(No Model.)

M. G. KELLOGG.

MULTIPLE SWITCHBOARD.

No. 592,336. Patented Oct. 26, 1897.

Fig. 1a.

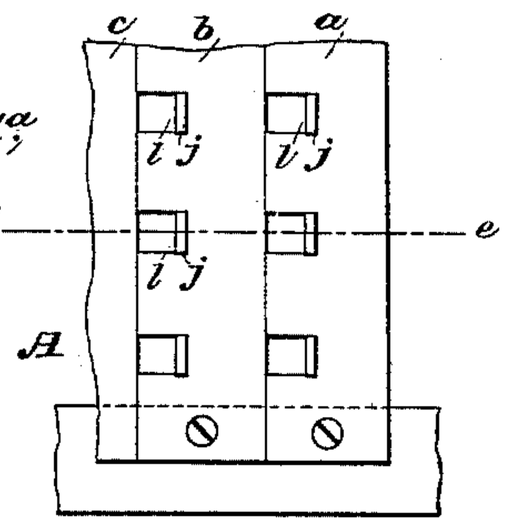


Fig. 1b.

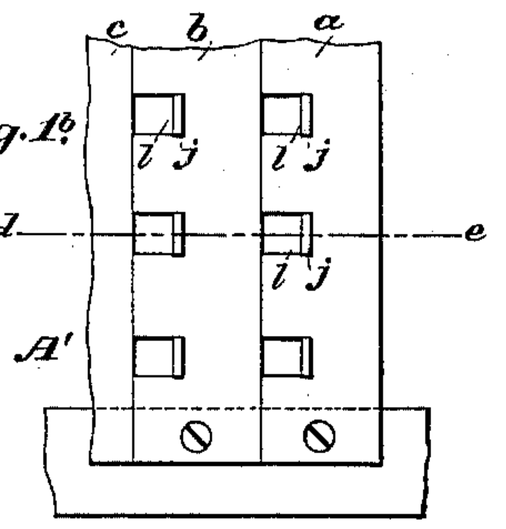


Fig. 2.

