(No Model.) 2 Sheets—Sheet 1.

M. HUTIN & M. LEBLANC.

ALTERNATING CURRENT DYNAMO.

No. 564,200. Patented July 21, 1896.

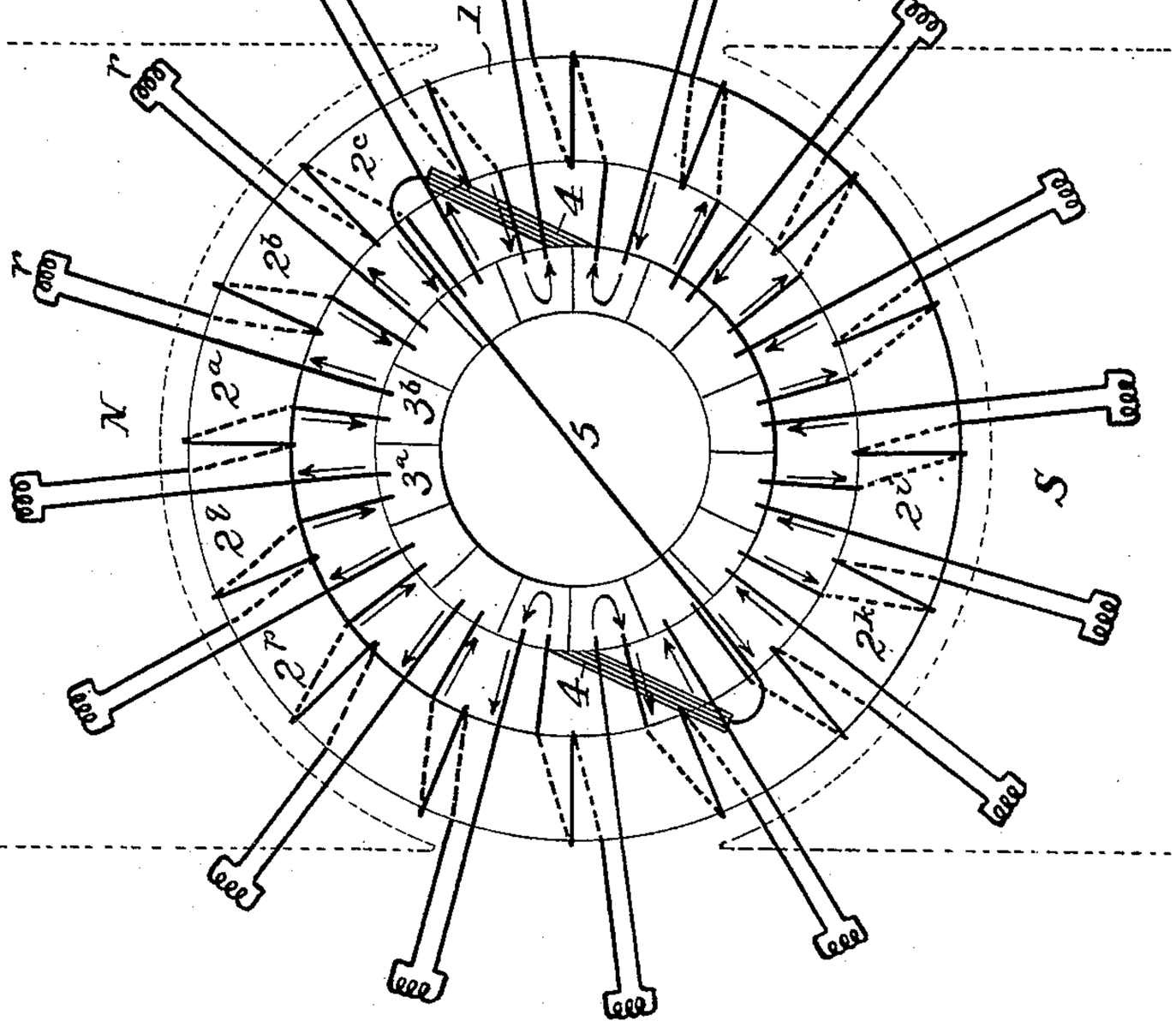

Fig. 2.

