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Patented Dec. 30, 1902.

E. ARNOLD, O. S. BRAGSTAD & J. L. LA COUR.  
METHOD OF GENERATING INDEPENDENT ELECTRIC CURRENTS.

(Application filed Jan. 13, 1902.)

(No Model.)

Fig. 1.

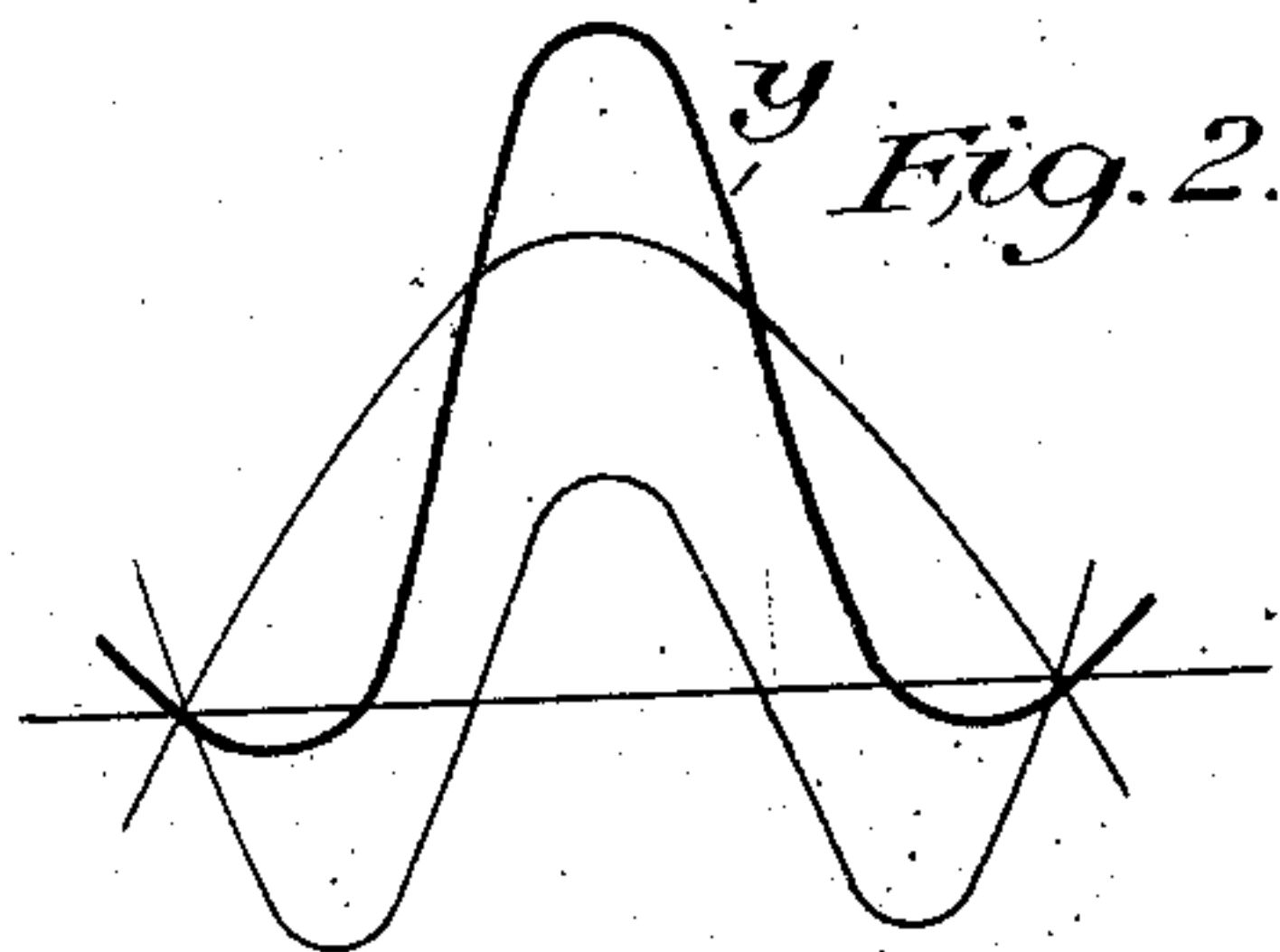
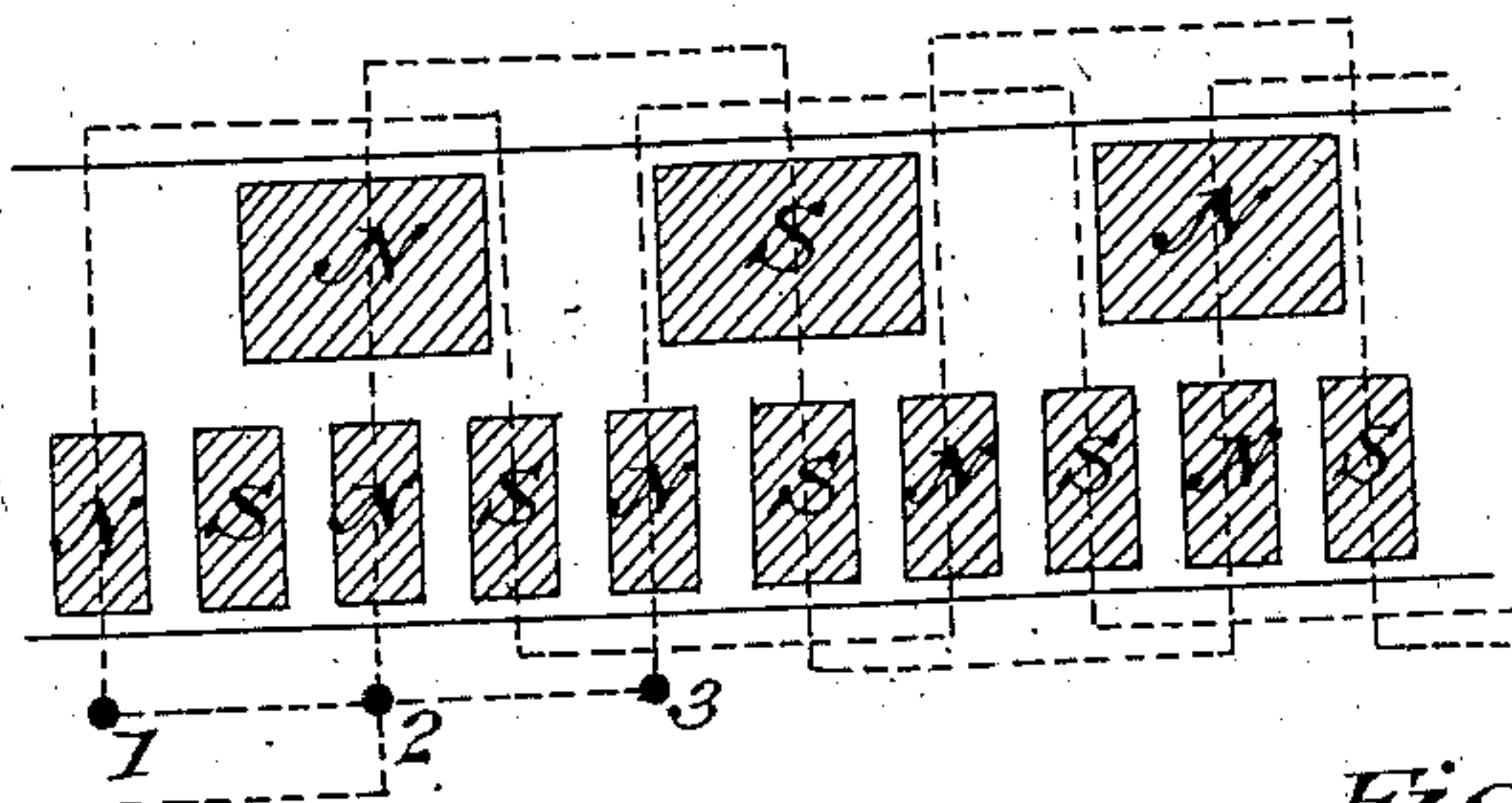


Fig. 3.

