(No Model.) 2 Sheets—Sheet 1.

J. I. SABIN & W. HAMPTON.

TELEPHONE SYSTEM.

No. 533,142. Patented Jan. 29, 1895.

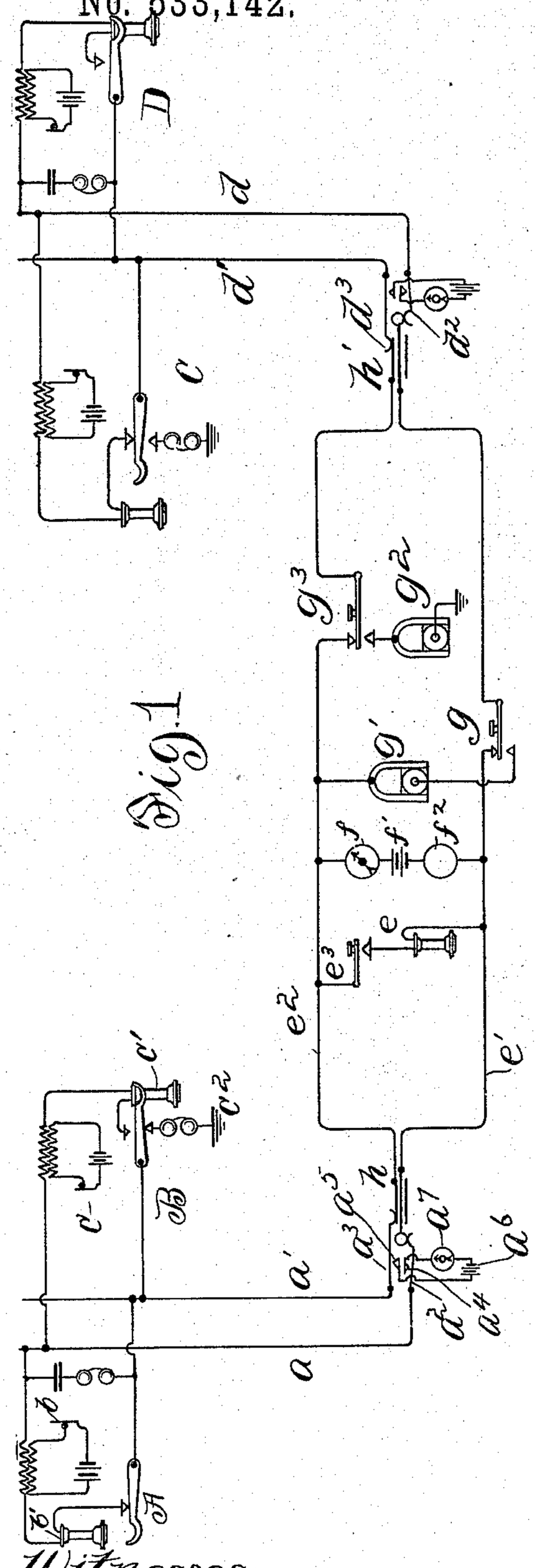

Fig. 1.

