(No Model.) 2 Sheets—Sheet 1.

R. KENNEDY.

TRANSFORMATION AND DISTRIBUTION OF ELECTRIC ENERGY.

No. 381,794. Patented Apr. 24, 1888.

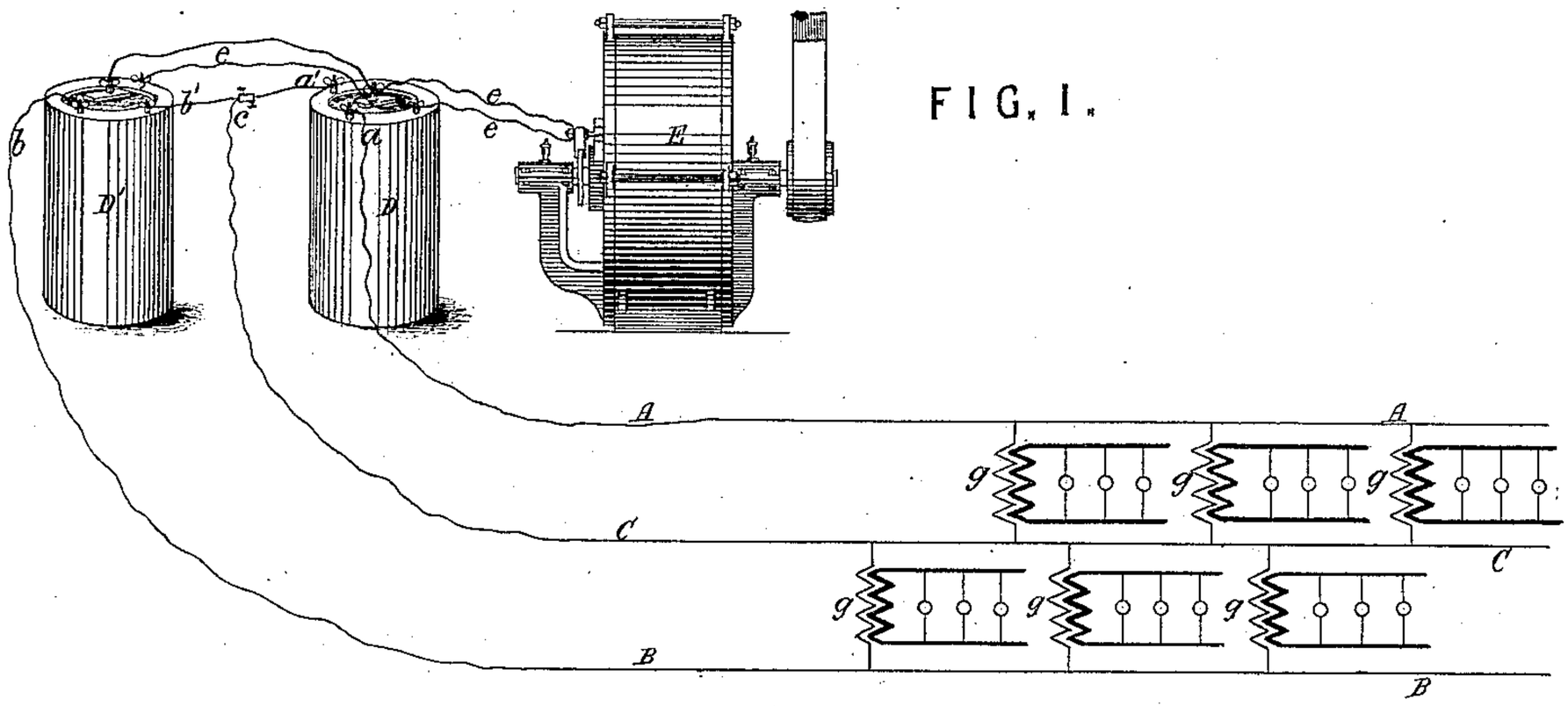

FIG. 1.