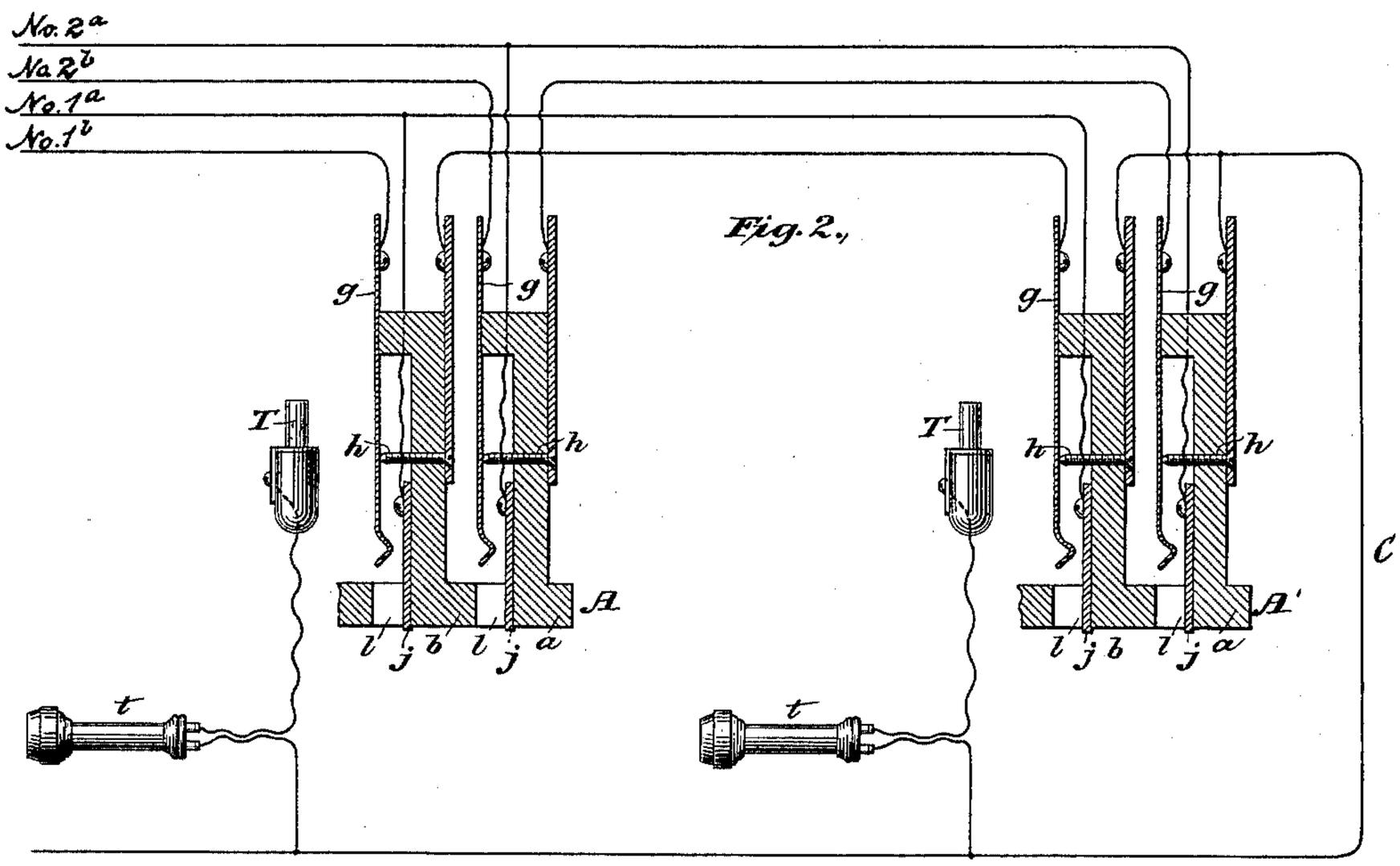


Fig. 3.

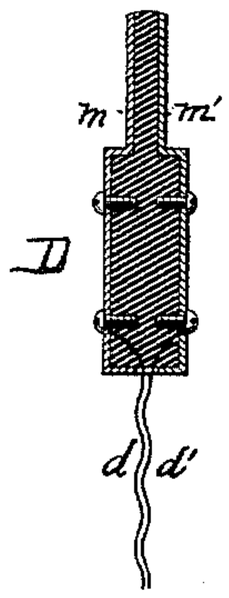
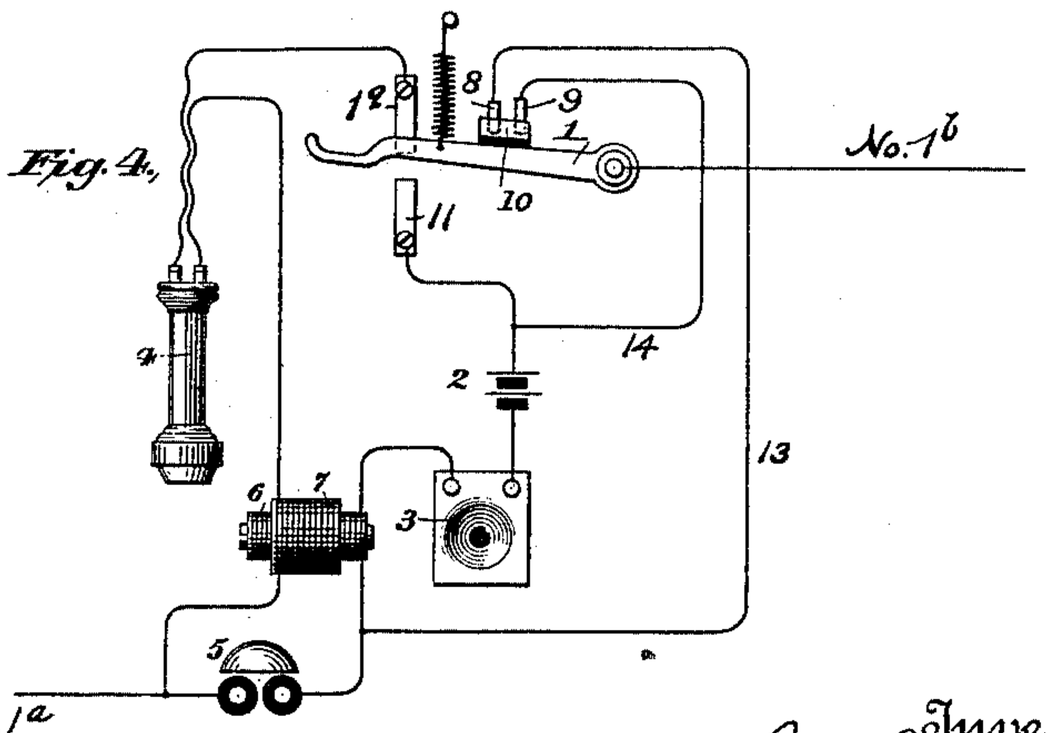


Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

MILO G. KELLOGG, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF SAME PLACE.

MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,336, dated October 26, 1897.