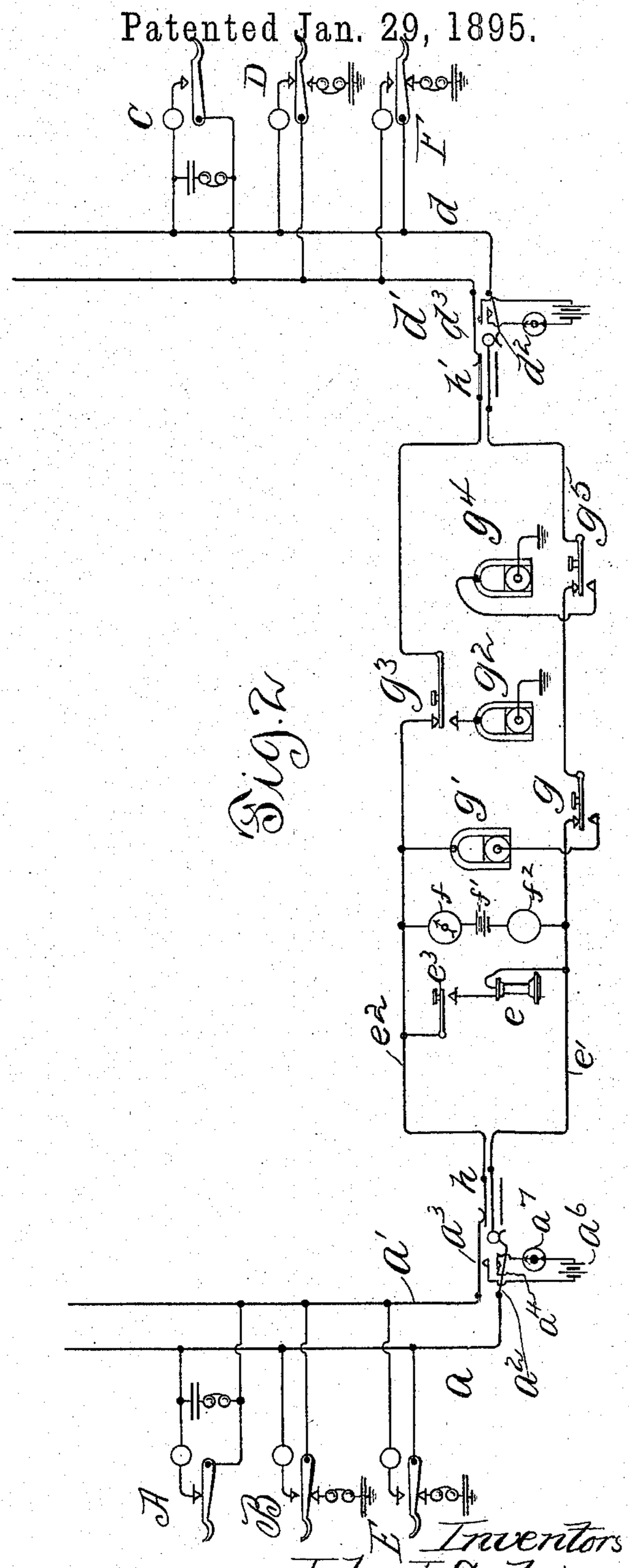

Fig. 2.

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(No Model.) 2-Sheets—Sheet 2.

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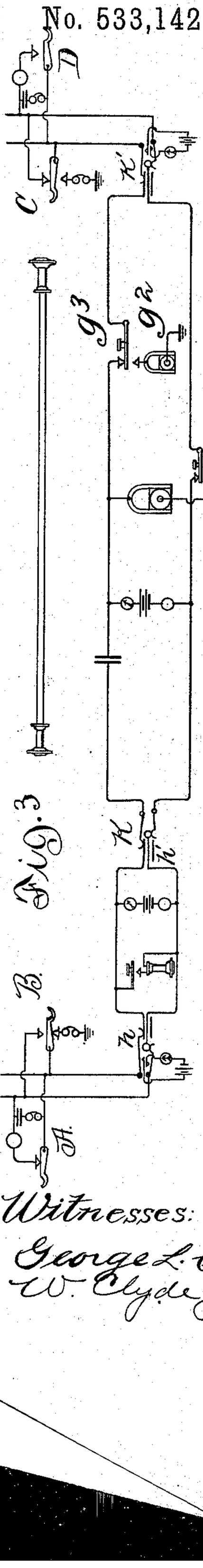

