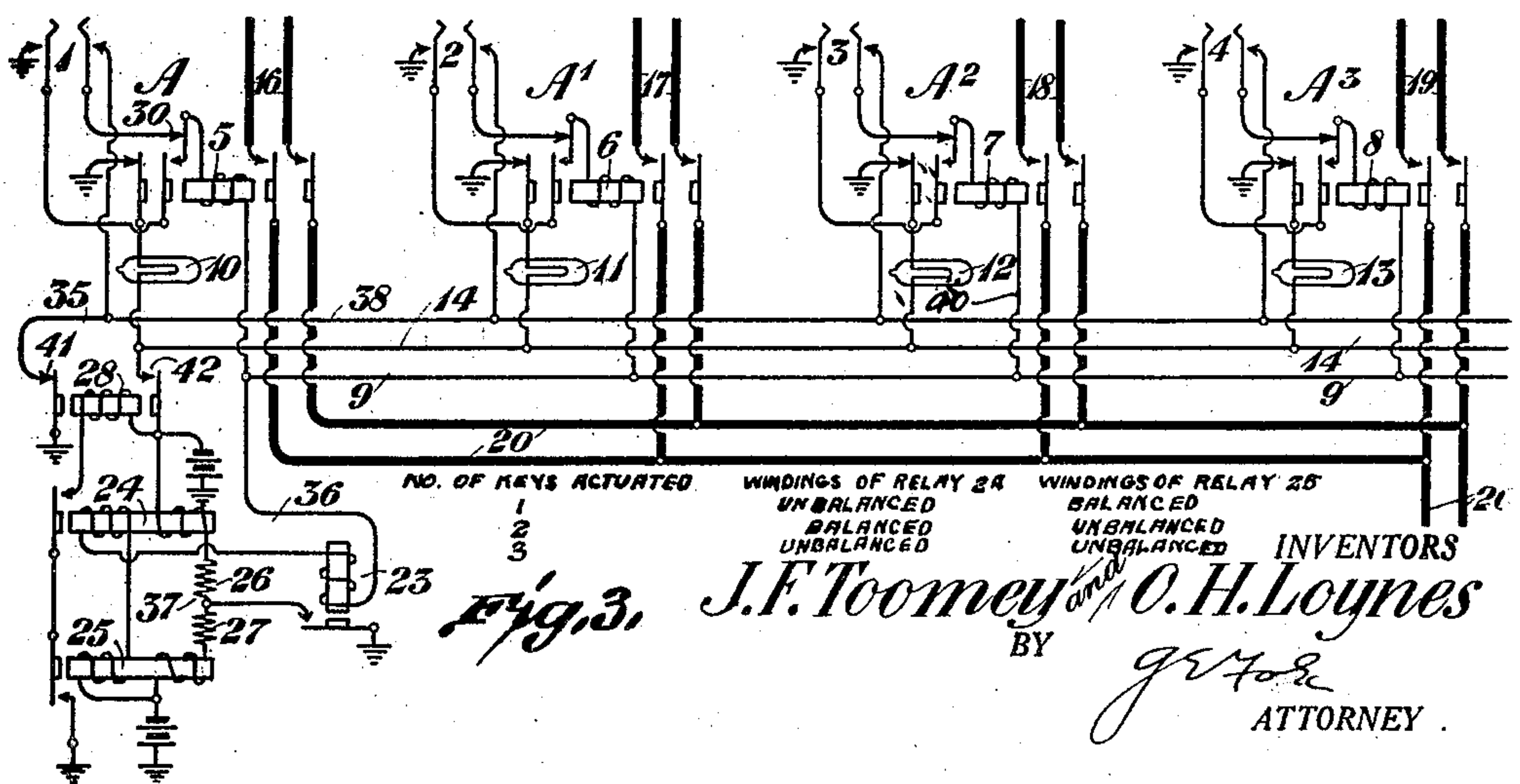
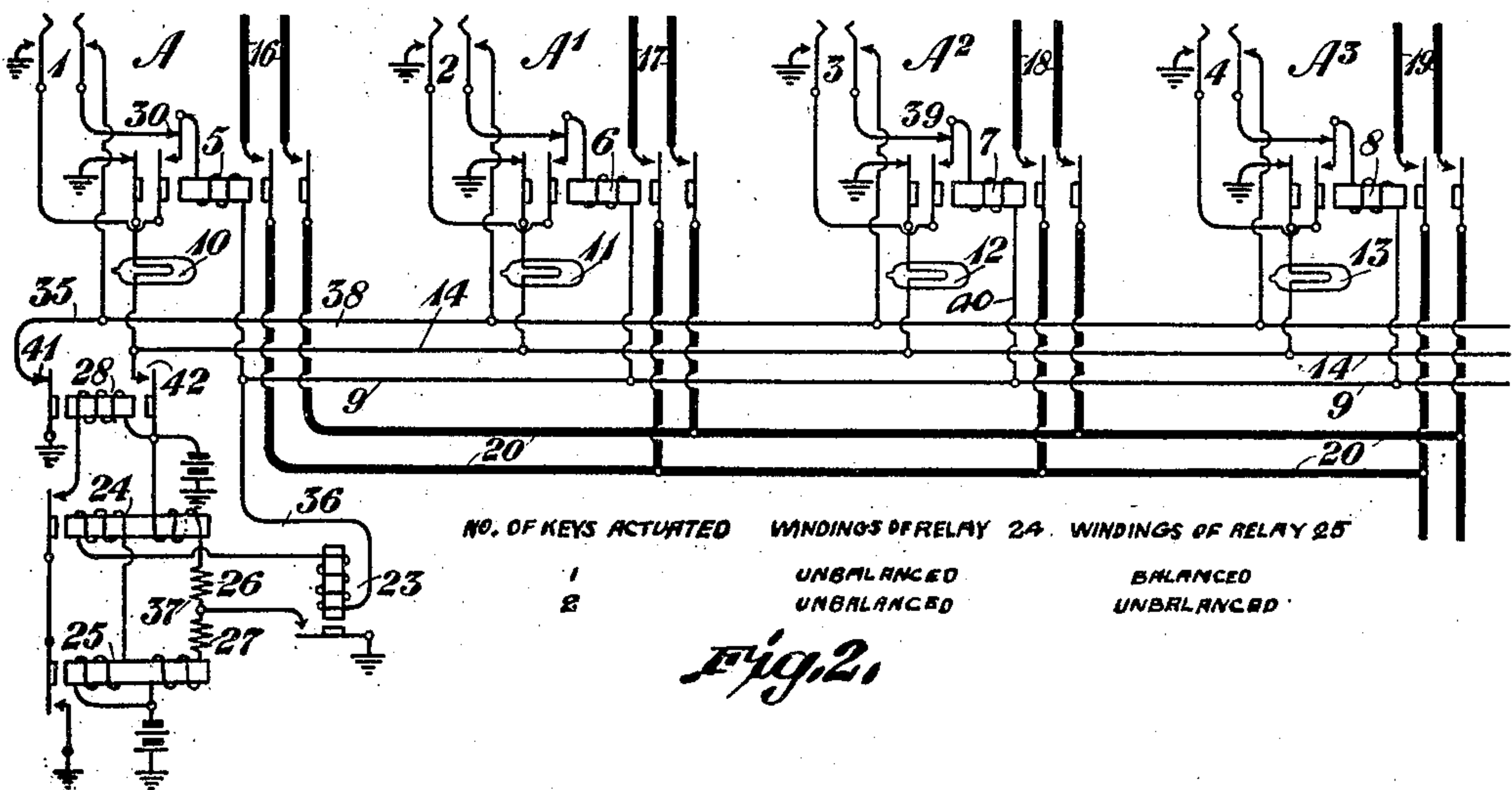
