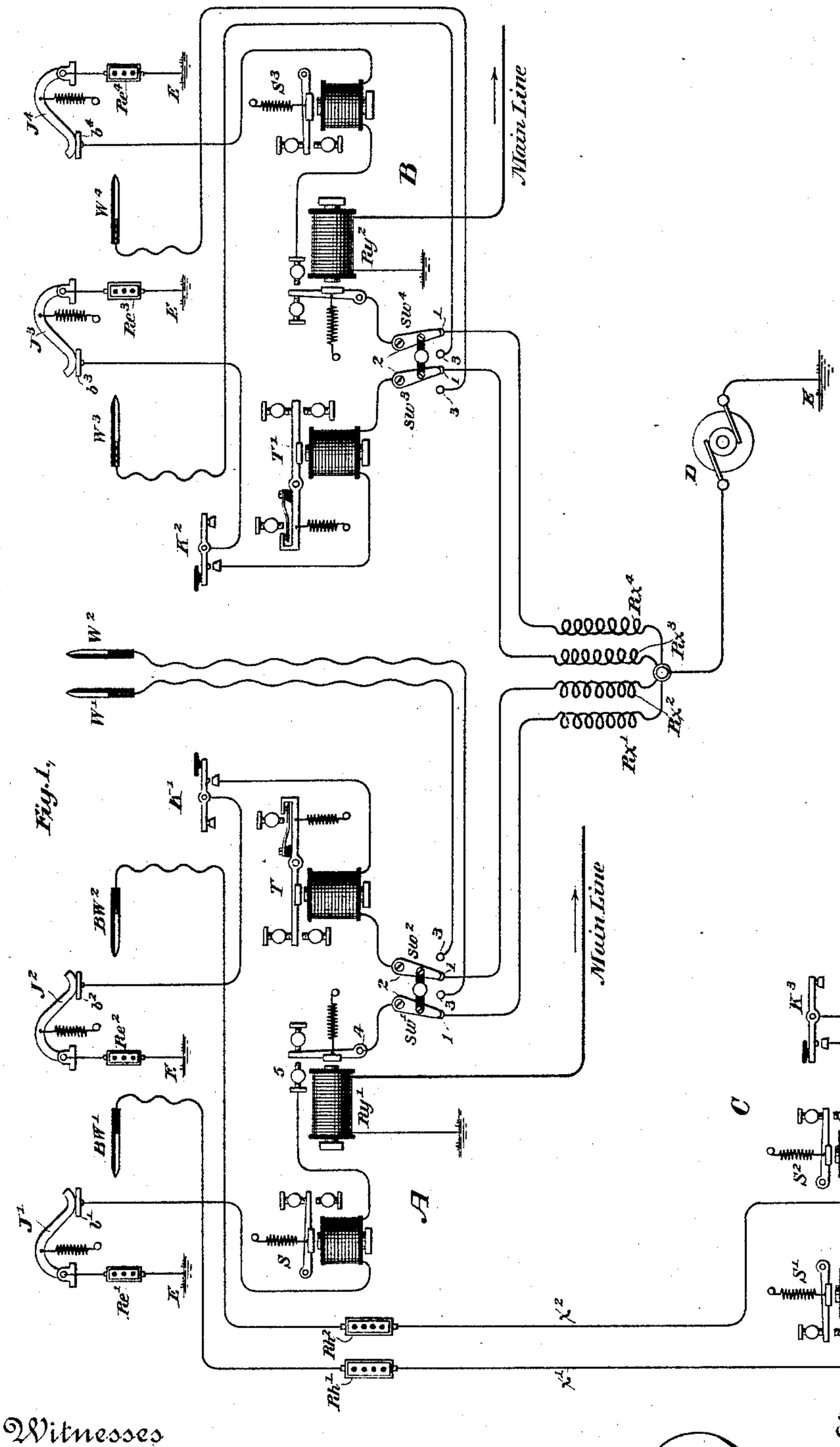
(No Model.) 3 Sheets—Sheet 1.

F. W. JONES.

TELEGRAPH CIRCUIT.

No. 441,847. Patented Dec. 2, 1890.



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TELEGRAPH CIRCUIT.