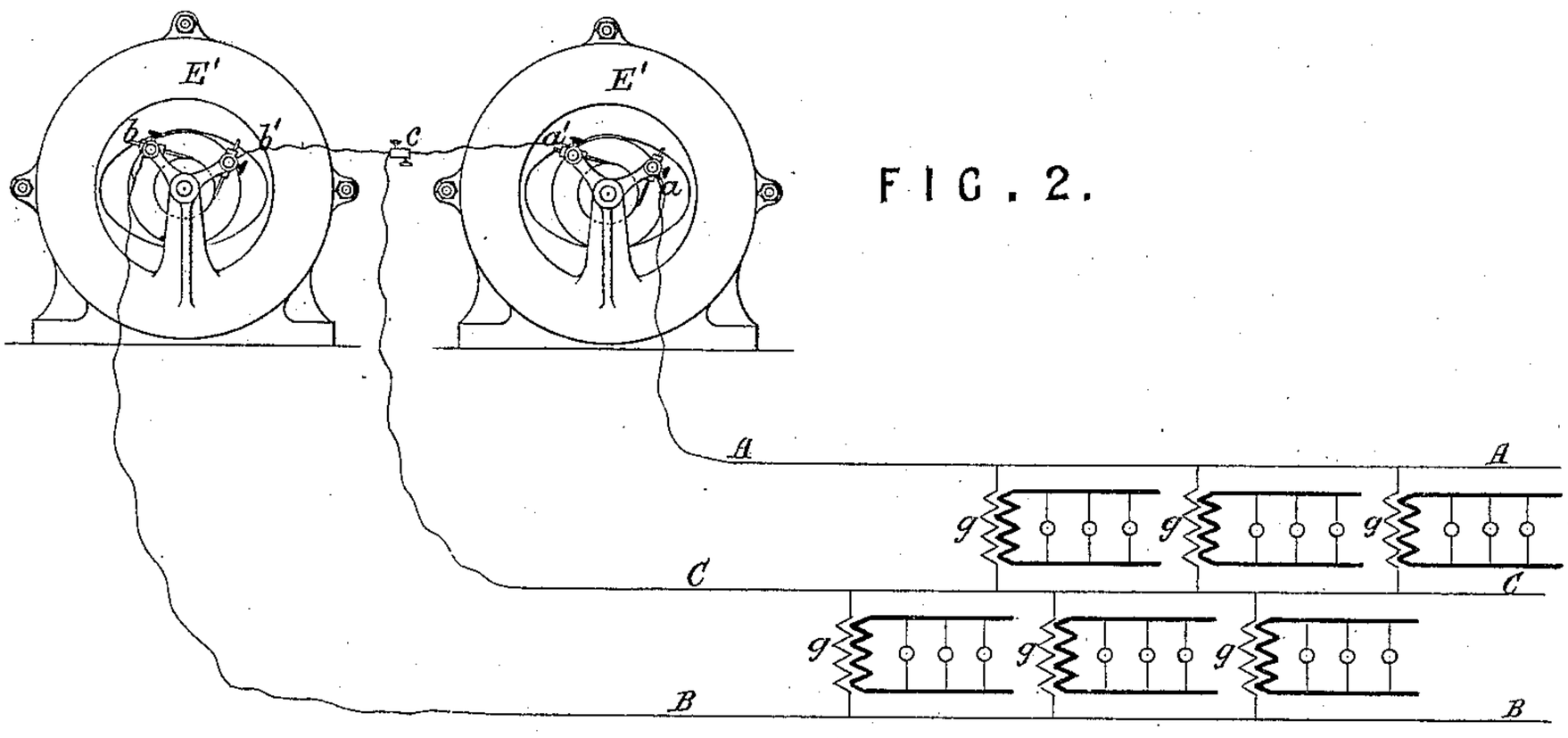

FIG. 2.