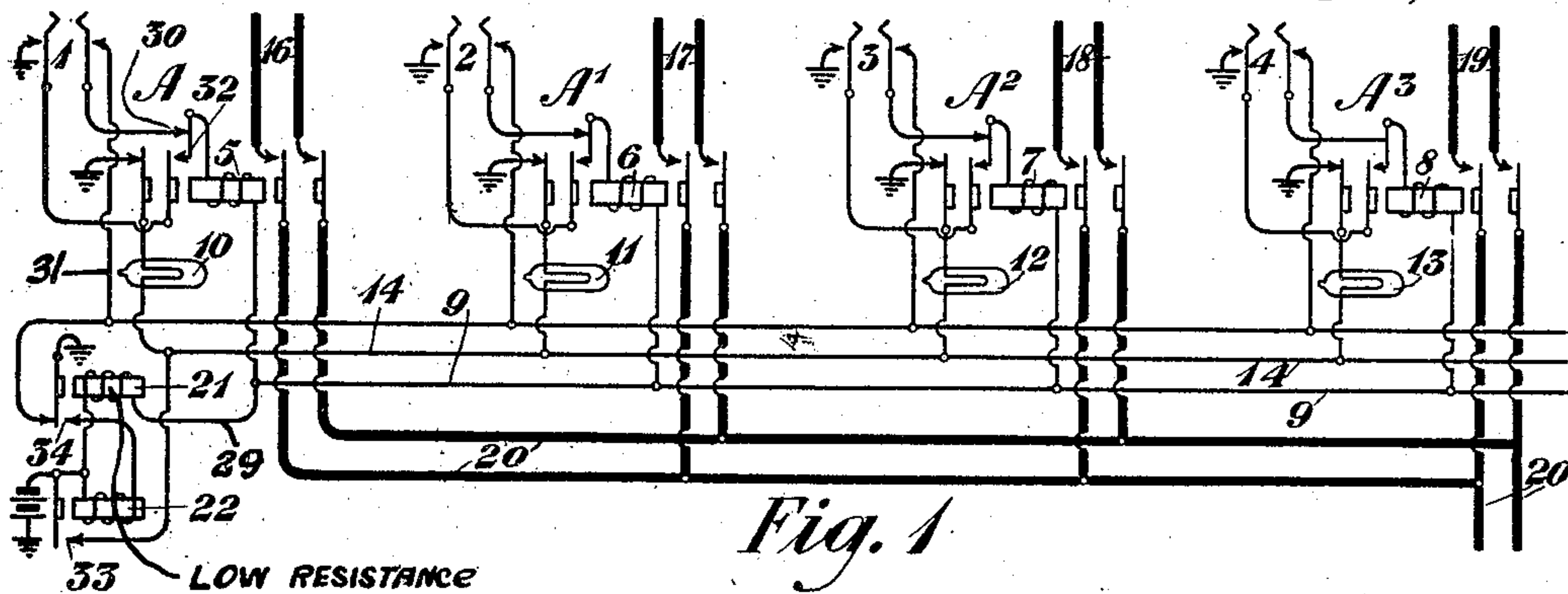