Fig. 3

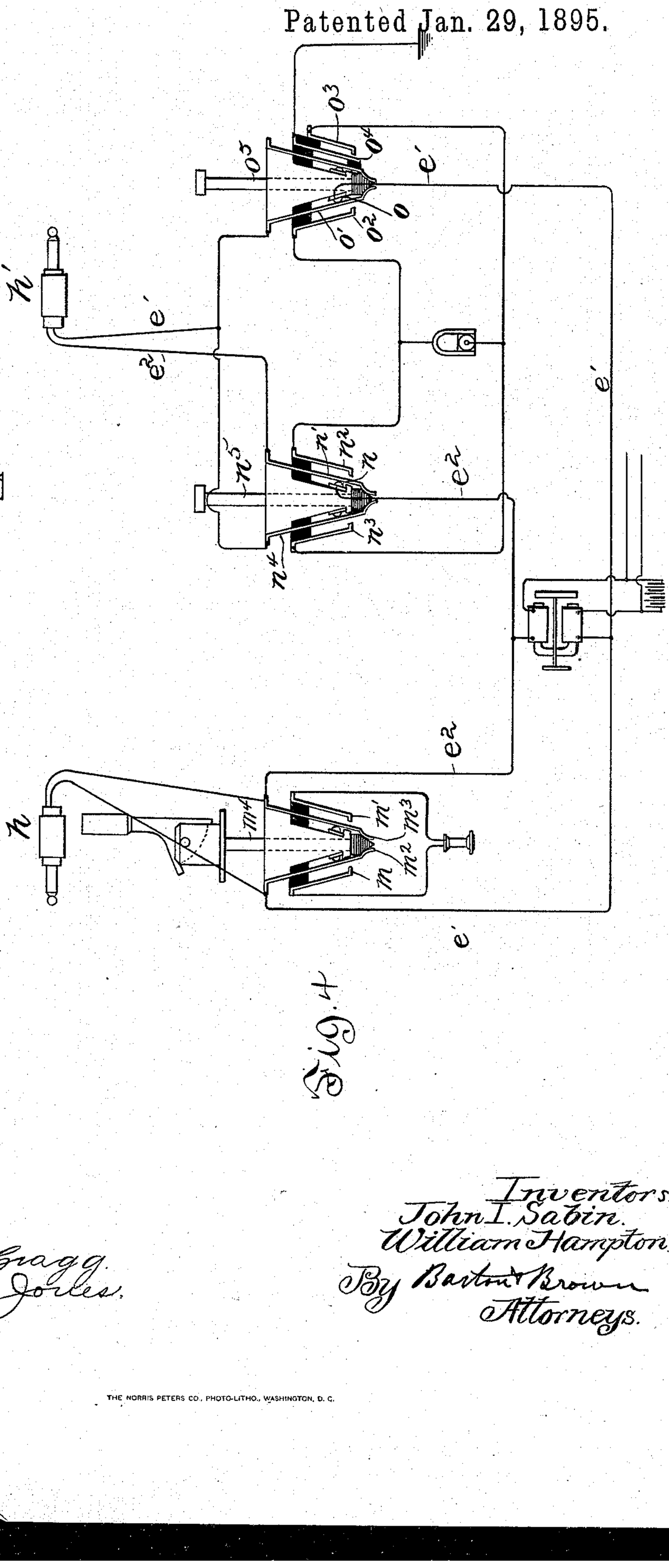

Fig. 4

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UNITED STATES PATENT OFFICE.

JOHN I. SABIN AND WILLIAM HAMPTON, OF SAN FRANCISCO, CALIFORNIA; SAID HAMPTON ASSIGNOR OF ONE-FOURTH OF THE WHOLE RIGHT TO SAID SABIN.

TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 533,142, dated January 29, 1895.

Application filed April 14, 1894. Serial No. 507,569. (No model.)

To all whom it may concern:

Be it known that we, JOHN I. SABIN and WILLIAM HAMPTON, citizens of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented a certain new and useful Improvement in Telephone Systems, (Case No. 9,) 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.

Our invention relates to telephone systems with bridged sub-station apparatus, and its object is the provision of means whereby the sub-station apparatus of several subscribers may be connected with a single line extending to the central station, and whereby the operator thereat may selectively signal either of the subscribers so connected.