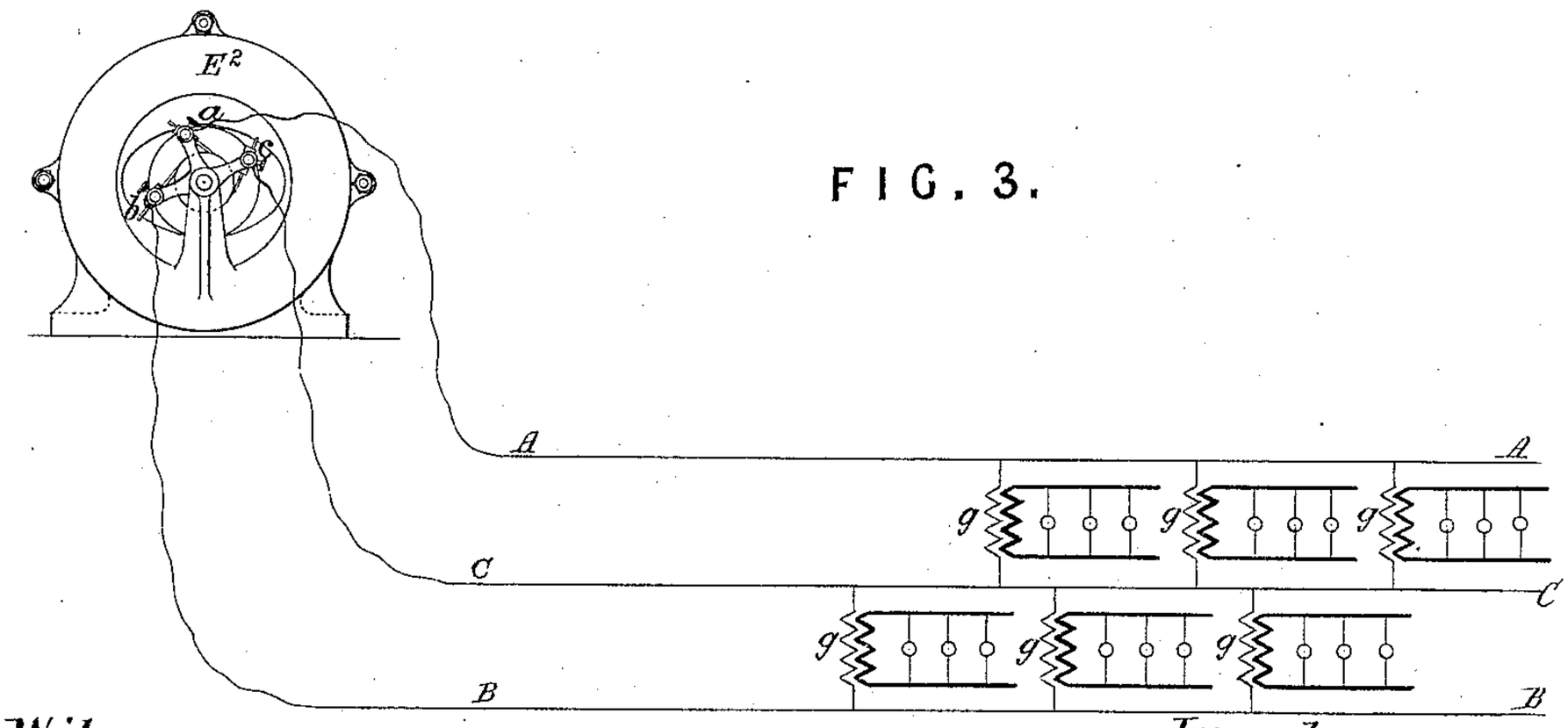

FIG. 3.

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(No Model.) 2 Sheets—Sheet 2.

