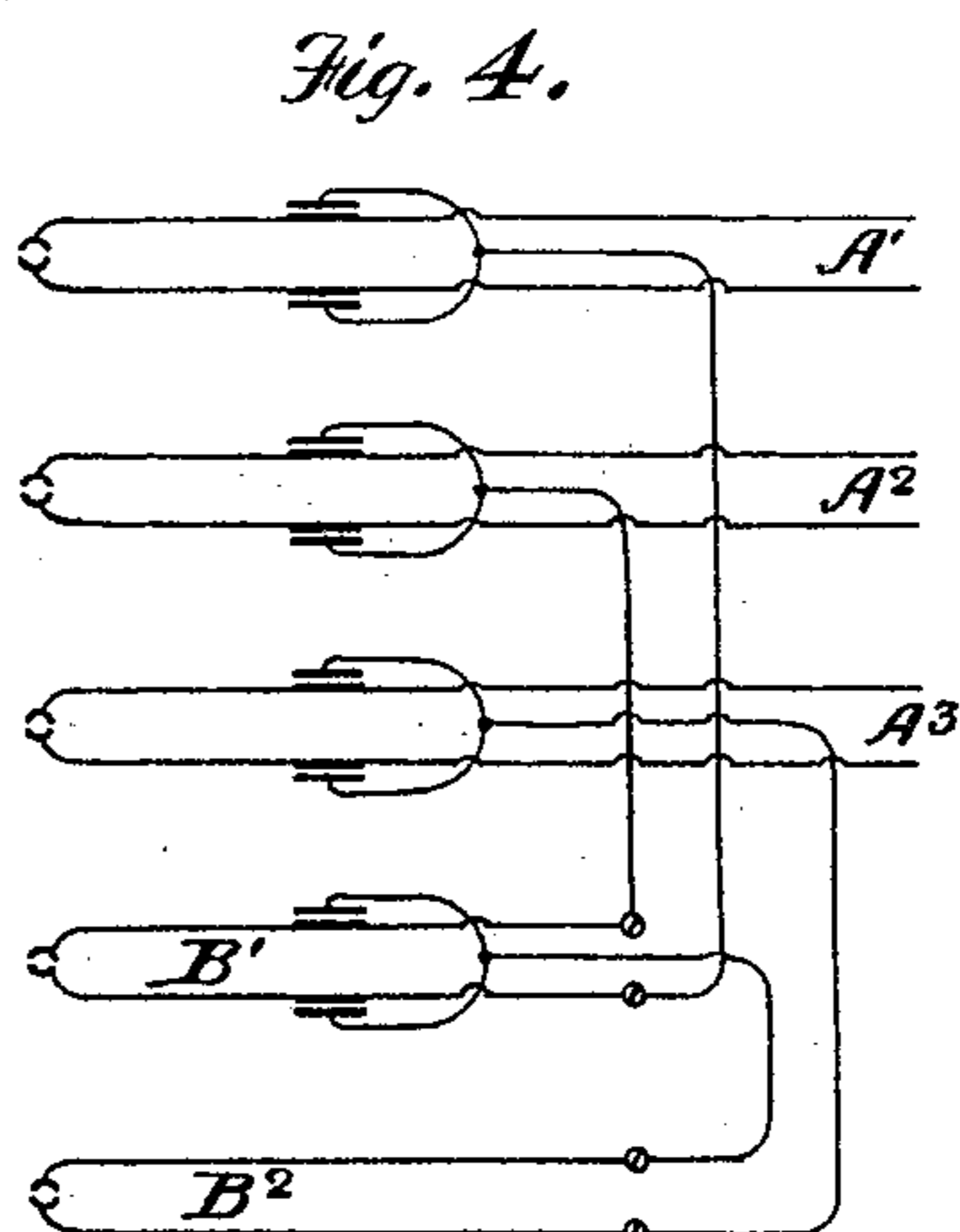
