(No Model.)

R. KENNEDY.

SYSTEM OF DISTRIBUTING ELECTRIC ENERGY.

No. 461,139. Patented Oct. 13, 1891.

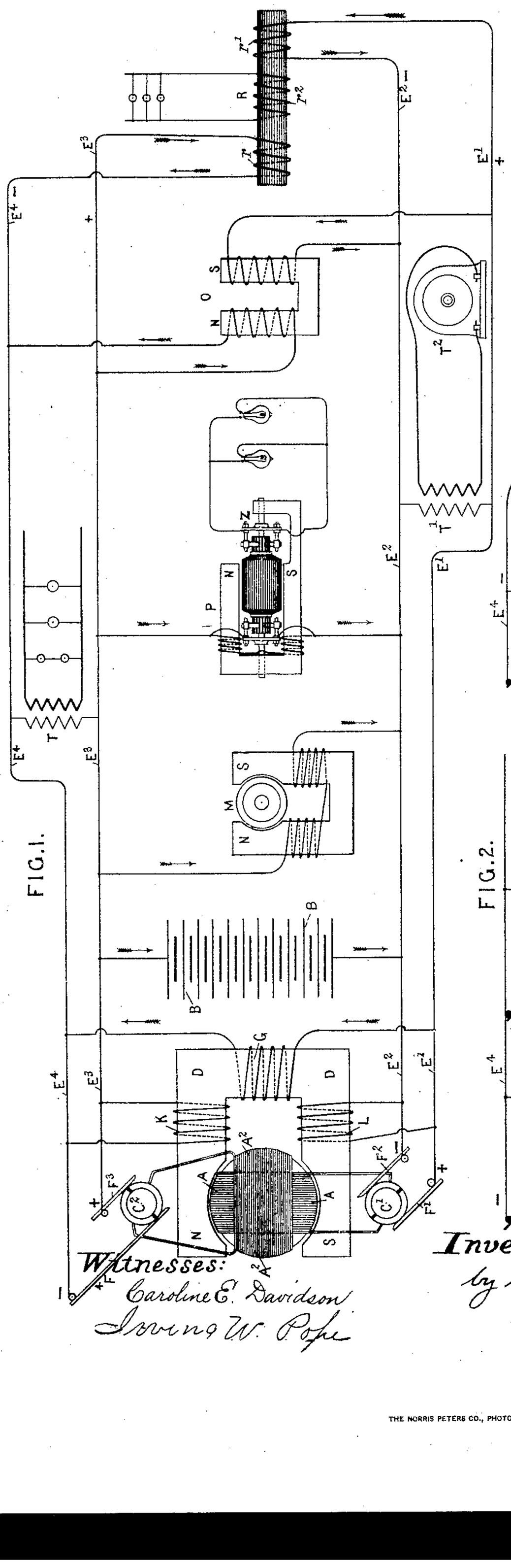

FIG. 1.

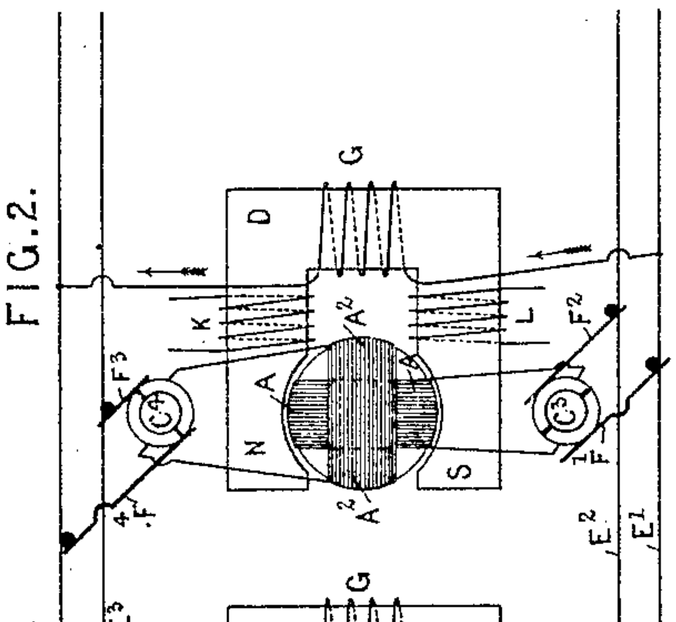

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

Witnesses:
Caroline E. Davidson
Irving W. Pope

Inventor, Rankin Kennedy
by his Atty Franklin L. Pope

UNITED STATES PATENT OFFICE.

RANKIN KENNEDY, OF GLASGOW, SCOTLAND.

SYSTEM OF DISTRIBUTING ELECTRIC ENERGY.

SPECIFICATION forming part of Letters Patent No. 461,139, dated October 13, 1891.

Application filed September 24, 1890. Serial No. 366,009. (No model.)

To all whom it may concern:

Be it known that I, RANKIN KENNEDY, a subject of the Queen of Great Britain, and a resident of Glasgow, Scotland, have invented certain new and useful Improvements in Systems of Distributing Electrical Energy, of which the following is a specification.