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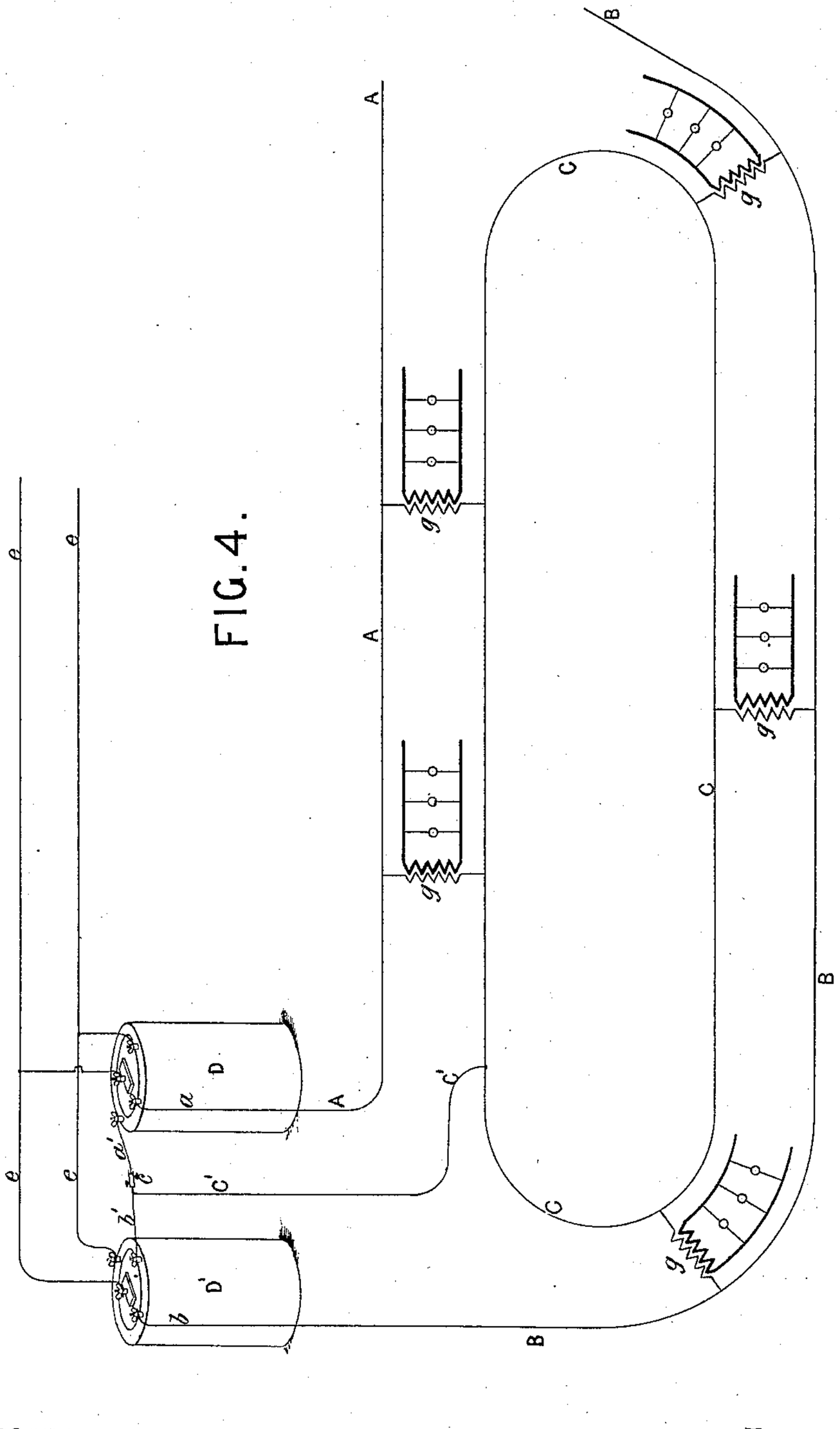
FIG. 4.