Application filed December 12, 1889. Serial No. 333,539. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, Illinois, temporarily residing at Stuttgart, in the Empire of Germany, have invented certain new and useful Improvements in Multiple Switchboards for Telephone-Exchanges, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to a telephone-exchange system in which the subscribers' lines are metalic-circuit lines connected to multiple switchboards; and it consists in a system of testing at any board to determine whether any line is in use.

I place as many boards in the central office as are found necessary or desirable in order to properly answer the calls and connect and disconnect the subscribers' lines. On each board I place for each line a spring-jack or similar switch having two contact-points which are normally in contact and a third contact-piece insulated from the rest, (except by the circuit connections,) said switch being adapted to receive a loop-switch plug and, when a plug is inserted, to disconnect the switch-points which are normally in contact and connect one of them with one of the contact-pieces of the plug and at the same time connect the other contact-piece of the plug with said third contact-piece of the switch mentioned above. Said third contact-pieces of the switches are so placed and arranged that an operator may at will apply a test-plug or similar device to them.

Figures 1^a and 1^b of the drawings are front views of sections of two multiple switchboards to which the same lines are connected. Fig. 2 is a diagram of the boards with the circuits and connections necessary to illustrate my invention. Fig. 3 shows a double or loop plug adapted to be used with the switches. Fig. 4 is a diagram of the subscriber's-station apparatus necessary to illustrate my invention.

In the drawings like parts and apparatus are represented by the same letters and figures of reference.

In Fig. 2, A is a sectional view of the switchboard shown in Fig. 1^a, and A′ is a sectional view of the switchboard shown in Fig. 1^b, each as indicated by the line *d e*. *a b* represent rubber strips, of the shape substantially as shown, on which the metal parts of the switches are mounted. *l l* are square holes through the fronts of and at the edges of the strips, adapted to receive and guide the switch-plugs. The contact-springs *g g* are mounted to the rear of and are parallel to the switch-holes *l l* to which they belong, as shown. The contact-points *h h* corresponding to the contact-springs pass through the rubber strips, as shown. *j j* are the contact-pieces of the switches, insulated from the other parts, (except by the circuit connections,) each adapted to connect one side of the line to one of the contact-pieces of the loop-plug when inserted and also to be the test-contacts of its line at its board. The switch-plugs are substantially as shown in Fig. 3.

The several parts mentioned above are so made, shaped, arranged, and adjusted that when a plug is inserted into any switch-hole it raises the spring *g* in the rear of the hole from the contact-point *h*, (on which it normally rests,) and the spring is connected to one of the contact-pieces of the plugs, while the other contact *j* of the plug is connected to the contact-piece *j* of the switch which is used. Each section of a rubber strip, with its contact-spring, contact-point, contact-piece, and the hole all arranged and operating as described, may be considered as a spring-jack switch.

t t in Fig. 2 are test receiving instruments and T T are test-plugs, one instrument and one plug for each operator, and each plug connected to one side of its test receiving instrument by a flexible cord, as shown.

The plugs and cords are so constructed that the operators may at will bring the metal tips of the plugs into contact with any of the contact-pieces *j j* at their boards.

The circuit of each subscriber's line is as follows: One branch, starting out from the subscriber's station, is connected with all the contact-pieces of the switches of the line on the several boards. The other branch of the line, starting out from the other side of the subscriber's-station apparatus, passes successively through the pairs of contact-points

normally in contact of its switches on the several boards, being connected in each case to the spring first. From the last contact-point *h* the line passes or is connected to all the test receiving instruments on their several boards on the other side of the instruments from that to which their test-plugs are connected.

In the subscriber's-station apparatus shown in Fig. 4, 1 is the telephone-switch. 2 is the battery. 3 is the transmitter. 4 is the hand-telephone. 5 is the signal-bell. 6 is the primary, and 7 is the secondary, of the induction-coil. The switch shown is the usual form of gravity telephone-switch, which closes the switch-circuits in one direction when the telephone is on the switch and opens those and closes other circuits when the telephone is off the switch. When the telephone is on its switch, the line-circuit is from line-wire No. 1^a, through bells 5, primary coil 6, transmitter 3, combined transmitter and test battery 2, contact 11, lever 1, and line-wire No. 1^b.

When the telephone is removed from the lever and is thus switched for use, the circuit is transferred as follows: line-wire No. 1^a, secondary coil 7, telephone 4, contact 12, lever 1, and line-wire No. 1^b. At the same time the transmitter-circuit is closed and the battery short-circuited from line as follows: contact 10, contact 8, wire 13, primary coil 6, transmitter 3, battery 2, wire 14, contact 9, and contact 10.

The order of the above-named elements is immaterial as long as their function is the same, and the connections between the whole outfit and the line-wires may be reversed.