The object of my invention is the distribution of electric energy from a generating-station over a considerable geographical area, and the supply of the same to consumers in any required quantity and at any required potential or pressure. My improved system is furthermore designed to combine all the essential advantages of the so-called "direct" or "continuous" and "alternating" systems of distribution, being capable of supplying electrical energy in any required form, and for any purpose from one group of main conductors.

In the accompanying drawings, Figure 1 is a diagram illustrating an apparatus embodying my invention. Figs. 2 and 3 show certain modifications of the same, and Figs. 4 and 5 are theoretical graphic diagrams illustrating phases of current produced by the operation of the apparatus.

Referring to Fig. 1 of the drawings, D represents a dynamo-electric generator. There are two coils or windings A′ and A^2 upon the armature at right angles to each other, and as these both revolve in the same magnetic field the current generated in the one coil is at its maximum at the instant that the other coil is at its minimum. These independent alternating currents are rectified by the respective commutators C′ C^2, so that two alternating pulsating unidirection currents are obtained in two circuits, the one being at a maximum at the instant the other is at a minimum. From the two rectifying-commutators C′ C^2 the two pulsating currents pass into the respective pairs of main distributing-conductors E′, E^2, E^3, and E^4 by way of the collecting-brushes F′ F^2 on commutator C′ and brushes F^3 F^4 on commutator C^2. The positive (+) brush F′ of commutator C′ is connected with the negative (—) brush F^4 on commutator C^2, either by a conductor directly between them or (for the purpose of self-regulation) through a thick wire main exciting-coil wound upon the field-magnet of dynamo D, as shown at G. This connection places the independent armature-windings A and A^2 in series with each other and with the main conductors E^2 E^3, (one of each pair.) K and L are two shunt-coils for exciting the field-magnet D. The excitation produced by the coil G varies automatically as the load of translating devices are connected and disconnected between the mains E^2 and E^3. The means of exciting the field may be that commonly employed in alternators—namely, by a separate continuous current, instead of the shunt-coils K and L, shown in the figure. Translating devices—as for example, a storage-battery B, a motor M, and a motor-generator P—are connected between main wires E^2 E^3, and are energized by the two alternately unidirection currents in these mains, which pass in series through the coils of said devices, and these two pulsating unidirection currents in series produce substantially the same effect as a single continuous current of equal value.

In supplying the hereinbefore-mentioned translating devices B, M, and P the current may be traced as follows: From commutator C′ it passes through + brush F′, thence through main exciting-coil G on field-magnet D of dynamo, thence through — brush F^4 on commutator C^2, coil A^2 on armature, and brush F^3 into + main conductor E^3, and then dividing passes through the several translating devices B, M, and P, and returns through — main conductor E^2 to commutator C′ by way of brush F^2. It is obvious that by these connections the translating devices B, M, and P are in parallel or multiple arc with each other, and also that the two armature-windings A and A^2 are in series connection with each other and with the external circuit E^2 E^3, through the several continuous current-translating devices mentioned. The two alternately-pulsating unidirection currents being generated in independent windings in series with each other, will produce the same effect as a continuous current upon the several translating devices B, M, and P. The motor-generator P is shown as supplying from an independent winding a continuous high or low pressure local or secondary current to a group of incandescent lamps placed in circuit with it in multiple arc or otherwise, as shown

at Z. Translating devices—such as transformers or motors—when connected directly between the mains E′ and E^2 or E^3 and E^4, receive one pulsating unidirection current only. Such a current is well adapted for an open magnetic circuit-inductional transformer, having its primary wire connected either between E′ and E^2 or between E^3 and E^4, and will induce an alternating current in its secondary circuit.

A transformer or converter T of the ordinary type is shown between the mains E^3 E^4, and an alternating current, either of lower or higher pressure than that of the pulsating primary current, may be obtained from the secondary of a transformer or converter, in whose primary such pulsating current acts, which alternating secondary current may be applied to alternating current-translating devices in the usual manner.

T′ is another transformer connected between the primary mains E′ E^2 and adapted to supply from its secondary circuit an alternating current, (induced by the primary pulsating current,) which is utilized in an alternating pulsating electric motor T^2.

At O is shown an electro-magnet wound with two independent coils, which are connected across E′ E^2 and E^3 E^4, respectively, in such way that the currents traverse the parallel coils separately, instead of in series, as is the case with connections made across mains E^2 E^3 only. A constant magnetism is thus obtained, or, in other words, the currents act as one continuous current upon the core of the magnet O. Alternating current-induction converters or transformers having double windings may also be connected across both the mains E′ and E^2 and E^3 and E^4. In order to operate alternating current-transformers by this method they are wound, as shown at R, with two independent primary coils r and r', while the secondary coil r^2 is wound in the usual manner. One pulsating unidirection current is passed through the one primary winding on the transformer or converter and the other pulsating unidirection current is passed through the other primary winding on the same transformer or converter in such manner that the pulsating unidirection currents in the one winding flow in the opposite direction to that in which the pulsating unidirection flow in the other winding. Under the inductive influence of these opposing exciting primary pulsating unidirection currents, one series of pulsations being at a maximum in one winding at the instant the other series is at a minimum in the other winding of the primary circuit, their combined effect is exactly the same as that of one alternating current in one primary winding, and hence ordinary converters for alternating currents may be employed in this system by dividing their primary coils into two independent windings r r', and passing the two pulsating unidirection currents respectively through the separate windings, but in opposite directions.