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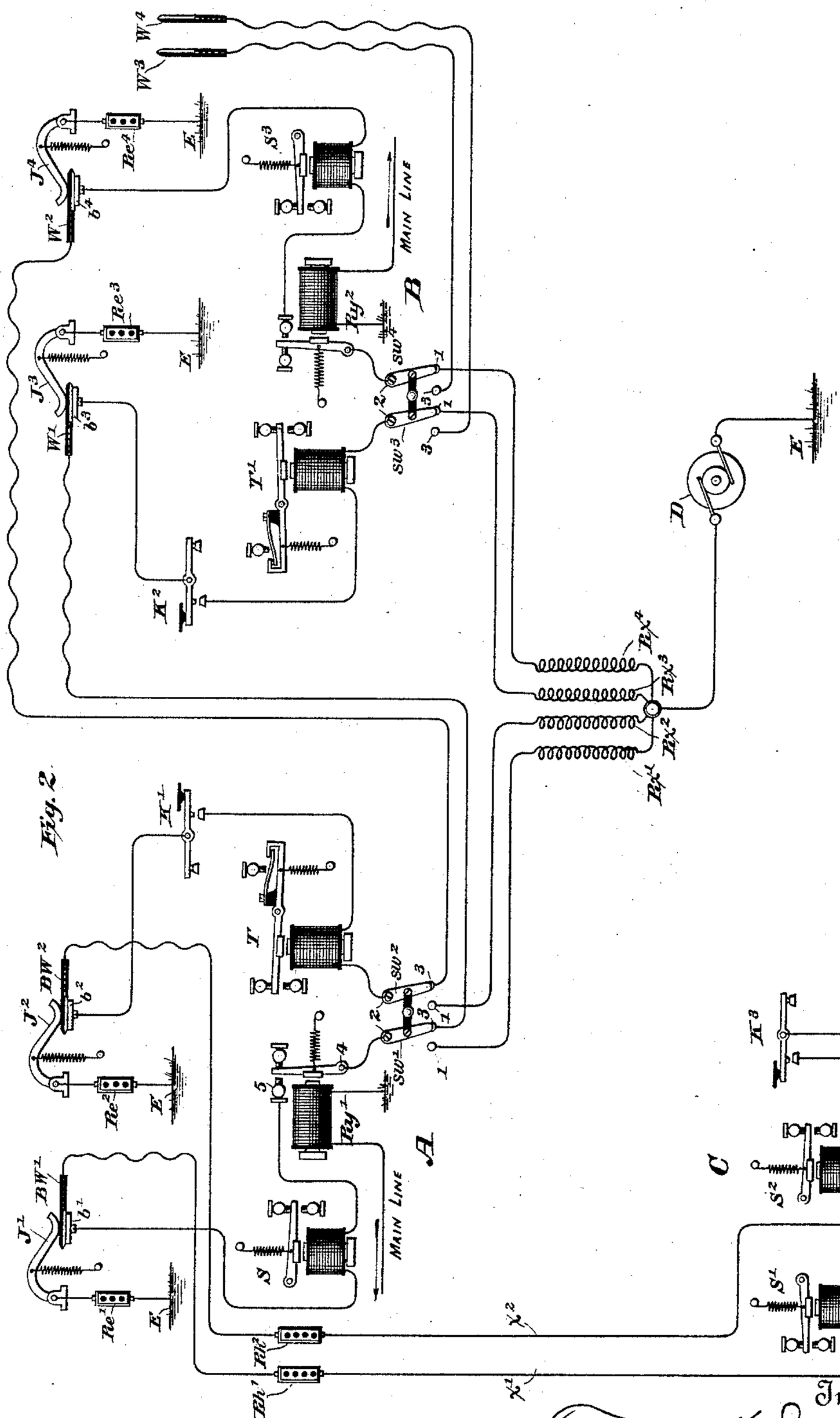