Our invention, in its preferred form, comprises a metallic circuit telephone line extending to contact terminals at the central station, the telephone sets of the several subscribers being included in normally open bridges between the two limbs of the metallic circuit, the bell of one subscriber being included in a bridge between the two limbs whereby he may be signaled over the metallic circuit, the bell of another subscriber being included between one limb of the metallic circuit and ground, whereby he may be signaled over one limb of the metallic circuit with ground return, while the bell of a third subscriber, when present, is included between the opposite limb of the metallic circuit and ground, whereby he may be signaled over the other limb of the metallic circuit with a ground return. Either of the subscribers may signal the central station by removing his telephone from its hook, thereby completing circuit through his telephone set and closing a battery circuit through an indicator at the central station. In order that the bridge containing the bell may not operatively close the circuit of the battery through the indicator a condenser, or a high resistance coil, may be included in the bridge, and likewise when the apparatus of three subscribers are connected to the line the operative closing of the battery circuit through the ground branches from the opposite sides of the line may be prevented by the employment of a condenser, or high resistance coil in one or both of the ground branches.

Our invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrative of two subscribers, each located on a two-subscriber circuit, connected for conversation. Fig. 2 is a similar view illustrative of two subscribers, each located on a three subscriber circuit, connected for conversation. Fig. 3 is a view of two subscribers connected for conversation through a trunk line after the manner of our invention. Fig. 4 is a diagrammatic view of the plug and cord connections as employed in our invention.

Like letters refer to like parts in the several figures.

The limbs a a' of the metallic circuit extend to the line springs a^2 a^3 which normally rest against the contact anvils a^4 a^5 between which are included the battery a^6 and indicator a^7. Between the limbs a and a' are included the telephone transmitter b and receiver b' of subscriber A, the circuit being normally open as the receiver hangs upon the hook.

The bell of subscriber A is included with a condenser in a bridge between the opposite sides of the circuit. The telephone transmitter c and receiver c' of subscriber B are similarly included in an open bridge between the two sides of the line, while the bell of subscriber B is included in a ground branch c^2 from one limb of the circuit, said limb being normally closed by the depression of the telephone hook. The limbs d d' likewise extend to line springs d^2 d^3 at the central station, the connection of the station apparatus of subscriber C being similar to that of subscriber B, while that of subscriber D is similar to that of subscriber A.

The operator's telephone set e is included in a normally open bridge between the tip and sleeve strands e' e^2 of the usual cord connectors, a key e^3 being provided for bridging the telephone into circuit. A clearing out indicator f and battery f' are included in a bridge between the two strands, a balancing coil f^2 being also located in said bridge. By

means of a key g, a generator g' may be bridged between the strands e and e', while the generator g^2, by means of a key g^3 may be connected between the sleeve strand e^2 and ground.

Suppose subscriber A is desirous of conversing with subscriber C. He removes his telephone from its hook, thus completing the circuit of battery a^6 through indicator a^7 and calling the attention of the operator, who inserts plug h in the spring jack, thereby moving line springs a^2 a^3 out of contact with contact anvils a^3 a^4 and cutting out battery a^6 and indicator a^7. The operator now depresses key e^3, thus bridging her telephone into circuit and receives the number of the called subscriber C. She then inserts plug h' in the spring jack in which the limbs d d' terminate, and depresses key g^3 thus sending a calling current from the grounded generator g^2 over limb d' to ground through the bell of subscriber C. Subscriber C removes his telephone from its hook and A and C are in conversation. Had A desired communication with D instead of C the operator would have depressed key g instead of key g^3, thereby bridging generator g' into circuit and sending a calling current through the bell of subscriber D. In order to determine which of the keys to depress, any preferred system of identification of the subscribers with grounded bells may be employed. Thus all subscribers with grounded bells may be designated by even numbers, while those having bells bridged between the metallic limbs may be designated by odd numbers. When the subscribers have completed conversation they hang up their telephones, thus opening the circuit of battery f' through clearing out indicator f, and conveying to the operator the signal for disconnection.

In Fig. 2, a third subscriber is added to each metallic circuit line. Thus the bell of subscriber E is provided in a normally closed ground branch from the limb a of the line, the bell of subscriber B being in a ground branch from the limb a'. Likewise the bell of subscriber F is included in a ground branch from the limb d of the other metallic circuit. As ground branches are thus provided from both limbs of the metallic circuit, the current of battery a^6 would find circuit through indicator a^7 to operate the same were not some provision made to prevent it, and in order to prevent the operation of said indicator the resistance through the ground branches may be such as to prevent an operative current from traversing the indicator, or condensers may be included in one or both of the ground branches, as illustrated. The cord connectors may remain the same as in the two-telephone system, with the addition of a grounded generator g^4 which, by means of a key g^5, may be connected with the tip strand e' to send calling currents through the grounded bells of subscribers E and F.