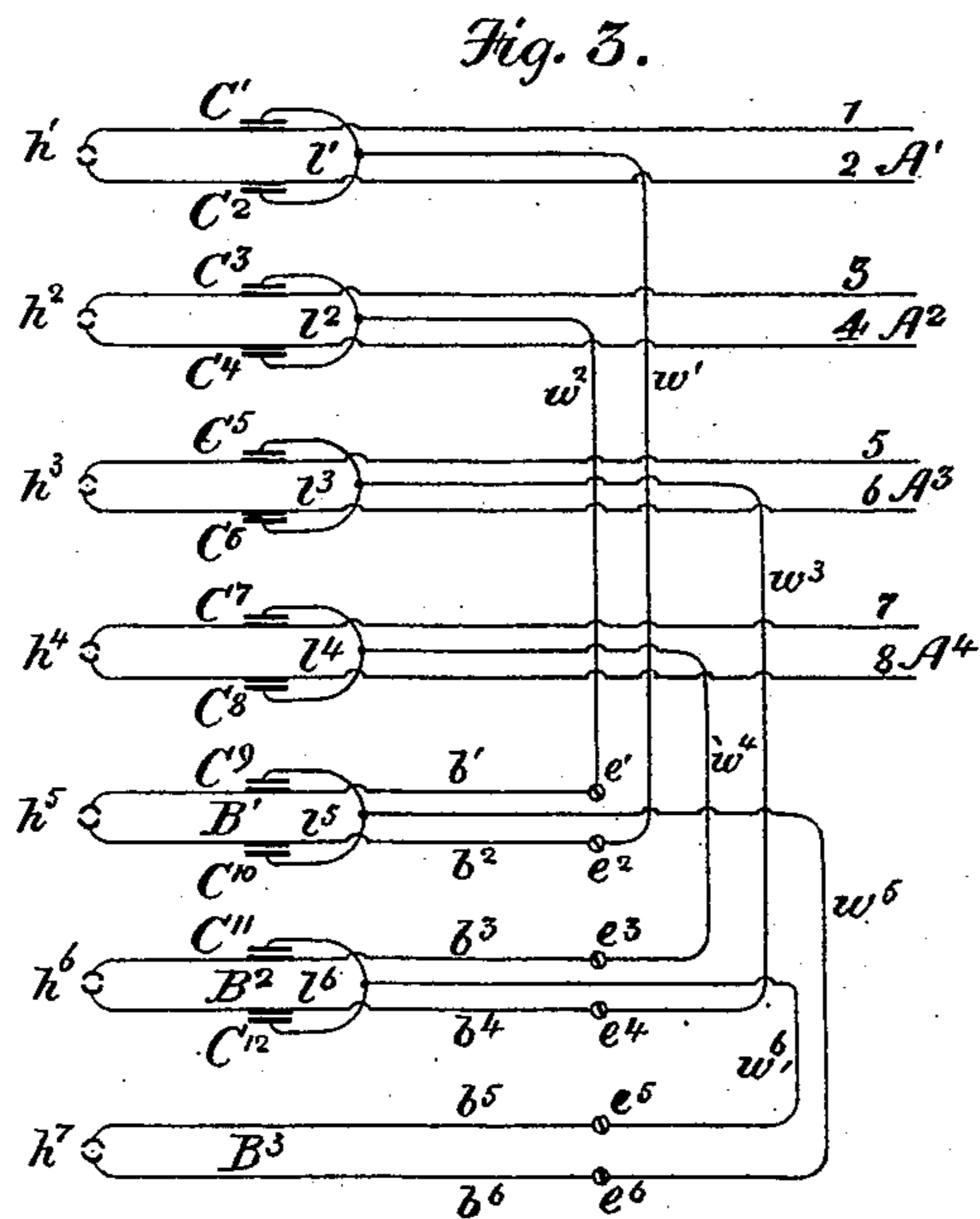
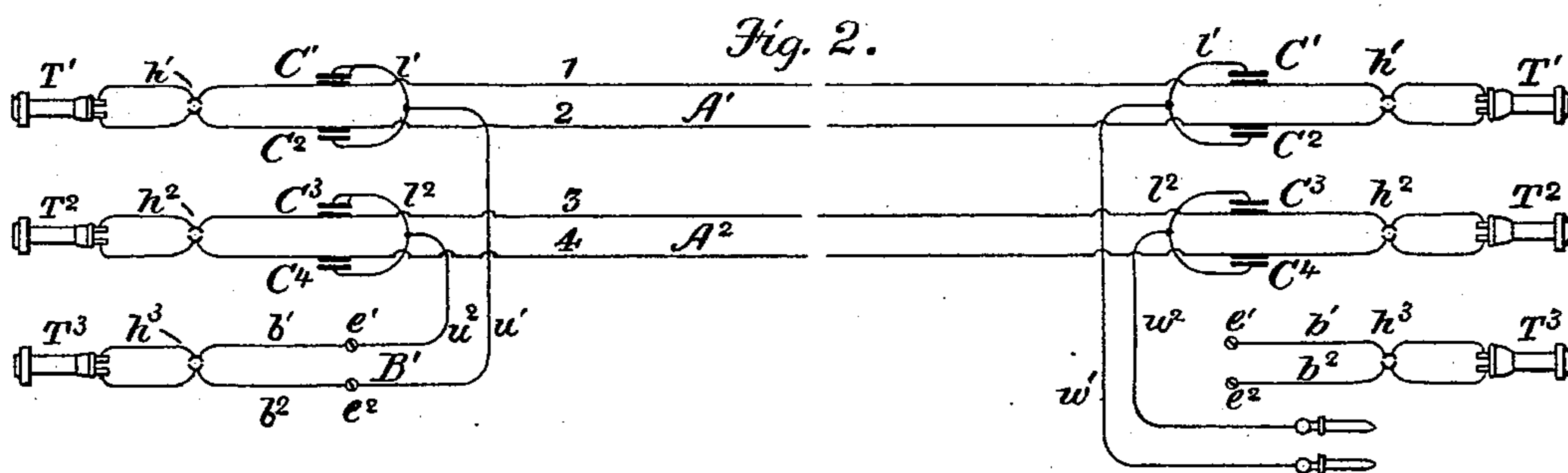