The battery serves as a transmitter-battery and also as a test-battery for the line, as will be apparent.

The lines and test receiving instruments are not grounded at the central office, but are open to the ground there.

I have not indicated any calling apparatus or the operator's answering and connecting apparatus in detail, as it is not necessary to do so to illustrate my invention, and well-known forms of apparatus can be used for the purpose. It is sufficient to say that two plugs like plug D, Fig. 3, have their contacts *m* and *m'* connected together with flexible conductors *d* and *d'*. When inserted in a jack, one contact, say *m*, is connected to spring *g* and lifts it from its anvil *h*, and the other contact *m'* is connected to test-contact *j*. Thus two lines may be connected together. For the calling system an independent calling-circuit common to many subscribers' stations—such as the Law and American district systems—may be used.

The operation of the test system is as follows: When a line is to be tested, the operator places her test-plug on the contact-piece *j* of the line, and if the line is not switched at some board and the subscriber's telephone is on its switch there will be a complete circuit established in which is the operator's test-receiving instrument and the subscriber's battery, and the instrument will sound or respond, indicating that the line is "free" and can be switched to; but if the line is switched at any board the test-circuit is interrupted and the instrument will not sound, or if the subscriber's telephone is off from the switch the battery is not in the circuit and the instrument will not sound.

The test-circuit is as follows: From the test-plug T to contact-piece *j*, to which the test is applied, thence through the circuit of the line by way of the subscriber's station and through the contacts *g h* of the switches of the line, and thence through the test receiving instrument back to the test-plug. When the line is switched at any board, this test-circuit is opened at the pair of contacts *g h* of the switch at which the line is switched.

When the instrument, on a test being made, does not sound, the operator will therefore know that either the line is switched for use or the subscriber's telephone is switched for use, and she will not connect the line with another line.

In some systems of multiple-switchboard testing the test merely indicates whether or not a line is switched at some board. In other systems of testing the test merely indicates whether or not the subscriber's telephone is switched for use. In this system the line tests "busy" whether it is switched at some board or the subscriber's telephone is switched for use.

In this system the test receiving instruments are not grounded, and an accidental ground on a line tested between the subscriber's station and the pairs of contact-points of the switches would not give a false signal that the line was "free" when it was switched at the central office, as might be the case were the instrument grounded on the side opposite to that to which the test is applied. Such accidental grounds are liable to occur, and it is apparent that were the instruments grounded as suggested confusion would be liable to occur in the operation of the system. The test receiving instruments and the subscriber's batteries should be such that the instrument will respond or sound when they are closed to each other through the test-circuits of the lines.

I claim as my invention and desire to secure by Letters Patent—

1. A test-circuit for a metallic-circuit line disconnected from the ground, from one side of a test receiving instrument to a test plug or device, thence to one side or branch of the line when the test is applied, thence through the circuit of the line and a pair of switch contact-points normally closed but open while the line is switched for use by the switch which controls them, to the other side of said test receiving instrument, in combination with a battery at the subscriber's station in

the circuit of the line while his telephone is not switched for conversation but not otherwise, substantially as set forth.

2. A test-circuit for an ungrounded metallic-circuit line, from one side of a test receiving instrument to a test plug or device, thence to one side or branch of the line while the test is applied, thence through the circuit of the line and pairs of switch contact-points, one pair on each of several boards, each pair normally closed but open while the line is switched at their board, to the other side of said test receiving instrument, in combination with a battery at the subscriber's station and a switch with contact-points which switch the battery-current into the circuit of the line while the subscriber's telephone is not switched for use and out of the circuit while the telephone is switched for use, substantially as set forth.

3. A test-circuit for an ungrounded metallic-circuit line, from one side of a test receiving instrument, to a test plug or device, thence through the circuit of the line and a pair of switch contact-points normally closed but open while the line is switched by a switch which controls them, to the other side of said test receiving instrument, in combination with a battery at the subscriber's station, and a switch with contact-points which switch the battery-current into the circuit of the line while the subscriber's telephone is not switched for use and out of the circuit while the telephone is switched for use, substantially as set forth.

4. A test-circuit for an ungrounded metallic-circuit line, from one side or branch of the line, through the circuit of the line and a pair of switch contact-points normally closed but open while the line is switched by a switch which controls them, to a wire or circuit common to the lines, thence through branch or derived circuits, one for each board, each containing a test receiving instrument and terminating in a test plug or device adapted to be brought for testing into connection with said side or branch of the line, in combination with a battery in the direct circuit of the line while the subscriber's telephone is not switched for use but not otherwise, substantially as set forth.