J. F. TOOMEY AND O. H. LOYNES.
TELEPHONE CALL CIRCUITS.
APPLICATION FILED APR. 21, 1920.

1,427,923.

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UNITED STATES PATENT OFFICE.

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TELEPHONE-CALL CIRCUITS.

Application filed April 21, 1920. Serial No. 375,568.

To all whom it may concern:

Be it known that we, JOHN F. TOOMEY and OWEN H. LOYNES, residing at New York and Wood Ridge, in the counties of New York and Bergen, and States of New York and New Jersey, respectively, have invented certain Improvements in Telephone-Call Circuits, of which the following is a specification.

10 This invention relates to telephone circuits, and more particularly to telephone call wire circuits.

In practice when a subscriber wishes to be connected with another subscriber, the number of the wanted subscriber is communicated to an operator at a central office and if the called subscriber is connected with that particular office the call may be completed thereat. If, however, the line of the desired subscriber is connected to a distant office, it is necessary that a conductor, commonly known as a trunk line, shall be provided between the two offices with which the lines of both subscribers may be connected. It is also necessary to provide means whereby the operator at the central office shall be enabled to communicate with an operator stationed at a distant office in order that the distant operator may assign to the central office operator the particular trunk line to be used for the connection. For this purpose at each initiating operator's position there are provided certain keys or buttons which enable the operator to complete a talking circuit to a distant office. These are ordinarily termed call wire circuits. In previous call wire systems, the circuits were so arranged that either one or all the operators in the same office could bridge their telephone sets across the call wire circuits at the same time. This feature caused considerable trouble because the connection of a large number of operators' sets to the call wire circuit at the same time reduced the transmission efficiency to a point where it was difficult to pass calls over the circuit. Accordingly, one of the principal objects of this invention consists in the provision of means whereby a call circuit is adapted to be used by only a predetermined number of operators at a time, the circuit being inoperative at such interval to other operators. Another feature consists in providing sig-

nals at all positions, other than those in use, to indicate to the operators at such positions that the wire circuit is inaccessible for connection at this time. Other and further features of the invention will hereinafter appear.

This invention may now be more fully understood by reference to the accompanying drawing, in which three embodiments are diagrammatically illustrated.