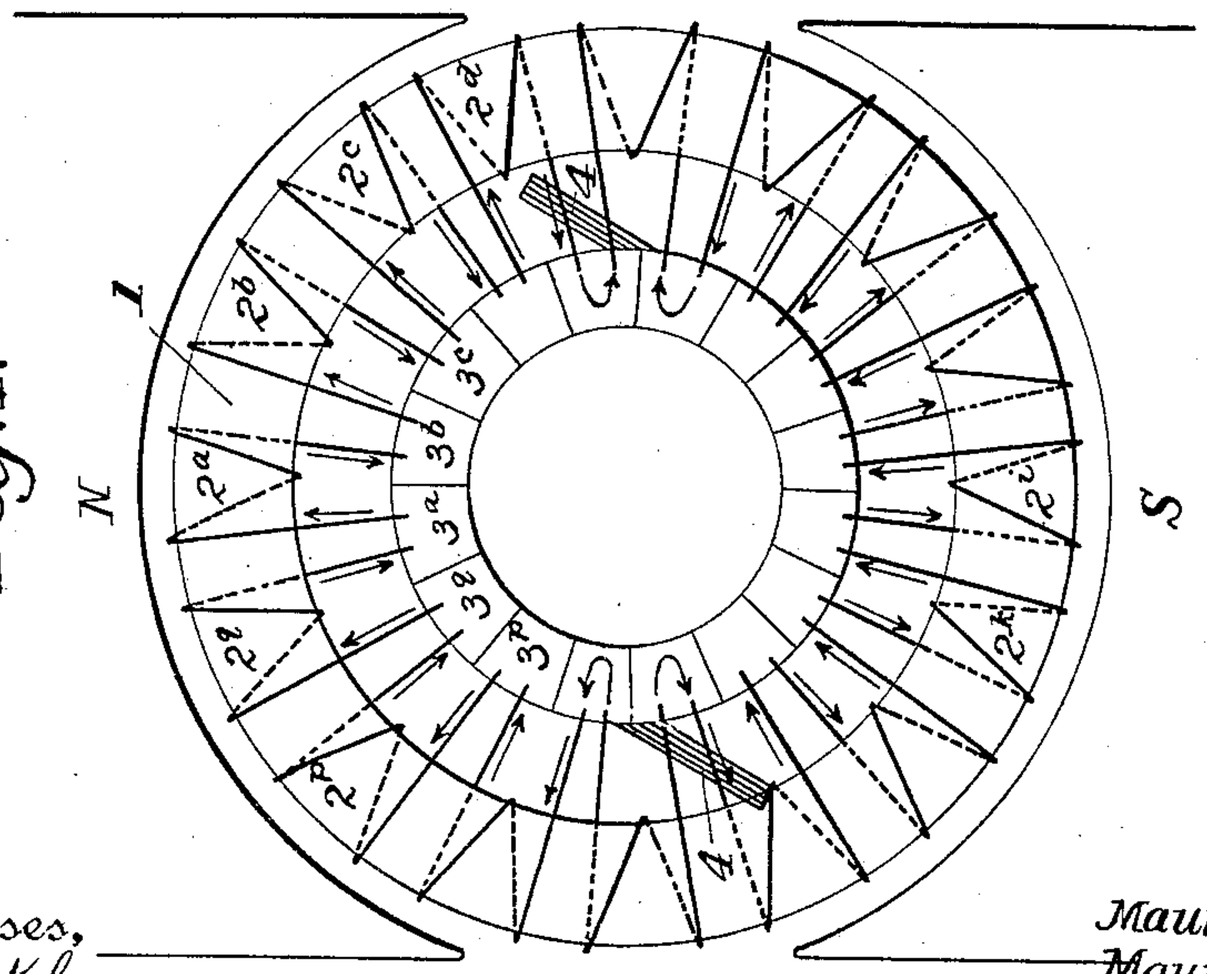

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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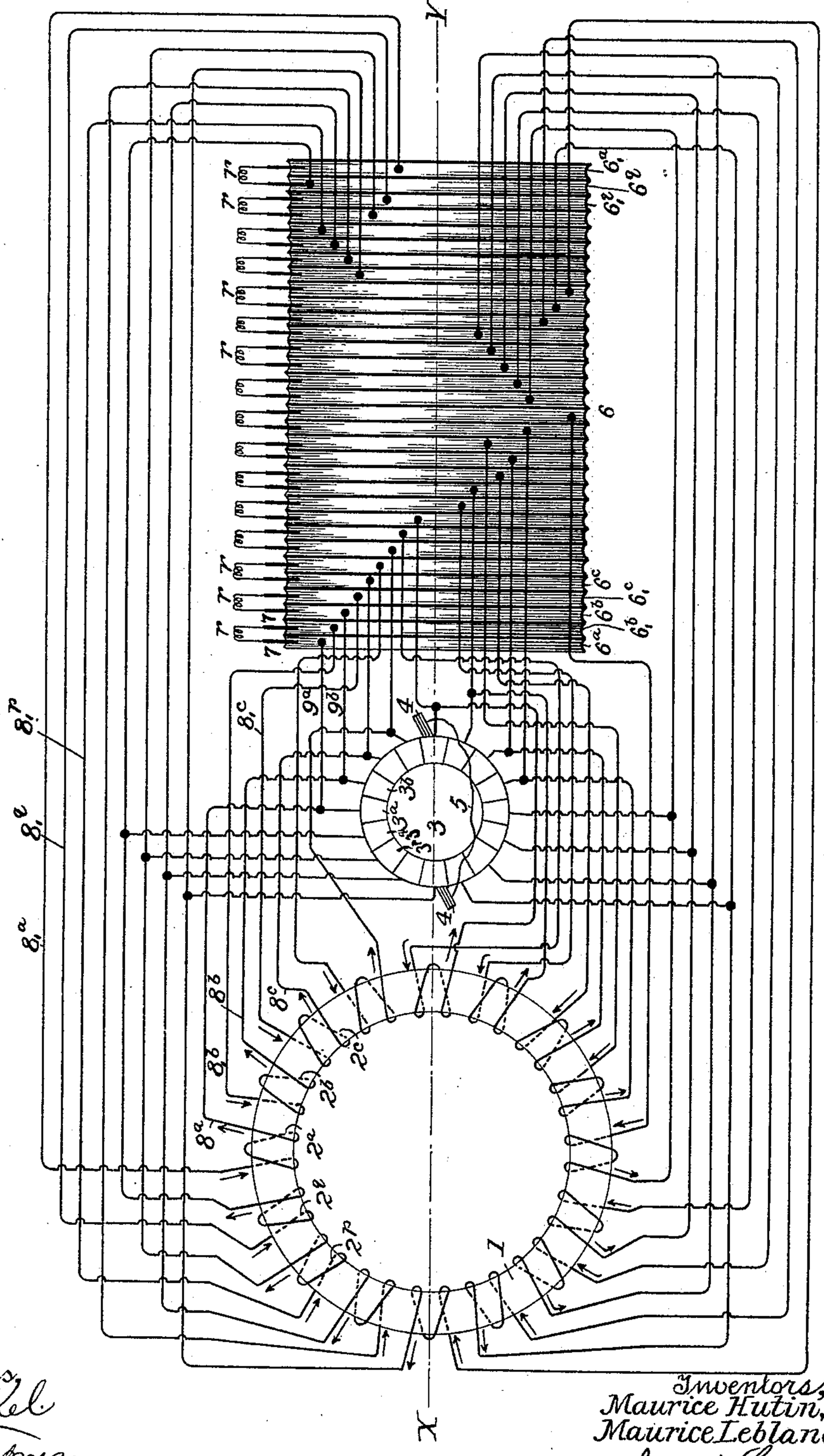

Fig. 3.

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UNITED STATES PATENT OFFICE.

MAURICE HUTIN AND MAURICE LEBLANC, OF PARIS, FRANCE, ASSIGNORS TO THE SOCIÉTÉ ANONYME POUR LA TRANSMISSION DE LA FORCE PAR L'ÉLECTRICITÉ, OF SAME PLACE.

ALTERNATING-CURRENT DYNAMO.

SPECIFICATION forming part of Letters Patent No. 564,200, dated July 21, 1896.

Application filed May 10, 1894. Serial No. 510,703. (No model.) Patented in France January 6, 1893, No. 226,965; in England June 24, 1893, No. 12,458; in Belgium June 27, 1893, No. 105,289; in Switzerland July 3, 1893, No. 7,071; in Italy August 24, 1893, XXVIII, 34,724, LXVIII, 147, and in Spain February 9, 1894, No. 15,265.