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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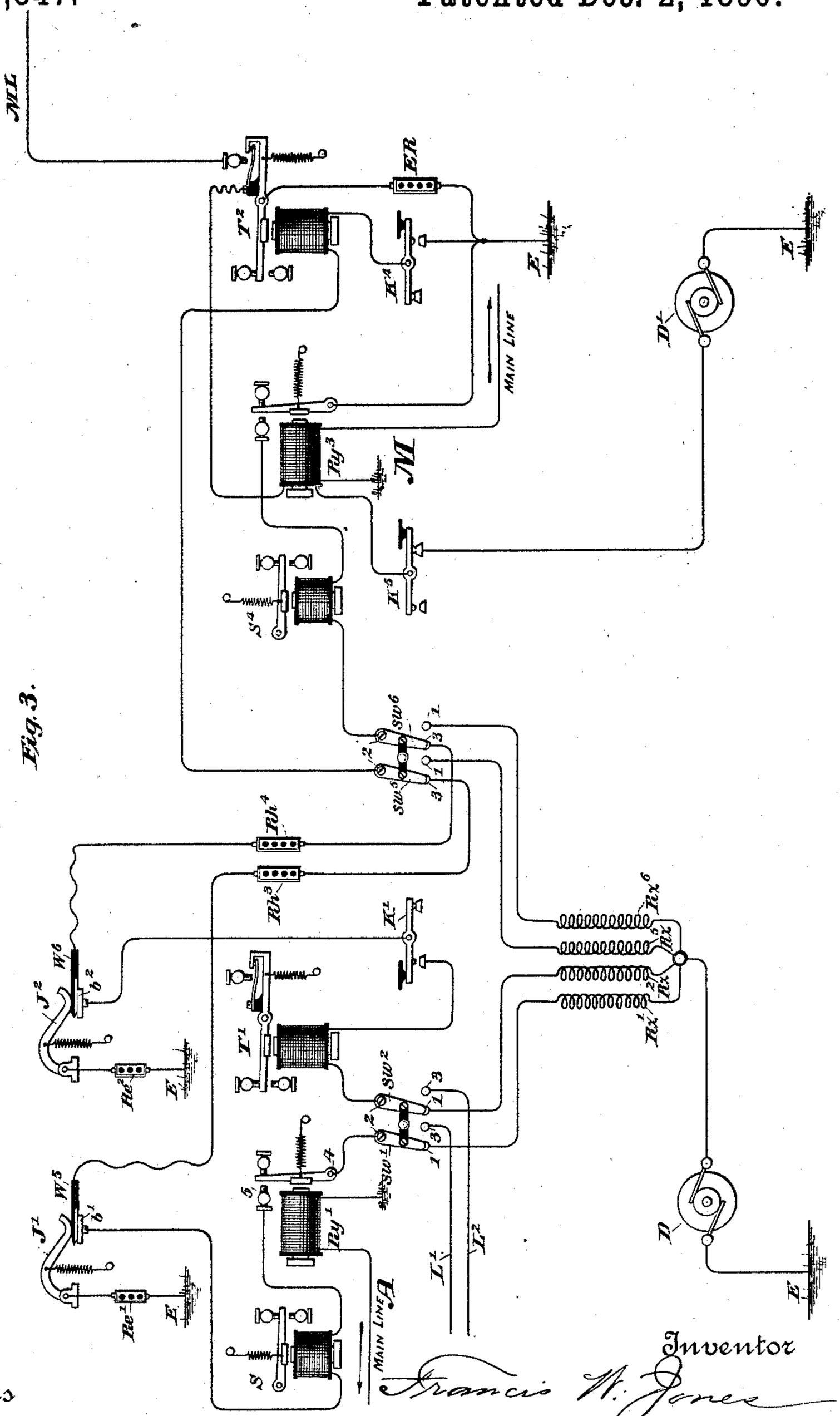
TELEGRAPH CIRCUIT.

No. 441,847. Patented Dec. 2, 1890.

Fig. 3.



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UNITED STATES PATENT OFFICE.

FRANCIS W. JONES, OF NEW YORK, N. Y.

TELEGRAPH-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 441,847, dated December 2, 1890.

Application filed June 24, 1890. Serial No. 356,584. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS W. JONES, a citizen of the United States, and a resident of New York city, in the county and State of New York, have invented a new and useful Improvement in Telegraph-Circuits, of which the following is a specification.

My invention relates to apparatus designed for use in a main telegraph-office where local circuits and branch-office wires are supplied with their working electric currents from dynamo-machines, storage-batteries, or other similar sources. In a main telegraph-office it is very desirable to make a speedy connection between the sending and receiving apparatus of a quadruplex or duplex system situated in said main office and the sending and receiving apparatus in a branch office, so that the operators in the branch office may be able to send signals through and receive signals from such quadruplex or duplex circuit with as great facility as if situated directly in the main office.

My invention relates also to the method of connecting apparatus and wires to each other to admit of any easy and rapid connection of a single Morse circuit with a quadruplex or duplex circuit, so that messages may be automatically repeated from the duplex circuit to the single circuit, and vice versa, in such a way that the operator on the Morse wire may be able to either send to or receive from the distant office on the duplex circuit without the assistance of an operator at the office where the repeaters are situated.