In the arrangements of the invention there are shown in Figures 1, 2 and 3 four telephone switchboard positions, A, A¹, A² and A³, together with the essential elements pertaining to the improved circuits. While only four positions are illustrated, it will be understood that many additional positions may be associated therewith. At each position there are a plurality of call circuit keys or buttons, one of said keys being illustrated at each of the above mentioned positions as indicated by the numerals 1, 2, 3 and 4. Associated with each of said keys is a position relay as shown at 5, 6, 7 and 8. These relays are arranged in parallel and are connected to the common conductor 9. Signal lamps 10, 11, 12 and 13 are associated with each position relay and connected in parallel to a common conductor 14. These lamps, when lighted, indicate to the operators that the call circuit is in use and at this time is not available for connection. The conductors 16, 17 and 18 and 19 are each connected with the usual operator's set and are associated, respectively, with the relays 5, 6, 7 and 8. Said relays when operated connect the operator's talking set with the call circuit 20.

In Fig. 1 a low resistance relay 21 is shown as connected in common with the position relays 5, 6, 7 and 8. Upon the depression of any one call circuit key, the relay 21 is removed from the control of the remaining keys, thereby allowing only one operator access to the call circuit at one time. The energization of relay 21 causes the operation of relay 22, and the latter relay, upon operating, closes a circuit which provides for the illumination of the lamps at all other positions except the one at the position where the key is actuated.

In Figs. 2 and 3 are illustrated modifications of Fig. 1. Fig. 2 is arranged so that two operators may have access to the call

circuit at one time, while Fig. 3 is arranged for the accommodation of three operators. A low resistance relay 23, is connected in common with the call circuit keys in a manner similar to relay 21 in Fig. 1. Differential relays 24 and 25 have one of their windings connected in series with relay 23 and the operation of the latter relay will close a circuit by way of its armature through the opposite windings of said differential relays. Resistance elements 26 and 27 of different values are associated, respectively, with the differential relays 24 and 25, and these resistances serve to provide a balanced or unbalanced condition of said differential relays, according to the number of call circuit keys operated at one time. In Fig. 2 the relays 24 and 25 will become unbalanced upon the depression of two call circuit keys at one time, and in Fig. 3 said relays will be unbalanced upon the actuation of three call circuit keys. The operation of both differential relays will cause relay 28 to be energized, thereby preventing additional connection with the call circuit at such time. The operation of relay 28 will also close a circuit whereby the lamps at all other positions except those in use are illuminated.

The details of these circuits may be more sufficiently understood from the following description of their operation.

In Fig. 1, which is designed for the use of but one operator at a time, an operator, for instance, at position A desiring to communicate with a distant office depresses the call circuit key 1, thereby closing a circuit from battery, winding of relay 21, conductor 29, winding of relay 5, contact 30, right-hand contact of key 1, conductor 31, armature of relay 21 to ground. The closing of this circuit causes the energization of relays 5 and 21. The operation of relay 5 opens the contact at 30 and closes a locking circuit from ground, left-hand contact of key 1, contact 32 and winding of relay 5, conductor 29, winding of relay 21 to battery. Relay 5 is thus maintained energized while key 1 is operated, and while said relay is in an operated condition, a circuit will be closed through its right-hand contacts for the connection of conductors 16 which lead to an operator's telephone set, thereby providing for connection with the call circuit 20. The operation of relay 5 also breaks the ground connection at its outer left-hand contact, thereby preventing lamp 10 from lighting at this time. The operation of relay 21 closes a circuit by way of its front contact from ground, winding of relay 22 to battery. This circuit causes the relay 22 to operate and closes the following circuit: From battery, contact 33, common conductor 14 through the lamp filaments at each of the associated positions to ground,

thereby lighting the lamps at all unactuated positions. This condition prevails until the operator at A restores her key to normal. Should an operator ignore the busy signal as indicated by the lighting of the position lamp, and attempt to obtain connection with the call circuit, she will be unable to do so because the normal ground connection through contact 34 of relay 21 was opened upon the energization of relay 21. Thus an exclusive connection with the call circuit of only one position at a time is assured.