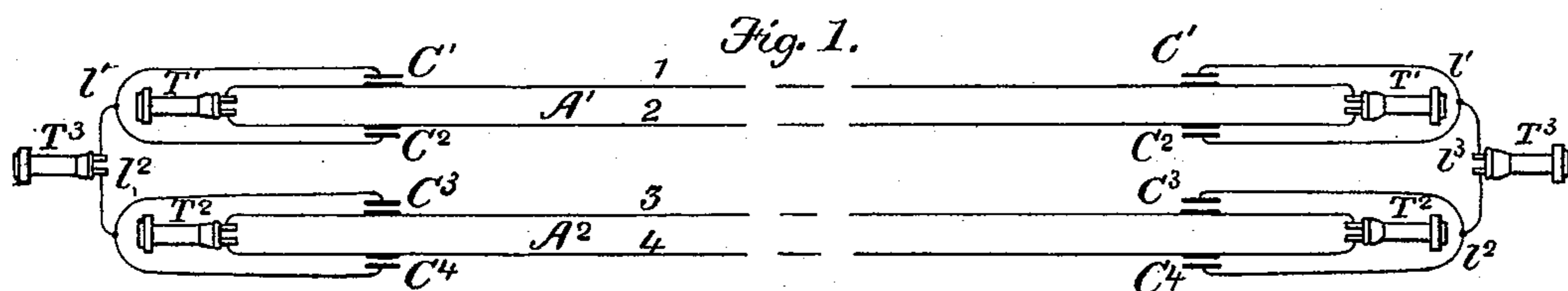