Fig. 2 shows the mains E′ E^2 E^3 E^4, supplied by two separate generators in parallel, arranged as in Fig. 1, the connections being exactly the same.

Fig. 3 shows a modification, in which only three mains E′ E^4 and E^2 E^3 are required instead of four, the intermediate double main E^2 E^3 serving as a common return for the other two E and E^4. In this arrangement the shunt-coils K L are used on the generator, as in Fig. 1; but the coil G is dispensed with, and connections are made from the brushes F^2 F^3 directly to the intermediate main E^2 E^3. The translating devices O R T act substantially the same in this instance as in Fig. 1; but single-wound translating devices or storage-batteries cannot be operated in connection with this modified arrangement.

Fig. 4 is a diagram illustrating graphically the action of the hereinbefore-described distributing system of two pulsating unidirection currents a and b, one being at a maximum when the other is at a minimum, and flowing in the same direction, one through one coil and the other through another coil, wound upon the same core of a magnet or motor. Their value, when considered as one continuous current, is represented graphically by the rectangular area inclosed between the parallel lines v w and x y. Pulsating currents, when passed in series through one circuit or through a storage-battery, (provided the pulsations are all of the same polarity or direction,) act as a continuous current, the rise of the one compensating for the simultaneous fall of the other.

Fig. 5 is a diagram illustrating graphically the action upon a transformer of two pulsating currents, one at a maximum when the other is at a minimum, as represented by the curves a and b, the one flowing in one coil in the opposite direction to the other flowing in another coil. Both coils, acting upon the core of a common transformer, produce the same inductive effect as an alternating current, as represented by the thick alternating resultant line c c c, x y being the zero-line in each of these figures.

I claim as my invention—

1. In a system of electrical distribution, two armature-windings which alternately traverse the same or similar magnetic fields, whereby alternating electrical pulsations of unlike phases are induced in the respective windings, in combination with independent pairs of main conductors, independent commutators whereby the alternating pulsations induced in the respective windings are rectified before traversing the respective pairs of main conductors, a conductor directly uniting one positive brush of one with one negative brush of the other of said commutators, and translating devices connected between the conductor connected with the other positive

brush of one pair and the conductor connected with the other negative brush of the other pair of said mains, substantially as set forth.

2. In a system of electrical distribution, two armature-windings which alternately traverse the same or similar magnetic fields, whereby alternating electrical pulsations of unlike phases are induced in each of said windings, in combination with independent pairs of main conductors, independent commutators whereby the alternating pulsations induced in the respective windings are rectified before traversing the respective pairs of main conductors, a field-coil the terminals of which are respectively connected to one positive brush of one and one negative brush of the other of said commutators, and translating devices connected between the conductor connected with the other positive brush of one pair and the conductor connected with the other negative brush of the other pair of said mains, substantially as set forth.

3. In a system of electrical distribution, two armature-windings which alternately traverse the same or similar magnetic fields, whereby alternating electrical pulsations of unlike phases are induced in each said winding, in combination with translating devices having two independent coils acting conjointly upon a core common to both, one of said coils being traversed by one and the other by the other of the sets of pulsations induced in the respective armature-windings, substantially as set forth.

4. In a system of electrical distribution, two armature-windings which alternately traverse the same or similar magnetic fields, whereby alternating electrical pulsations of unlike phases are induced in each said winding, in combination with translating devices having two independent magnetizing-coils acting conjointly upon a core common to both, one of said coils being traversed by pulsations of one polarity derived from one of said armature-windings and the other by pulsations of opposite polarity derived from the other of said armature-windings, whereby alternate magnetism is induced in said core, substantially as set forth.

5. In a system of electrical distribution, two armature-windings which alternately traverse the same or similar magnetic fields, whereby alternating electrical pulsations of unlike phases are induced in each said winding, in combination with translating devices having two independent magnetizing-coils acting conjointly upon a core common to both, said coils being traversed by pulsations of unlike polarity derived alternately from said armature-windings, respectively, whereby continuous magnetism is induced in said core, substantially as set forth.

6. In a system of electrical distribution, two armature-windings which alternately traverse the same or similar magnetic fields, whereby alternating electrical pulsations of unlike phases are induced in the respective windings, in combination with independent pairs of main conductors, independent commutators whereby the alternating pulsations induced in the respective windings are rectified before traversing the respective pairs of main conductors, translating devices connected between the positive and negative main conductor of each of said pairs, translating devices connected between the positive conductor of one pair and the negative conductor of the other pair of said main conductors, and translating devices having two windings, said windings being independently connected between the respective positive and negative conductors, respectively, substantially as set forth.

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

RANKIN KENNEDY.

Witnesses:
W. R. M. THOMSON,
JOHN SIME.