and lamp 11 does not light. The operation of key K has no effect on this circuit condition.

Tip and ring reversed.

The relay 9 operates by a circuit established over the sleeve conductors and causes the lamp 11 to be lighted. The operation of the key K, however, places a short circuit around the lamp in an obvious manner and extinguishes it.

Tip and sleeve reversed.

Under this condition relay 9 does not operate because there is no battery over the tip conductor of the cord, and therefore no circuit is provided for the lighting of lamp 11. The operation of the key K has no effect on the circuit.

Ring and sleeve reversed.

Under this test relay 9 and marginal relay 8 will operate, the latter due to the fact that it is adjusted to operate through the lower

resistance of the ring conductor of the cord, but not through the resistance of the sleeve conductor. The lamp circuit is therefore opened by the operation of the relay 8 and the lamp 11 will not light. The operation of key K will not change this condition.

The testman upon noting the action of the circuit under test by means of the signal lamp in the test set, will be readily apprised of the condition of said circuit.

While the arrangements of this invention have been illustrated as embodied in certain specific arrangements which have been deemed desirable it will be understood that they are capable of embodiment in many and widely varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A testing system comprising a portable set for testing telephone cords, conductors for said cords, terminals connected with said conductors, said portable test set being adapted for association with said terminals, means in said test set controlled upon such association by the operating condition of the conductors for the sleeves of said cords, a circuit controlled by the actuation of said means for testing the operating condition of the conductors of the tip and ring strands of said cords, and means associated with the

controlled circuit whereby the efficiency of the conductors is determined.

2. A testing system comprising a link circuit, conductors having terminals included in said circuit, a portable test set adapted to be associated with said terminals, a relay in the test set responsive to such association for closing a circuit whereby the operating condition of the sleeve conductor of the link circuit is tested, a second circuit responsive to the operation of said relay for testing the operating condition of the tip and ring conductors of said link circuit, and signaling means included in said second circuit for indicating the result of such tests.

3. A testing system comprising a link circuit, conductors having terminals included in said circuit, a portable test set adapted to be associated with said terminals, means in said test set responsive to such association for testing the continuity of the sleeve conductor of said link circuit, a circuit controlled by the actuation of said means for testing the continuity of the tip and ring conductors of said circuit, and means associated with the controlled circuit for indicating the result of such tests.

In testimony whereof, I have signed my name to this specification this 10th day of December, 1920.

GEORGE W. KUHN.