(No Model.)

W. W. JACQUES.  
TELEPHONE CIRCUIT.

No. 453,483.

Patented June 2, 1891.



Witnesses.  
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# UNITED STATES PATENT OFFICE.

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## TELEPHONE-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 453,483, dated June 2, 1891.

Application filed March 7, 1891. Serial No. 384,104. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM W. JACQUES, of Newton, in the State of Massachusetts, have invented a new and useful Improvement in Telephone-Circuits, of which the following is a specification.

The object of the invention is with a given number of metallic circuits to increase such number without adding to the number of wires and without changing the electrical conditions of the original circuits. As in other systems, original metallic circuits are used in additional or imposed circuits as single conductors—*i. e.*, as one wire, either the outgoing or the return wires of a metallic circuit; but whereas in other systems this has been done always to the detriment of the original circuits, and whereas the additional or imposed circuits have been in every case inferior to the original circuits of which they have been composed, in my system each original circuit is unimpaired and works as if there were no additional circuit or circuits imposed upon it, and each imposed circuit is superior to the original circuits of which it makes use. In the old systems sometimes considerable resistances have been interposed directly in the main or original circuits, as where induction-coils have been used with conductors of the original circuits for the purpose of inducing upon them the current of an additional circuit, and in such cases the additional circuit has had in it twice as many coils as the original. At other times a part of the current of an original circuit has been shunted off, as where the instruments in original circuits have been placed in bridges with resistances behind them, and in this latter case the additional circuit has contained all these resistances. Moreover, where the number of metallic circuits is increased by the use of bridges or induction-coils it is exceedingly difficult to maintain the proper proportion of the resistances of the bridges or the proper balance of the induction-coils among themselves, as the case may be.

In carrying out my invention I dispense with bridges and induction-coils and employ condensers as a means for inducing the currents of the additional circuits upon the original lines in such manner that the electrical

condition of the original line is not changed. The original lines are not cut, and nothing in the nature of a resistance is introduced in them. It is only necessary that the two condensers inserted in the two branches of any one metallic circuit, as hereinafter described, shall have the same inductive capacity, and from this it follows, as will hereinafter appear, that the invention is as applicable to an odd number of original circuits as to an even number.

In the drawings, Figure 1 is a diagram representing an additional metallic circuit imposed upon two original metallic circuits according to my invention. Fig. 2 is a diagram disclosing the same invention that is shown in Fig. 1, but more fully illustrative of apparatus actually employed in practicing the invention. Fig. 3 is a diagram illustrating the manner in which two additional metallic circuits may be imposed upon four original metallic circuits, one additional circuit upon each pair of original circuits, and also how a third additional circuit may be imposed upon the first two additional circuits. Fig. 4 is a diagram representing additional metallic circuits imposed upon an odd number of original metallic circuits according to my invention.

In Fig. 1 the wires 1 and 2 form, as shown, an original metallic circuit A', and T' T' are telephones at either end. In like manner the wires 3 and 4 form a second metallic circuit A'', and T'' T'' are telephones at either end.

C' C' are condensers connected with wire 1 of the original circuit A' at either end, and C'' C'' are condensers correspondingly connected with wire 2 of the same circuit at either end. One plate of each condenser C' C'' at either end of the circuit is directly connected with its line-wire, as shown, while the opposite plates are connected in loop l', as shown. In like manner condensers C''' and C''' are connected with wires 3 and 4 of the second metallic circuit A'' at either end thereof, one plate of each pair of condensers being in direct contact with its line-wire, and the opposite plates being connected by a loop l'', as shown. The two loops l' and l'' are connected by a third loop l''' at either end, and in this

third loop  $l^3$  at either end is placed a third telephone apparatus  $T^3$ .

In the operation the telephones  $T'$   $T'$  are in the metallic circuit  $A'$ , as shown. The 5 condenser-plates connected to this circuit, it is seen, can have no effect upon it. The same is true of telephones  $T^2$   $T^2$  and their metallic circuit  $A^2$  and the condenser-plates contained therein.  $T^3$  and  $T^3$  are in a metallic circuit, 10 one limb of which consists of a part of loop  $l^3$ , loop  $l'$ , and condensers  $C' C^2$  at one end of circuit  $A'$ , wires 1 and 2 in said circuit, and condensers  $C' C^2$ , loop  $l'$ , and a part of loop  $l^3$  at the other end of the same circuit, while 15 the other limb in like manner consists of the remaining parts of loop  $l^3$  at either end, loop  $l^2 l^2$ , condensers  $C^3 C^4 C^3 C^4$ , and wires 3 and 4. In using either telephone apparatus  $T^3$  what is said at  $T^3$  at either end cannot be 20 heard at either  $T'$ , because the disturbance of the current at either  $T'$  effects equally the two wires 1 and 2, in which the  $T'$  telephone-current is moving in opposite directions, and the same is true for like reasons of the tele- 25 phones  $T^2$ ; but what is said at either  $T^3$  can be heard at the other  $T^3$ , since the wires 1 and 2 are in effect but a single conductor or wire in continuation of loop  $l^3$  for one side or 30 while wires 3 and 4 make the other limb. No harm is done to the circuit 1 2, because the plates of the condensers actually in contact with the lines offer no resistance. The telephones at  $T^3$  work better than those at  $T'$  35 and  $T^2$ , because they are in a circuit of greater conductivity.