When calling currents are sent over the metallic circuit to ring the bridged bell, a portion of the current will be diverted through the grounded branch containing the two grounded bells. The resistance of the grounded bells may be adjusted to the diverted current so that the same will fail to ring said bells, while the full current from the generator, which traverses the bell when calling currents are sent over a metallic limb and ground, is sufficient to ring the bell. The grounded bells thus remain irresponsive to currents sent over the completely metallic circuit, but respond to currents sent over their respective metallic limbs and ground.

Fig. 3 illustrates subscribers A and C as connected through a trunk line or divided board system. The trunk line terminates in a spring jack k at one end and a plug k' at the other end. Subscriber A, desiring connection with subscriber C, removes his telephone from its hook, thus signaling the operator at the first board, who inserts plug h and bridges her telephone into circuit, and, having received the call, inserts plug h' into spring jack k of the trunk line. She then instructs the operator at the second board that connection is desired with subscriber C, and the operator thereat inserts plug k' of the trunk line in the spring jack in which terminate the limbs d d'. She then depresses key g^3, thus sending calling current through the bell of subscriber C who removes his telephone from its hook and is in communication with subscriber A. Had subscriber D been called for, key g would have been depressed to send calling current through the bell of subscriber D. The subscribers, by hanging up their telephones, actuate the clearing-out indicator, and the operators effect the disconnection. The calling apparatus may thus be all located at the second board, the operator at the first board being required only to bridge her telephone into circuit and insert the plugs in the proper sockets.

In Fig. 4 we have illustrated the manner in which the operator's apparatus is arranged in practice, a single generator being arranged to send calling currents over a metallic or grounded circuit. The operator's telephone set is connected between contacts m m' against which the springs m^2 m^3 are adapted to be pressed, when the plunger m^4 is depressed, to bridge the telephone set between the tip strand e' and the sleeve strand e^2. The sleeve strand e^2 is normally completed through the contact anvil n and spring n' resting against the same. Normally out of contact with spring n' is located a contact n^2 which is connected with one side of the generator g', the other side of the generator being connected with a similar contact n^3 which normally rests out of contact with a spring n^4 which is connected with the tip strand e'. By depressing the plunger n^5, the spring n' is moved out of contact with anvil n, thus disconnecting the same from plug h, and is moved into contact with contact n^2, spring n^4 being at the same time

brought into contact with contact n^3, the generator g' being thus bridged between the strands e' and e^2. To provide for connecting the generator between the tip strand e' and ground for signaling the subscriber with a grounded bell, the tip strand e' is normally closed through the contact anvil o and spring o' resting against the same. A contact o^2 rests normally out of contact with spring o' and is connected with one side of generator g', the other side of the generator being connected with a contact o^3. Normally out of contact with said contact o^3 is a spring o^4 which is connected with ground. When plunger o^5 is depressed, spring o' is moved out of contact with anvil o, thus disconnecting the spring from plug h, the spring being by the same act brought into contact with contact o^2, thus connecting generator g' with the tip strand e'. The spring o^4 is by the same operation brought in contact with contact o^3, thus connecting the opposite side of generator g' to ground.

As shown in Fig. 1 a balancing coil f^2 is located in the bridge containing the battery f' and clearing-out indicator f, for the purpose of balancing the circuit.

In Fig. 4 we have illustrated a manner of securing the desired balanced condition without the employment of an additional coil, the clearing-out indicator being for this purpose made with two coils f^3 and f^4 which are connected respectively between the opposite poles of the battery and the strands e' and e^2. The coils may be placed upon the legs of a U-shaped core f^5 opposite the ends of which is mounted the armature f^6, and the coils being thus magnetically and electrically equivalent a perfect balance of the line is secured. The battery may be utilized for more than one cord connector. Thus the conductors f^7 f^8 may, after being connected respectively with the two coils of a similar clearing-out indicator, pass to the two strands of a second cord connector.