Witnesses:
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Inventor:
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UNITED STATES PATENT OFFICE.

RANKIN KENNEDY, OF GLASGOW, COUNTY OF LANARK, SCOTLAND, ASSIGNOR OF ONE-HALF TO ROBERT DICK, OF SAME PLACE.

TRANSFORMATION AND DISTRIBUTION OF ELECTRIC ENERGY.

SPECIFICATION forming part of Letters Patent No. 381,794, dated April 24, 1888.

Application filed December 29, 1886. Serial No. 222,931. (No model.)

To all whom it may concern:

Be it known that I, RANKIN KENNEDY, a subject of the Queen of Great Britain and Ireland, and a resident of Glasgow, county of Lanark, Scotland, have invented certain Improvements in the Transformation and Distribution of Electric Energy, of which the following is a specification.

This invention has for its object the saving of prime cost in laying down the main supply-conductors and comprises the supplying of high-potential alternating currents of electric energy for operating secondary generators in great numbers from a central supply-station. According to one arrangement of my invention I use, in combination with two main current transformers having their secondary wires joined in series order, a system of main conductors known as the "three-wire system" and hitherto practiced for the purpose of distributing low-potential currents directly to the lamps or other translating devices.

In the accompanying drawings, Figure 1, Sheet 1, represents a diagram view showing the three-wire system of main conductors A B C applied according to one arrangement of my improvements to supply high-potential alternating currents of electric energy from two main transformers, D D′, to the secondary generators *g*, arranged in parallel or multiple arc order between the main supply-conductors A and C and B and C, respectively, C being a common conductor to both A and B. In this arrangement the two main transformers D D′ are supplied with electric energy from a low-potential alternating-current dynamo E, or dynamos by the wires *e* to transform this energy into currents of high potential. Fig. 2, Sheet 1, represents a similar view showing how the three-wire arrangement of main supply-conductors A B C can be applied to a system of distribution of electric energy by secondary generators *g*, operated direct from two high-potential alternating-current dynamo electric machines, E′ E′, joined in series order, instead of from main transformers D D′, as in the arrangement shown in Fig. 1; and Fig. 3, Sheet 1, represents a like view showing how the secondary generators *g* can be operated by the three-wire system of main supply-conductors A B C, according to my improvements, direct from one high-potential alternating-current dynamo-electric machine, E², having two circuits joined in series order within itself.

To apply the three-wire system according to the arrangement of my improvements shown in Fig. 1 of the diagrams, for the purpose of providing main supply-conductors for high-potential alternating currents and applicable to the operation of secondary generators, I employ a low-potential alternating-current dynamo-machine, E. This low-potential dynamo-machine delivers its currents of electricity into the primary wires *e* of two main current transformers, D D′, which primary wires *e* are joined in multiple-arc order, as shown in the diagram, (but they might be in series order,) to the terminals of the low-potential dynamo-electric generator E; or it might be a number of these generators.

The secondary wires of the two main current transformers D D′ (which transform the low-potential alternating current supplied to them by the dynamo or dynamos into currents of high potential) are joined together in series order. The two free ends *a b* are then joined up to the main supply-conductors A B, which pass through the district to be supplied with alternating electric currents of high potential for operating secondary generators *g*, having translating devices in their secondary circuits, as usual.

At the junction *c* of the two secondary wires *a′ b′* of the main current transformers D D′ a third main supply-conductor, C, is connected. This third wire also passes between the other two main conductors, A B, through the district to be supplied with high-potential alternating electric currents. The secondary generators *g* to be supplied by this three-wire system of conductors A B C are in practice arranged in two sets, and are respectively connected in multiple arc between A and C, and also between B and C. Thus C becomes a common conductor to both A and B, and I so arrange the connection of the secondary generators *g* to these main conductors that one half of all the generators in the district shall be connected to A and C and the other half to B and C, and this arrangement evenly divides the supply of