My invention still further relates to a new and useful organization of wires and apparatus by which the local circuits and apparatus of one duplex system may be readily connected with the local circuits and apparatus of another duplex system in such a manner as to permit an automatic transmission of messages from one system to the other simultaneously.

My invention also further embraces a new and useful arrangement of telegraph apparatus and wires in connection with dynamo-machines or any similar source of electric currents, rendering the operation of said apparatus, wires, and machines reliable, free from overheating, and easily and quickly adjusted to obtain the best results.

In the accompanying drawings, Figure 1 is a diagram of apparatus, circuits, and wires forming the general features of my invention. Figs. 2 and 3 are diagrams more fully illustrating the same, like letters and figures indicating like parts.

In Fig. 1, J' J^2 J^3 J^4 indicate the movable jaws of four spring-jacks, and b' b^2 b^3 b^4 the opposite contact-plates on which the jacks bear.

D is a dynamo-machine or other similar source of electric energy, connected at one pole to earth and the other pole connected through resistances Rx' Rx^2 Rx^3 Rx^4 with the various local circuits of two distinct duplex systems to be operated in or near one main office.

A and B indicate, respectively, the two sets of duplex telegraph apparatus, or one duplex set and one side of a quadruplex set, located in the repeating or main office. Each set A and B is shown in its normal condition ready for operation. The local circuits of set A are established as follows: The receiving-circuit from earth *via* dynamo D, resistance Rx', points 1 and 2 of the three-point switch Sw', local points 4 and 5 of relay Ry', sounder S, contact-plate b', and spring-jack J', resistance Re' to earth. The sending-circuit of set A connects from earth *via* D Rx^2, points 1 and 2 of three-point switch Sw^2, transmitter T, key K′, contact-plate b^2, spring-jack J^2, resistance Re^2 to earth. The local circuits of set B are established correspondingly to those of A. From points 3 3, &c., of three-point switches Sw' Sw^2 Sw^3 Sw^4 flexible conducting-cords are connected with wedges W′, &c., each wedge having one side insulated and the other side a conductor, in a well-known way.

C represents the receiving and sending apparatus at a branch office, the circuits from which are as follows: The receiving-circuit from earth *via* sounder S′, thence by branch or leg wire X′ to the main office through rheostat RH′ to the live or conducting side of wedge BW′. The sending-circuit of said branch office starts from earth *via* key K^3, sounder S^2, branch or leg wire X^2 to the main office

through rheostat Rh^2 to the live or conducting side of wedge BW^2. Resistances Re' Re^2 Re^3 Re^4, which may be adjustable or otherwise, are permanently connected with the movable part of the spring-jacks and the earth, as shown.

Assuming the dynamo D to have a potential of thirty volts and the local circuit *via* Rx', b', and J$'$ a resistance of one hundred and fifty ohms—composed as follows: Rx', thirty ohms; S, twenty ohms; Re' and the other parts of the circuit, one hundred ohms; total, one hundred and fifty ohms—then the electro-magnet S will be energized by a current of two hundred millampères when Ry' is closed at point 5, and similarly in respect to the other circuits *via* Rx^2 Rx^3 Rx^4. Should BW$'$ be inserted between J$'$ and the plate b', the movable part of J$'$ and the resistance Re' will be thrown out of circuit by the insulated side of BW$'$ and a new circuit will be established *via* b', the conducting side of BW$'$, rheostat Rh', and wire x' through branch-office apparatus C to earth. It is obvious that if the resistance of Rh', wire x', and sounder S is additively equal to resistance Re', then the current flowing from the dynamos *via* Rx', S, and BW$'$ to branch office C will be equal to two hundred millampères, and the electro-magnets now in circuit will be energized by the same strength of current as was S of the main office prior to the insertion of BW$'$, and similarly of all the other local circuits shown.