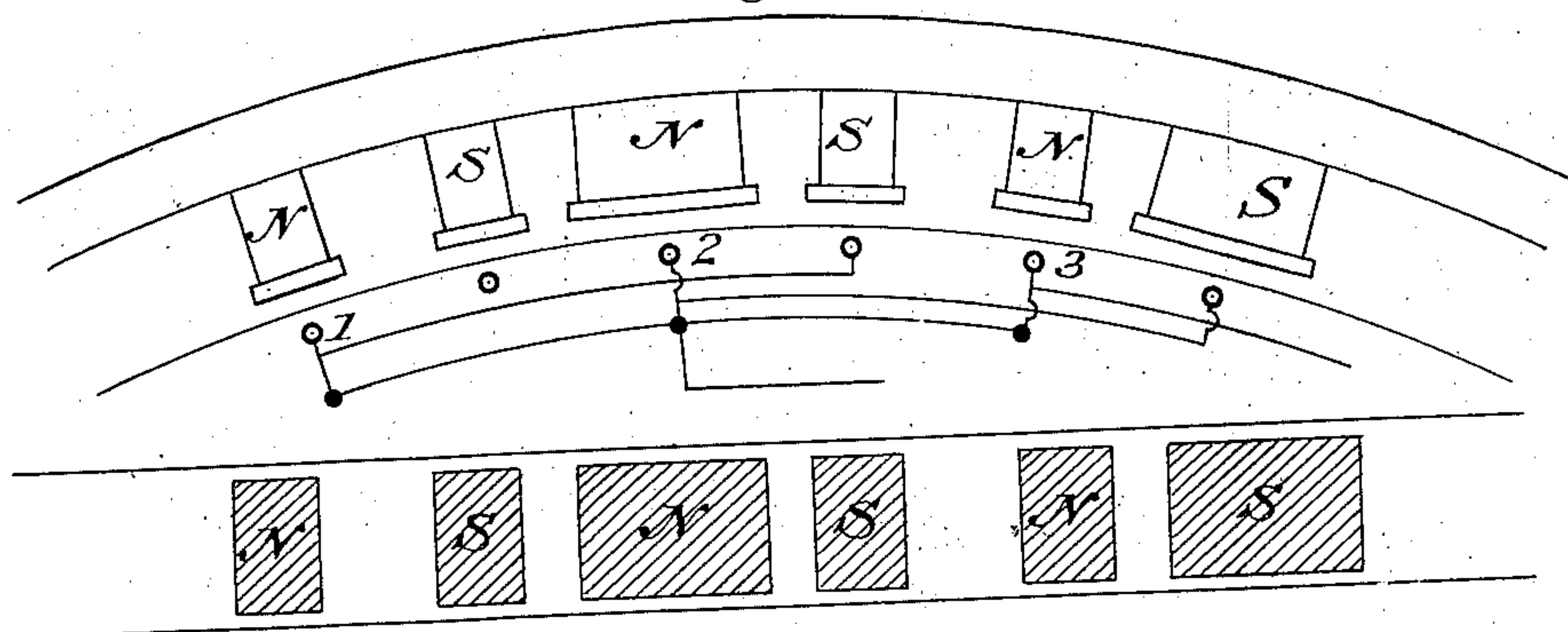


Fig. 4.