energy between the conductors A and B. It is not absolutely necessary under my improvements to make the two sets of secondary generators *g* equal; but for the best results it is preferable. The action of this combination of the main current transformers D D′ with three main current supply-conductors, A B C, in carrying out the purpose of my invention I explain thus: The low-potential alternating-current dynamo E or dynamos deliver electric energy into the two main-current transformers D D′ by the primary wires *e* at a potential, say, for example, fifty volts. Each main current transformer D and D′ raises this potential to, say, two thousand volts in the secondary wires *a a′* and *b b′*, and the two secondary wires *a b* of the main current transformers being joined in the series the difference of potential between the free ends *a b*, to which the main conductors A and B are joined, will be four thousand volts, and the difference of potential between the free ends *a* and *b*, to which the main conductors A and B are respectively connected, and the junction *c* of the secondary wires *a′ b′*, to which the main supply-conductor C is joined, will be two thousand volts, and a saving of copper in the main supply-conductors A, B, and C is thus effected; for, say, if twenty secondary generators *g* are to be supplied in the district with the two-wire system, the weight of conductors A and B per yard would require to be for the two, say, for example, one pound per yard. On the three-wire system A, B, and C ten of the generators *g* would be supplied from A to C and ten from B to C. Thus A and B would require weight per yard sufficient for supplying ten generators; or, say, half a pound per yard would be sufficient weight for both conductors A and B—that is, one-quarter pound per yard for A and one-quarter for B. C also would have a weight per yard for the supply of ten generators—namely, a quarter-pound per yard. Thus on the two-wire system A and B one pound per yard would be the weight of both conductors together; on the three-wire system the weight of the three wires A, B, and C together would be three-quarters of a pound per yard, and thus a saving of wire of one-quarter pound per yard would be effected by my new system. The secondary potentials of the two main current transformers do not require to be equal.

When it is desired to apply my improvements to a system of distribution of electric energy of alternating currents in which the main transformers are not used, and high-potential alternating currents are supplied direct to operate the secondary transformers *g* from dynamo-electric machines, in this arrangement the main supply-conductors A and B would be respectively connected up to the two free terminals *a b* of the two dynamos E E′, and the main supply-conductor C connected to the junction *c* of the terminals *a′ b′* of the respective dynamos E E′, as illustrated in Fig. 2 of the diagrams, or at the junction *c* of the two circuits when only one dynamo, E^2, with two circuits is employed, as illustrated in Fig. 3 of the diagrams.

In any of the combinations described in reference to Figs. 1, 2, and 3, the central main-current supply-conductor C may be made an endless-wire circuit. This endless wire C is illustrated in Fig. 4, Sheet 2 of the diagrams, and is shown as joined by the branch C′ to the junction *e* between the two ends *a′ b′* of the secondary wires of the main current transformers D D′, and has connection, as shown in the diagram, at any desired parts of its length with the two sets of secondary generators *g* and main conductors A and B.

I do not here claim the combination of the main transformers with alternating-current generators and secondary generators, as that forms the subject of an application for patent filed by me December 27, 1886, Serial No. 222,530.

What I claim is—

1. The combination of an electric generator or generators with three main conductors, secondary generators in parallel or multiple arc connection to said main conductors, and translating devices in the secondary circuits of the secondary generators, substantially as set forth.

2. The combination of a generator of alternating currents and two main transformers with three main conductors therefrom, secondary generators in parallel or multiple arc connection to said main conductors, and translating devices in the secondary circuits of said secondary generators, substantially as set forth.

3. An electrical-distribution system having three main conductors, means for supplying high-potential alternating currents of electric energy to said conductors, secondary generators in parallel or multiple arc connection to such main conductors, and translating devices in the secondary circuits of said secondary generators, substantially as herein set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RANKIN KENNEDY.

Witnesses:
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JOHN SIME,
Both of 96 *Buchanan Street, Glasgow.*