To all whom it may concern:

Be it known that we, MAURICE HUTIN and MAURICE LEBLANC, citizens of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Alternating Dynamos, of which the following is a specification.

This invention has reference to alternating-current machines, and is the subject of Letters Patent granted to us in France, No. 226,965, dated January 6, 1893; in Belgium, No. 105,289, dated June 27, 1893; in England, No. 12,458, dated June 24, 1893; in Switzerland, No. 7,071, dated July 3, 1893; in Italy, Vols. XXVIII and LXVIII, Nos. 34,724 and 147, dated August 24, 1893, and in Spain, No. 15,265, dated February 9, 1894.

The invention has for its object the production of alternating-current machines, adapted for use both as generators and motors, and in which the effects of self-induction shall be suppressed to the same extent as is the case in ordinary continuous-current machines of the Gramme or Siemens type. This object is attained by such modifications of Gramme or Siemens machines, whereby they become adapted for the production or consumption of alternating currents, without, however, changing the electrical reactions within the machines. In this manner the characteristic freedom from the effects of self-induction inherent in such machines is preserved. The manner of accomplishing this result is set forth in the following detailed description, with reference to the accompanying drawings, in which—

Figure 1 represents an end view of a machine of the Gramme type, mainly in diagram; Fig. 2, a like view of a Gramme machine modified in accordance with our invention, and Fig. 3, a diagram showing in detail the circuit-connections of such machine.

Like numerals of reference indicate like parts throughout all the drawings.

The theoretical considerations which led to the present invention will be understood by a contemplation of some of the electrical conditions of a continuous-current machine with separately-excited field and a Gramme armature, such as is represented in Fig. 1. In this figure of the drawings, NS represent two field-magnet poles, which are understood to be of constant intensity, and may be the poles either of a permanent magnet or of a separately-energized electromagnet. The Gramme ring-core 1 is shown as wound with a number of coil-sections 2^a, 2^b, 2^c, &c., with the outgoing terminal of each coil-section and the incoming terminal of the next adjacent coil-section connected to the same commutator-segment 3^a, 3^b, 3^c, &c. The brushes 4 4 are shown as bearing upon the commutator at the ends of the diameter of commutation, as usual, to deliver continuous current to the line with which they are connected, and in such line are understood to be translating devices, such as electric lamps, electric motors, &c.

If the internal resistance of the ring-winding, taken between the brushes, is designated by $\wp$; and the external resistance by R, and if I is the intensity of the current produced by the machine, then the quantity of energy wasted in the machine is $\wp I^2$, and the quantity of energy utilized in the external circuit will be RI^2.

If the number of coil-sections on the ring is 2n, then the resistance of each of these sections will be $\frac{4\wp}{2n.}$

Supposing now that, instead of making the resistance of the external circuit R, the brushes are short-circuited, so that the external resistance becomes zero, and further supposing that the resistance of each of the coil-sections of the armature is increased from

$$\frac{4\wp}{2n} \text{ to } \frac{4\wp}{2n} + \frac{4R}{2n.}$$

In that case the resistance of the whole armature-winding, taking all its 2n coil-sections in series, will be

$$2n\left(\frac{4\wp}{2n} + \frac{4R}{2n}\right) = 4\wp + 4R,$$

and the resistance taken between the brushes

will be one-quarter of this value—that is to say, it will be $\wp + R$. The quantity of energy expended in the armature will then be $(\wp + R)\, I^2$, while the energy expended in the external circuit will be zero.

It is quite evident that, by the changes we have thus supposed to be made, the machine will furnish no energy in the external circuit, but will waste all the energy in the internal circuit. Now, while such a machine would be quite useless, it would still possess the characteristic of the Gramme machine, namely: It would not manifest the phenomenon of self induction.

It will further be evident that the machine will still remain without self-inductive effect if the additional resistance $\frac{4R}{2n}$, for each coil-section, is placed not in the coil-section proper, but in the circuit of each coil-section and externally to the machine. The only difference in the operation of the machine will now be that the energy consumed will be effective in the resistances in the circuits of the coil-sections, but externally to the machine, while again no energy will be consumed between the brushes.