In the diagram at Fig. 2 the two circuits 1 2 and 3 4 end, respectively, in two-contact 40 plug-holes  $h' h^2$ , and into which the two telephones  $T'$  and  $T^2$  may be plugged, as indicated, to complete the circuits, while  $b' b^2$  are a pair of idle wires or bars meeting at one end in a similar two-contact plug-hole  $h^3$ , into which 45 telephone  $T^3$  may be plugged, and their other ends terminating in similar contact plug-holes  $e' e'$ , into which may be plugged, as shown, wires  $w'$  and  $w^2$ , leading from loops  $l' l^2$ , formed as shown in Fig. 1. In this case 50 the loop corresponding to loop  $l^3$  of Fig. 1 consists of wire  $w'$ , bar  $b^2$ , telephone  $T^3$ , bar  $b'$ , and wire  $w^2$ .

In the diagram shown at Fig. 3 the line-wires 1 and 2 belong to original metallic circuit  $A'$ , line-wires 3 and 4 to original metallic 55 circuit  $A^2$ , line-wires 5 and 6 to original metallic circuit  $A^3$ , and line-wires 7 and 8 to original metallic circuit  $A^4$ , and each pair of line-wires terminates in a double-contact plug-hole  $h' h^2 h^3 h^4$ , as shown. Each line-

wire has a condenser  $C' C^2 C^3$ , &c., and the 60 pairs of condensers in each metallic circuit are looped together by loops  $l' l^2 l^3 l^4$ .

$B' B^2 B^3$  are three pairs of idle wires or bars, made up, as shown, of idle bars  $b', b^2, b^3, b^4, b^5$ , and  $b^6$ , the said pairs terminating at 65 one end, as shown, in double-contact plug-holes  $h^5 h^6 h^7$ , and the single bars terminating at their other ends in single-contact plug-holes  $e' e^2 e^3 e^4 e^5 e^6$ . The idle bars  $b', b^2, b^3$ , and  $b^4$  are furnished, as shown, with con- 70 densers  $C^9, C^{10}, C^{11}$ , and  $C^{12}$ , and the outer plates of these condensers are coupled in pairs, as shown, by loops  $l^5$  and  $l^6$ , which two loops are themselves looped by means of wires  $w^5$  and 75  $w^6$  and to a pair of idle bars  $B^3$ . Further explanation of Fig. 3 is unnecessary.

It will readily be seen that original circuits  $A'$  and  $A^2$  are looped together for an imposed circuit, that circuits  $A^3$  and  $A^4$  are looped to- 80 gether for a second imposed circuit, and that the two said imposed circuits are looped together for a third imposed circuit.

In the arrangement shown in Fig. 4 each original metallic circuit  $A' A^2 A^3$  will be pro- 85 vided with its own telephones, and the circuits  $A' A^2$ , by means of their condensers and the pair of idle bars  $B'$ , looped as shown, will furnish an additional circuit for a telephone plugged into the idle bars  $B'$ . A fifth circuit may, as shown, be imposed upon the three 90 original circuits  $A' A^2 A^3$ , and the fourth already imposed by means of a second pair of idle-bars  $B^2$  and the two pairs of condensers placed in circuit  $A^3$  and the first pair of idle-bars  $B'$ , and it follows that after additional 95 circuits have been imposed upon any number of original metallic circuits two metallic circuits may always be added to the system by the addition of two through-line wires.

I claim— 100

The combination, with two metallic circuits, of two pairs of condensers, one pair for each circuit, and one plate of a separate condenser being in contact with each line-wire, while the 105 opposite or free plates of the pair of condensers of each circuit are connected by a metallic loop, and the two loops thus formed are connected by a third, substantially as described.

In testimony whereof I have signed my 110 name to this specification, in the presence of two subscribing witnesses, this 26th day of February, 1891.

WILLIAM W. JACQUES.

Witnesses:

GEO. WILLIS PIERCE,  
FRANK C. LOCKWOOD.