5. A test-circuit for an ungrounded metallic-circuit line, from one side or branch of the line, through the circuit of the line and pairs of switch contact-points, one pair on each of several boards, each pair normally closed but open while the line is switched at their board, to a wire or circuit common to the lines, thence through branch or derived circuits, one at each board, each containing a test receiving instrument and terminating in a test plug or device adapted to be brought for testing into connection with said side or branch of the line, in combination with a battery at the subscriber's station, and a switch with contact-points which switch current from the battery in the circuit of the line while the subscriber's telephone is not switched for use and out of the circuit while the telephone is switched for use, substantially as set forth.

6. In a telephone-exchange system, a test receiving instrument normally connected on one side to one side or branch of an ungrounded metallic-circuit line and connected on its other side to a test plug or device adapted to be brought for testing into connection with the other side or branch of the line, in combination with switching devices to break said normal connection between one side or branch of the line and one side of the test receiving instrument while the line is switched for use, a battery at the subscriber's station and a switch with contact-points which send current from the battery to the circuit of the line while the subscriber's telephone is not switched for use, but not otherwise, substantially as set forth.

7. In a telephone-exchange system, an ungrounded metallic-circuit line, one side or branch of which normally passes, successively, through pairs of switch contact-points, one pair on each of several boards, each pair being normally closed but open while the line is switched at their board, and thence connected to one side of a test receiving instrument, in combination with a test plug or device connected to the other side of said instrument and adapted to be brought for testing into connection with the other side or branch of the line, a battery at the subscriber's station and a switch with contact-points which connect it into the direct circuit of the line while his telephone is not switched for use and only then, substantially as set forth.

8. In a telephone-exchange system, an ungrounded metallic-circuit line, one side or branch of which passes, successively, through pairs of switch contact-points, one pair on each of several boards, each pair normally closed but open while the line is switched at their board, and thence connected to one side of several test receiving instruments, one at each of the boards and each connected on its other side to a test plug or device adapted to be brought for testing into connection with the other side or branch of the line, in combination with a battery in the circuit of the line while the subscriber's telephone is not switched for use but not otherwise, substantially as set forth.

9. In a telephone-exchange system, an ungrounded metallic-circuit line, normally connected on one of its sides or branches to one side of each of several test receiving instruments one at each board and each connected on its other side to a test plug or device adapted to be brought for testing into connection with the other side or branch of the line, in combination with switching devices to break the said normal connection between the lines and the test receiving instruments while the line is switched for use, a battery at the subscriber's station and a switch which switches current from the battery into the

line while his telephone is not switched for use and only then, substantially as set forth.

10. In a telephone-exchange system, ungrounded metallic-circuit lines, multiple switchboards for said lines, switches for said lines, one switch on each of the boards, each switch having a pair of contact-points normally in contact, but open while their line is switched at their board and a third contact-piece insulated from the rest (except by the circuit connections,) and test receiving instruments, one at each board, each line passing, on one of its sides or branches, successively, through its pairs of contact-points on the several boards and thence connected to one side of each of said test receiving instruments, and each line also connected, on its other side or branch to each of said third contact-pieces of its switches, in combination with test plugs or devices, one for each of the test receiving instruments and connected to the other side of the instrument and adapted to be brought for testing into connection with any of said third contact-pieces at its board, a battery at each subscriber's station and a switch which switches current from the battery into the circuit of the line while the subscriber's telephone is not switched for use, and only then, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, an ungrounded metallic-circuit line, and test receiving instruments, one at each board and each normally connected on one side to one side or branch of said line, in combination with switching devices to connect said line with another line for conversation and when it is thus connected to open said normal connection between it and the test receiving instruments, and a battery in the circuit of the line when the subscriber's telephone is not switched for use but not otherwise, substantially as set forth.

12. A test-circuit for a metallic-circuit line disconnected from the ground, from one side of a test receiving instrument to a test plug or device, thence to one side or branch of the line when the test is applied, thence through the circuit of the line and a pair of switch contact-points normally closed but open while the line is switched for use by the switch which controls them, to the other side of said test receiving instrument, in combination with a battery in the circuit of the line while the telephone is not switched for conversation, substantially as set forth.

13. A test-circuit for an ungrounded metallic-circuit line, from one side or branch of the line, through the circuit of the line and pairs of switch contact-points one pair on each of several boards, each pair normally closed but open while the line is switched at their board, to a wire or circuit common to the lines, thence through branch or derived circuits, one at each board, each containing a test receiving instrument and terminating in a test plug or device adapted to be brought for testing into connection with said side or branch of the line, in combination with a battery normally in said test-circuit, substantially as set forth.

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