It is evident that our invention is susceptible of modifications, and we do not, therefore, desire to limit ourselves to particulars; but,

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a telephone system, the combination with a metallic circuit line extending to the central station, of a call device located at a sub-station in a bridge between the two limbs of said metallic circuit, a second call device located at a second sub-station in a branch from one limb of said line to ground, a key at the central station adapted when depressed to include a source of calling currents in circuit between the limbs of said line, and a second key adapted when depressed to include a source of calling currents in circuit between ground and the limb of the line to which said second call device is connected, substantially as described.

2. In a telephone system, the combination with a metallic circuit line extending to the central station, of a call device located at a substation in a bridge between the two limbs of said metallic circuit, a second call device at a second sub-station located between one of said limbs and ground, a third call device at a third sub-station located between one of said limbs and ground, a key at the central station adapted when depressed to include a source of calling currents between the limbs of said circuit, a second key adapted when depressed to include a source of calling currents between one of the limbs of said circuit and ground, and a third key adapted when depressed to include a source of calling currents between the other of said limbs and ground, substantially as described.

3. The combination with a metallic circuit telephone line extending to the central station and normally closed thereat through a battery and indicator, of sub-station telephone sets in normally open bridges between the opposite limbs of said line, a call device at one of said sub-stations in a bridge between the opposite limbs of said line, a device included in said bridge for preventing the operative closing of the current of said battery through said indicator, a call device at another of said sub-stations in a ground branch from one limb of said line, and means for sending calling currents through either of said call devices, substantially as described.

4. The combination with a metallic circuit telephone line extending to the central station and normally closed thereat through a battery and indicator, of sub-station telephone sets in normally open bridges between the opposite limbs of said line, a call device at one of said sub-stations in a bridge between the opposite limbs of said line, call devices at other of said sub-stations between the opposite limbs of said line and ground, devices included in the circuits of the call devices to prevent the operative closing of the current of said battery through said indicator, and means for sending calling currents through either of said call devices, substantially as described.

5. The combination with a metallic circuit telephone line extending to the central station and normally closed thereat through a battery and indicator, of sub-station telephone sets included in normally open bridges between the opposite limbs of said line, a switch at each of said sub-stations for closing the bridge to complete the battery circuit through said indicator to actuate the same, means for cutting said indicator and battery from the line by the act of making connection therewith, a battery and clearing out indicator adapted to be at the same time connected in a bridge between the opposite sides of said line, a call device at one sub-station in a bridge between the two limbs of the line, a second call device at another sub-station between one of the limbs and ground, and means for connecting a calling generator be-

tween the two limbs of said line or between ground and the limb to which said second call device is connected, substantially as described.

6. The combination with a metallic circuit telephone line extending to an operator's board, and connected thereat with a trunk line by means of cord connectors, of an operator's telephone set adapted to be bridged between the strands of said cord connector, a metallic circuit telephone line extending to a second operator's board and connected thereat through said trunk line, sub-station telephone sets in normally open bridges between the limbs of said second line, a call device at one of said sub-stations in a bridge between the limbs of said second line, a second call device at another of said sub-stations in a ground branch from one of said limbs, and means at the board of the second operator for sending a calling current through either of said call devices, substantially as described.

7. The combination with a double strand cord connector, of a calling generator, a key adapted when depressed to bridge said generator between the strands, and a second key adapted when depressed to connect said generator between one of said strands and ground, substantially as described.

8. The combination with a battery in a bridge between the opposite limbs of a metallic circuit, of a call device in circuit therewith, said call device comprising a pair of equivalent electro-magnetic elements, connected one on each side of said battery, whereby a balance of the line is secured, substantially as described.

In witness whereof we hereunto subscribe our names this 7th day of April, A. D. 1894.

JNO. I. SABIN.
WM. HAMPTON.

Witnesses:
JNO. A. MATTON,
L. E. MARSH.