In case it is required to connect the local circuits of set A with those of set B to form an automatic repeater, it is only necessary to turn the three-point switches Sw' and Sw^2, Figs. 1 and 2, of set A to the right, connecting the points 2 and 3, and then inserting wedge W$'$ in spring-jack J^3 and W^2 in J^4, when a proper arrangement of circuits will be established, as follows: A circuit will be formed from earth *via* the dynamo D, Rx^3, Sw^3, T$'$, key K^2, contact-plate b^3, wedge W$'$, *via* flexible cord to Sw', points 3 and 1, thence *via* points 4 and 5 of Ry', sounder S, contact-plate b' J$'$, and resistance Re' to earth, as shown in Fig. 1. In Fig. 2 the circuit above described is continued through wedge Bw' of flexible cord Rh' and x' to branch office and earth, instead of *via* Re' and earth, when BW$'$ is not inserted. A similar circuit to that above described will be established *via* Rx^4, Sw^4, Ry^2, S^3, b^4, and W^2 of set B, connecting with set A *via* flexible cord and Sw^2, as will be readily understood by inspection of the drawings. The resistance of these circuits as connected per Fig. 2 will be somewhat greater than that previously assumed for various parts of the circuits, and the working-current will be less than before the insertion of W$'$ and W^2, yet not sufficiently so as to render the electro-magnets inoperative.

Fig. 2 more clearly shows the connections described for the operation of sets A and B to automatically repeat into each other's main-line circuits through the mutual control of their local circuits, and the extension of their local circuits to earth at branch office C is shown on the left-hand side. The dynamo-circuits *via* Rx' and Rx^2 are shown open at Sw' and Sw^2, and the resistances Re' Re^2 Re^3 Re^4 are removed from their normal circuits by the insulated portion of the wedges.

Fig. 3 exhibits the apparatus and the necessary local connections for placing a single Morse circuit in connection with a duplexed circuit, or with one side of a quadruplexed circuit, at a repeater-station, whereby the distant operator of the duplexed or quadruplexed circuit on one side of the repeater-station may be able to transmit and receive messages to or from any station on the single Morse circuit on the other side of the repeater-station. During the time of such connection of the single with the multiple circuit, but one transmission of signals is possible either from the single circuit to the multiple circuit, or vice versa.

The single Morse circuit M L at M is shown in the drawings connected locally with a duplex set of apparatus at A in such a manner as to be capable of receiving signals from the duplex relay Ry' and of transmitting signals *via* the transmitter T of the duplex set without interference of one with the other in a well-known way. It is to be understood that the distant operator on the duplex circuit should keep his key closed when desiring to receive signals from a Morse station on the single circuit in order that relay Ry' at A, Fig. 3, will remain in a closed position to hold transmitter F^2 closed to preserve the continuity of main line M L, as will be seen.

The main and local circuits of one-half of a Toye repeater are shown at M. The Morse main-line circuit is completed from earth *via* dynamo D$'$, key K^5, relay R^3, transmitting-spring of T^2 to the main-line wire M L and distant station. When T^2 is in a closed position, the current from D$'$ is at liberty to charge the main wire; but when T^2 is open, as shown in M, the current from D$'$ seeks earth *via* resistance E R on the lever of T^2, holding relay Ry^3 closed in a well-known manner. The half-repeater, or, as it is generally termed, the "monkey," is shown connected to a duplex set at A in proper condition to repeat into each other. The receiving-sounder S^4 of the single-line repeater M is connected in local circuit from earth through the lever and front stop of relay Ry^3, three-point switch Sw^6, thence *via* point 3, resistance Rh^4, wedge W^6, contact-plate b^2, key K$'$, transmitter T$'$ Sw^2 Rx^2, and *via* dynamo D to earth. The sending-key K^4 and transmitter T^2 are connected in local circuit from earth *via* three-point switch Sw^5, point 3, resistance Rh^3, wedge W^5, plate b', sounder S, relay-point, and lever of relay Ry' Sw' Rx' to dynamo and earth. The resistances Rh^3 and Rh^4 are to be made nearly equal to the

resistances Re' and Re^2, respectively, so that when W^5 and W^6 are inserted, as shown in A, the currents from D will meet with approximately the same resistance *via* Rh^3 and Rh^4, as is the case when the wedges W^5 and W^6 are not inserted in J' J^2, and the currents go to earth *via* Re' and Re^2.

To restore the sets A and M to their normal or non-repeating condition it is necessary to remove W^5 and W^6 from J' and J^2 and turn the three-point switches Sw^5 and Sw^6 to connect with their points 1 1 on the right. The local circuits of the single-line repeater M will then be supplied by currents from dynamo D *via* resistances Rx^5 Rx^6, as will be readily seen.

I do not limit myself to applying my invention to the particular telegraph apparatus I have described, since it is obvious that the same results may be attained with other apparatus.