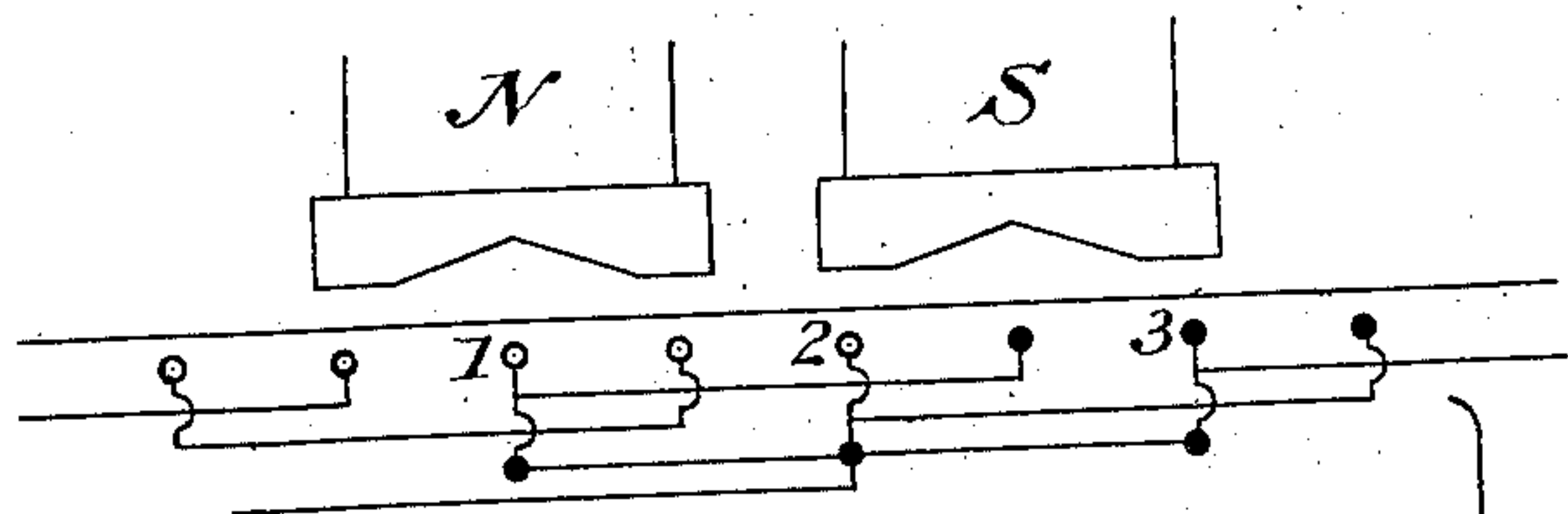
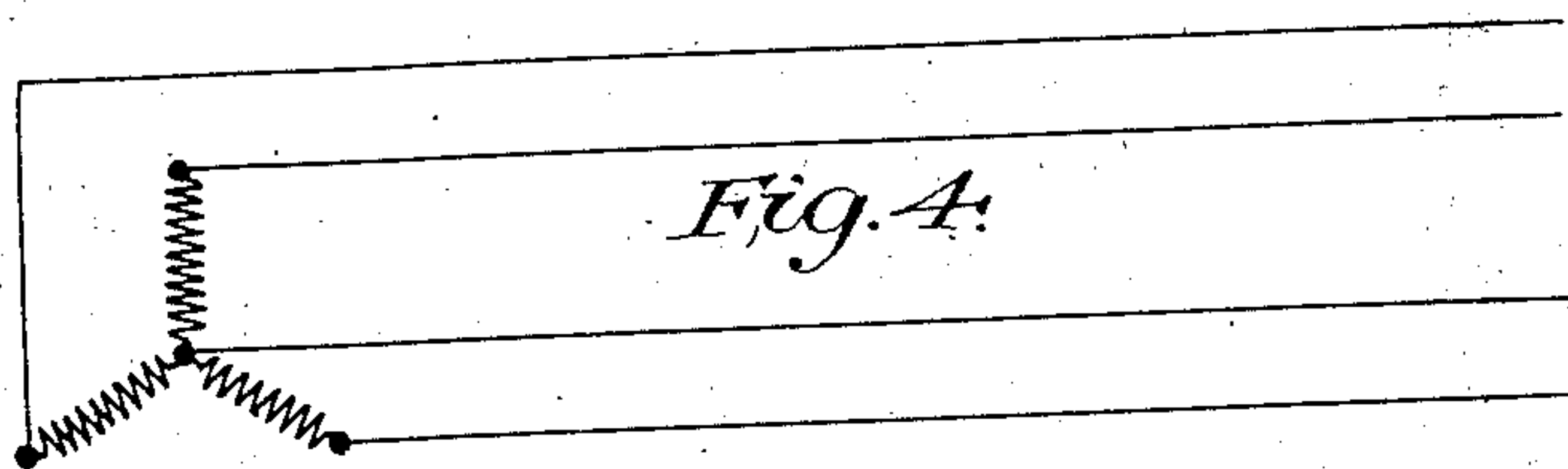