The modification last indicated is graphically represented in Fig. 2, and constitutes our improvement. Each coil-section of the armature is there shown as being extended externally to the machine, and containing the resistance $r = \frac{4R}{2n}$, while the brushes 4 4 are short-circuited by a conductor 5 of inappreciable resistance. The resistances r may be constituted by translating devices, such as lamps or electric motors, in which latter case the resistance of the circuit to the motor, the motor-circuit itself, and the counter-electromotive force developed by the motor, or, in other words, the impedance of the external portion of the circuit of each coil-section, represents the resistance r. It will thus be seen that the generator, thus constructed and connected to external circuits, will furnish to these circuits 2n alternating currents, dephased with reference to each other by $\frac{1}{2n}$ of a period, which currents may be utilized either separately in independent translating devices r, or may be utilized in one translating device, adapted to be operated by 2n-phase currents. Conversely, the machine thus constructed may be utilized as an alternating-current motor, fed by 2n-phase currents, in which case r would represent a generator, or a generating element of a generator.

It is not necessary that the brushes 4 4 be short-circuited, since they may be connected to an external circuit which, when the apparatus is used as a generator, would receive a continuous current at the expense of the alternating currents sent to the lines which contain the translating devices r.

In the practical construction of such machine, it is, of course, inadmissible to have the external portions of the armature coil-sections rigidly connected with these coil-sections proper, since in that case it would be necessary to rotate the field-magnet and brushes instead of the armature. It is, therefore, required that the external portions of the coil-section circuits be connected with the internal portions of the same by collector rings and brushes. This, and the whole scheme of the apparatus, is diagrammatically indicated in Fig. 3. Here the armature 1, the commutator 3, and the collector-rings 6 are shown as separated from each other, but it will be understood that in practice they will be mounted on the same shaft, the mathematical axis of which is indicated by the dotted line X Y.

There are shown sixteen armature coil-sections 2^a 2^b 2^p 2^q, connected with sixteen commutator-segments 3^a 3^b, 3^p 3^q, and with thirty-two collector-rings 6^a $6_1{}^a$, 6^b $6_1{}^b$, 6^c $6_1{}^c$, 6^q $6_1{}^q$. Upon adjacent pairs of these collector-rings bear pairs of brushes 7 7, which lead to the external circuits containing the translating devices, or sources of alternating electromotive force r. The direction of current in the armature-coils, for a given moment, is indicated by little arrows, and it will be observed that the outgoing terminals of the coils 2^a, 2^b, &c., are all directly connected by conductors 8^a, 8^b, &c., to the corresponding commutator segments 3^a, 3^b, &c., and by branch wires 9^a, 9^b, &c., to the collector-rings 6^a, 6^b, &c., while the incoming terminals of the same coils are directly connected with the collector-rings $6_1{}^a$, $6_1{}^b$, $6_1{}^c$, &c., by conductors $8_1{}^a$, $8_1{}^b$, $8_1{}^c$, &c. In this manner, there is placed in the external circuit of each armature coil-section a translating device, represented by the letter r, which, if the machine is used as a motor, may be either a separate generator or a generator-coil of an alternating-current machine.

While we have shown, by way of illustration and explanation of our invention, a two-polar machine, it will be readily understood that the machine may be multipolar; and while we have shown the armature as of the Gramme type, it will be readily understood that it may be of the Siemens or other equivalent type. Nor are we confined to the use of sixteen coil-sections in the armature, as shown, since any other suitable number will be within our invention.

The details of construction may also be varied in various ways without departing from our invention, so long as the fundamental principles of the same, as hereinbefore set forth, are observed.

Having now fully described our invention, we claim and desire to secure by Letters Patent—

1. A multiphase alternating-current machine composed of field-magnets of constant polarity, an armature having its coil-sections in a continuous series closed upon itself and

connected with the segments of a commutator; an external circuit derived from the commutator-brushes, and a series of external circuits, looped from and in series with the armature-coils, and each receiving or delivering alternating currents, substantially as described.

2. A generator of multiphase alternating currents, composed of a field magnet or magnets of constant polarity, an armature of the Gramme or Siemens type having its commutator-brushes short-circuited, and a number of external circuits, looped from and in series with the armature coil-sections, and each containing a translating device or devices, substantially as described.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

MAURICE HUTIN.
MAURICE LEBLANC.

Witnesses:
CLYDE SHROPSHIRE,
JULES ARMENGAUD.