The depression of an initial key in Fig. 2, such for example as key 1, will close a circuit from grounded contact 41 of relay 28, conductor 35, right-hand contact of key 1, normal contact 30, winding of relay 5, conductor 36, winding of relay 23, left-hand windings of differential relays 24 and 25 to battery. This circuit will energize relays 5 and 23. The operation of relay 5 will connect the operator's set with the call circuit through its right-hand contacts, and will also break the normal ground connection at its outer left-hand armature and prevent the illumination of the associated signal lamp 10 in a manner similar to that described in connection with the operation of said relay in Fig. 1. The operation of relay 5 will break the circuit through contact 30 and close a locking circuit from ground, left-hand contact of key 1, inner left-hand contact and winding of relay 5 and over conductor 36 as previously outlined whereby relay 23 was energized. The operation of relay 23 closes a circuit over its grounded contact to point 37, where the circuit divides into two branches, one branch passing through resistance 26 and right-hand winding of differential relay 24 to battery, and the other branch through resistance 27 and right-hand winding of differential relay 25 to battery. The circuits previously traced which pass through the windings of differential relay 24 are of different resistance values and provide an unbalanced condition of said relay and cause it to operate, but its operation at this time, however, provides no useful function. At the same time the circuits traced through the windings of differential relay 25 are of equal resistance and prevent said relay from operating. The operation of a second call key, for instance, key 3 at position A², at this time will close a circuit from grounded contact 41 of relay 28, conductors 35 and 38, right-hand contact of key 3, contact 39, winding of relay 7, conductors 40, 9 and 36, winding of relay 23 and right-hand windings of differential relays 24 and 25 to battery. The closing of this circuit will operate relay 7 causing said relay to connect the telephone set at position A² with call circuit 20 in an obvious manner. The operation of relay 7 will break

the normal ground connection at its outer left-hand contact and also the contact at 39 in a manner similar to that described in connection with the actuation of key 1. The breaking of contact 39 will open the circuit through right-hand contact of key 3 previously described and close a circuit from ground, left-hand contact of key 3, inner left-hand contact and winding of relay 7, over conductors 40, 9 and 36, winding of relay 23 and left-hand windings of differential relays 24 and 25. The closing of this circuit will maintain relays 23 and 24 energized but the resistance values now included in said circuit will change the balanced condition previously existing between the windings of differential relay 25 to a condition of unbalance thereby causing said relay to operate. The operation of relay 25 will close a circuit from the ground, contacts of relays 25 and 24, winding of relay 28 to battery. The closing of this circuit will cause the energization of relay 28, which upon operating will attract its armatures opening the ground connection at its right-hand contact 41 and closing through left-hand contact 42 a circuit from battery, common conductor 14 to ground through the filaments of lamps 11 and 13. The lamps 5 and 7 at positions A and A², respectively, will not light at this time for the reasons previous explained. Thus when any two operators are connected with the call circuit, as shown in Fig. 2, a busy signal lamp will light at all other positions, and the operators thereat are prevented from connecting with said call circuit at such time. In case the busy indication is disregarded and a key is depressed the position relay associated with said key will not operate because a circuit cannot be closed at this time due to the open contact 41 of relay 28. If one operator disconnects from the call circuit while the other operator remains connected therewith, the busy lamps at all the positions will go out and the same conditions will prevail as pointed out in connection with the operation of key 1 at position A, and a second operator may then be permitted access to the call circuit.

The modification, as shown in Fig. 3, is similar to Fig. 2, but permits the connection of three operators with the call circuit at a time. The depression of an initial key 1 at position A will cause the same circuit operation as described in connection with said key in Fig. 2, and provide for the energization of relays 5, 23 and 24. The actuation of a second key will also cause the same circuit conditions to prevail as explained in connection with key 3 at position A². In this instance, however, the resistance values included in the circuit will be such as to balance the windings of relay 24 causing said relay to become deenergized while the