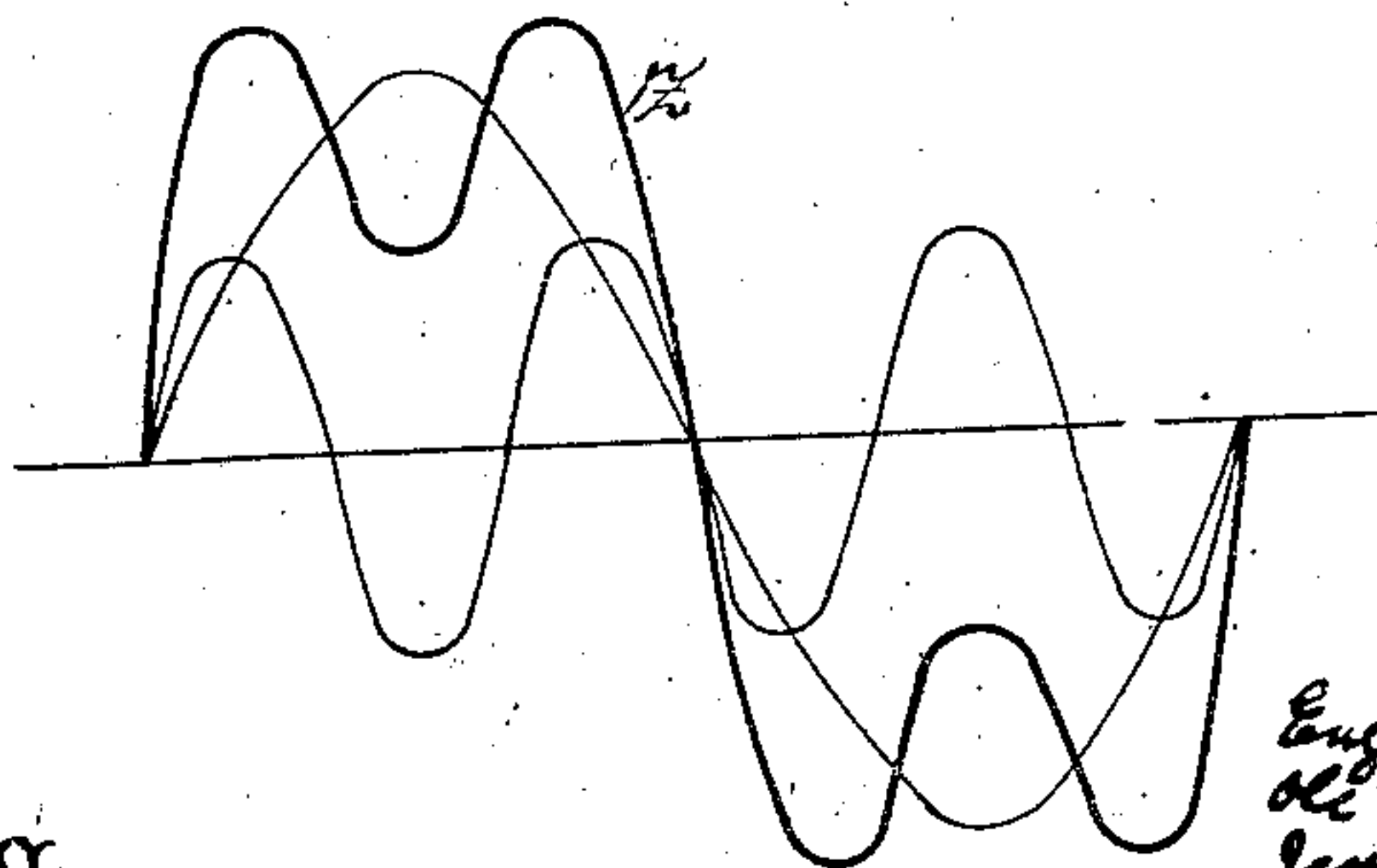