What I claim as my invention is—

1. In a local circuit of a multiplex telegraph system, the combination of a spring-jack J', whose movable jaw is connected to earth through an equalizing resistance, a wire including the electro-magnet of a sounder, said wire connecting point b' of the spring-jack with one point of the local contacts of relay Ry', a wire from the other point of the local contacts of relay Ry' to a three-point switch Sw', which is adapted to complete the local receiving-circuit *via* points 2 and 1, resistance Rx', and the source of electric current D to the earth, or to disconnect D at point 1 and to connect the local wire from the relay to point 3 and *via* a flexible cord to the wedge W', as and for the purpose described.

2. In a local circuit of a system of multiple telegraph, the combination of a spring-jack J^2, whose movable jaw is connected to earth through an equalizing resistance, a wire including a key K', the electro-magnet of transmitter T, connecting point b^2 of said spring-jack to point 2 of three-point switch Sw^2, which is adapted to complete the local transmitting-circuit either *via* points 2 and 1, equalizing resistance Rx^2, and source of electric current D to the earth, or to disconnect D at point 1 and to connect the local wire from the transmitter to point 3 and *via* a flexible cord to the wedge W^2, as and for the purpose described.

3. In a main or repeating telegraph station, the combination, with a system of multiplex receiving and sending local circuits, of a source of electric current D, equalizing resistances Rx' Rx^2, three-point switches Sw' Sw^2, which are adapted to connect said local circuits either with the source of electric current D or with the wedges W' and W^2, or their equivalents, which may be inserted in or connected with spring-jacks J^3 and J^4, respectively forming part of the sending and receiving local circuits of another multiplex system, as and for the purpose described.

4. In the main or repeating telegraph station operating multiplex circuits, the combination of the local receiving and sending circuits of a set of multiple telegraph having a source of electric current D that may be disconnected from said circuits by switches Sw' and Sw^2, spring-jacks J' and J^2, respectively connected through equalizing resistances Re' and Re^2 to earth, normally forming part of said circuit-wedges W' and W^2, which may be connected to said circuits by switches Sw' and Sw^2 with similarly-arranged local sending and receiving circuits of another set of multiplex telegraph by the insertion of said wedges W' and W^2 in spring jacks J^3 and J^4, whereby the main-line signals of the relay of one set may, through its local points, operate the transmitter of the other set, as and for the purpose described.

5. In a main or repeating telegraph station, the combination of the receiving and sending local circuits of a set of multiple telegraph having a source of electric current D, spring-jacks J' and J^2, equalizing resistances Re' and Re^2, permanently connected between the movable jaws of said spring-jacks and the earth, normally forming part of said circuits, wedges Bw' and Bw^2, which insulate the earth and resistances Re' and Re^2 from said local circuits, and at the same time connect therewith at points C' and C^2 the branch wires X' and X^2, the distant ends of which are connected to earth and include, respectively, equalizing resistances Rh' and Rh^2 and the usual receiving-sounder S', and key K^3 and sounder S^2, as and for the purpose described.

6. In a main or repeating telegraph station, the combination of the receiving and sending local circuits of a set of multiplex telegraph having a source of electric current D, spring-jacks J' and J^2, equalizing resistances Re' and Re^2, permanently connected between the movable jaws of said spring-jacks and the earth, normally forming part of said circuits, and the local circuits of a single-line repeater, which includes in its sending-circuit key K^4, electro-magnet of transmitter T^2, switch Sw^5, which is adapted to connect said sending-circuit either with wedge W^5, having one conducting and one insulating side, or with a source of electric current D, equalizing resistance Rh^3, and which includes in its receiving-circuit the local points of relay Ry^3, sounder S^4, switch Sw^6, which is adapted to connect said receiving-circuit with wedge 6, having one conducting and one insulating side, or with a source of electric current D, equalizing resistance Rh^4, so arranged that by the insertion of wedges W^5 and W^6 in or on spring-jacks J' and J^2, respectively, the insulating sides of the wedges will disconnect the movable jaws of spring-jacks J' and J^2, and the conducting side of said wedges will respectively connect the receiving local circuit of relay Ry' with the sounding local circuit of the single main,line repeater *via* point C', resistance Rh^3, switch Sw^5, electro-magnet of T^2, and key K^4 to earth, and the sending

local circuit of transmitter T with the receiving local circuit of the single main-line repeater *via* point C^2, resistance Rh^4, points 3 and 2 of switch Sw^6, sounder S^4, and local points of relay Ry^3 to earth, as and for the purpose described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 26th day of May, 1890.

FRANCIS W. JONES.

Witnesses:
GEO. W. BRECK,
C. E. ASHLEY.