windings of relay 25 will be in an unbalanced condition causing it to become energized. The energization or deenergization of said relays at this time, however, will perform no useful function. The operation of a third key, for instance, key 4 at position A³ during the interval the keys 1 and 3 at positions A and A², respectively, are actuated will close the following parallel circuit: from ground, contact 41 of relay 28, conductors 35 and 38, right-hand contact of key 4, normal contact of position relay 8, winding of relay 8, conductors 9 and 36, winding of relay 23 and left-hand windings of relays 24 and 25 to battery. The closing of this circuit will energize relay 8 and said relay upon operating will perform the same functions as outlined in connection with the previously mentioned position relays. The effective parallel resistance included in the circuit by the operation of relay 8 is such as to cause a condition of unbalance in the windings of both differential relays 24 and 25, thereby causing them to operate and close a circuit from ground through their contacts, winding of relay 28 to battery. This circuit will energize relay 28 which upon operating will attract its armatures breaking the contact at 41, and closing a circuit by way of its right-hand contact 42 which will cause the lamps to light at all positions other than those where the keys are depressed, as previously explained. When any one or two of the operators release a call circuit key, the circuit will resume the condition previously described in connection with the depression of two or one keys thereby rendering said call circuit accessible for the connection of three operators at all times. In a manner similar to that explained in connection with Fig. 2 the breaking of contact 41 will prevent additional connection of other positions at such times.

While resistances of certain values are herein employed by way of illustration, it will be understood that resistances of other values may be used. It will also be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a telephone system comprising a plurality of switchboard positions, a call circuit common to said positions, a key at each position, a relay for each position associated with each key, a signal associated with each relay, the relay for any position being operable upon the depression of the key at said position to provide a connection with said call circuit for that position and to render its associated signal inoperative, and means responsive to the actuation of a number less than the total number of said relays for prevent-

ing the actuation of the remaining relays and operating the signals associated therewith.

2. A telephone system comprising a plurality of switchboard positions, a call circuit common to said positions, a key at each position, a relay for each position associated with each key, the relay for any position being operable upon the depression of the key at said position to provide a connection with said call circuit for that position, and means responsive to the actuation of a number of relays greater than one for preventing the actuation of the remaining relays.

3. A telephone system comprising a plurality of switchboard positions, a call circuit common to said positions, a key at each position, a relay for each position associated with each key, the relay for any position being operable upon the depression of the key at said position to provide a connection with said call circuit for that position, a signal associated with each relay, means responsive to the actuation of a number of relays greater than one for preventing the actuation of the remaining relays, and means for operating the signals at all unactuated relay positions.

4. A telephone system comprising a plurality of switchboard positions, a call circuit common to said positions, a key for each position, a relay for each position associated with each key, the relay for any position being operable upon the depression of the key at said positions to provide a connection with said call circuit for that position, and means responsive to the actuation of more than two relays to prevent the actuation of the remaining relays.

5. In a telephone system comprising a plurality of switchboard positions, a call circuit common to said positions, a key for each position a relay for each position associated with each key, the relay for any position being operable upon the depression of the key at said position to provide a connection with said call circuit for that position, a signal associated with each relay, means responsive to the operation of more than two relays to prevent the actuation of remaining relays, and means for operating the signals at all unactuated relay positions.

6. In a telephone system comprising a plurality of switchboard positions, a call circuit common to said positions, a key associated with each position, means operable upon depression of the key at any of said positions for connecting that position with said call circuit, means responsive to the

operation of a plurality of said keys less than all thereof for preventing additional connection of positions associated with the remaining keys to said call circuit.

7. In a telephone system comprising a plurality of switchboard positions, a call circuit common to said positions, a key associated with each position, a relay associated with each key, operable upon depression of the key for connecting that position with said call circuit, a signal associated with each relay and rendered inoperative upon the actuation thereof, means responsive to the operation of a plurality of said keys less than all thereof for preventing additional connection of positions associated with the remaining keys to said call circuit, and means for operating the signals at all positions not associated with said call circuit.

8. In a telephone system comprising a plurality of switchboard positions, a call circuit common to said positions, a key associated with each position, a relay operable upon the depression of a key at any of said positions for connecting that position with said call circuit, a signal associated with each relay, differential relays serially connected with said first relay responsive to the operation of a plurality of keys less than all thereof for preventing additional connection of positions associated with the remaining keys to said call circuit, and a relay responsive to the operation of said differential relays for operating the signals at all positions not associated with said call circuit.

9. In a telephone system comprising a plurality of switchboard positions, a call circuit common to said positions, a key associated with each position, a position relay operable upon the depression of a key at any of said positions for connecting that position with said call circuit, a signal associated with each position relay and in parallel relation with respect to each other, differential relays serially connected with said first relay responsive to the operation of more than two position relays for preventing the actuation of the remaining position relays, and means responsive to the operation of said differential relays for operating the signals at all unactuated position relays.

In testimony whereof, we have signed our names to this specification this 19th day of April 1920.

JOHN F. TOOMEY.
OWEN H. LOYNES.