Fig. 5.



Witnesses:

Wm. Gillman, Jr.  
J. H. Hinkel

Inventors  
Eugene Arnold  
O. S. Bragstad  
J. L. La Cour

By Atty.

John S. Freeman



# UNITED STATES PATENT OFFICE.

ENGELBERT ARNOLD, OLE SIVERT BRAGSTAD, AND JENS LASSEN LA COUR,  
OF KARLSRUHE, GERMANY.

## METHOD OF GENERATING INDEPENDENT ELECTRIC CURRENTS.

SPECIFICATION forming part of Letters Patent No. 717,152, dated December 30, 1902.

Application filed January 13, 1902. Serial No. 89,555. (No model.)

*To all whom it may concern:*

Be it known that we, ENGELBERT ARNOLD, a subject of the Emperor of Germany, OLE SIVERT BRAGSTAD, a subject of the King of Sweden and Norway, and JENS LASSEN LA COUR, a subject of the King of Denmark, all residing at Karlsruhe, in the Grand Duchy of Baden, Germany, have invented certain new and useful Improvements in the Method of Generating Independent Electric Currents, of which the following is a specification.

A system of electrical distribution for simultaneous transmission of currents of different frequencies is protected by American Patents Nos. 645,907 and 647,741 to Frederick Bedell. The advantage of this superposing of currents of different character is thoroughly illustrated in our application for Patent, Serial No. 41,630, filed December 31, 1900; but this system of Bedell has the disadvantage that the introduced alternating currents sustain in the windings of the transformers or choking-coils a great drop of potential on account of self-induction.

The following-described method will obviate this disadvantage, because thereby electrical currents of different character are introduced in one and the same wire not by conduction, but by induction. This is accomplished by superposing magnetic fluxes in one and the same alternating-current armature. Moreover, the additional advantage is gained that the same generator-armature can be simultaneously employed for generating the superposed alternating current of different character.

Figure 1 is a diagrammatic representation of an embodiment of the invention. Fig. 2 is a diagram showing the wave. Fig. 3 is a diagrammatic representation of a modification of the invention. Fig. 4 is a diagram of the armature-coil connections and the generator of the form indicated in Fig. 3. Fig. 5 is a diagrammatic representation of another embodiment of the invention also showing the wave.

The principle of our invention, briefly put, consists in the simultaneous generation of alternating currents of different numbers of periods and phases by the use of generators with one or two primary inductive windings

and with only one induced (secondary) winding. Similarly, as in one and the same winding of a transformer two totally-independent electromotive forces of different frequencies by means of a suitable arrangement of two primary inductive windings can be induced, so it is also possible in the same armature-winding of an alternating-current generator by means of a proper arrangement of two systems of field excitation to induce independent polycyclic currents. The  $n$ -fold harmonics of an  $n$ -phase starsystem all flow similarly through all  $n$  phases from or to the neutral point, and therefore possess in relation to the fundamental wave the same properties as do the independent polycyclic currents in relation to each other. For that reason the triple harmonic of the main currents of a three-phase generator, for example, can be conveniently used as superposed current, because then the generating of both kinds of currents can occur in the same three-phase armature—that is to say, instead of only one pole system two such are employed, whereof one possesses threefold the number of poles of the second. These two pole systems, whose polarity is denoted by N and S, disposed as in Fig. 1, in juxtaposition on the same pole-wheel, can be excited independently or simultaneously, as in a homopolar (unipolar) generator. By this means, through superposition of the two induced electromotive forces, as in the arrangement shown in Fig. 2, the resulting wave  $y$ , Fig. 2, is obtained, which also would be yielded if the two pole fields were superposed one above the other, forasmuch as both pole systems are pushed one into another, so that every third pole of the system with threefold number of poles falls together with a main pole of the same polarity, as illustrated in Fig. 3. Fig. 4 shows the diagram of the armature-coil connections in the generator, Fig. 3. Through using the triple harmonics as superposed current in the manner indicated by Fig. 2 the maximum induction in the transformers is lessened by means of the superposed current, so that the hysteresis loss of the same will be lowered, although the total output is increased. It is possible, for example, to use twenty-five periods for driving motors and



about seventy-five periods for lighting. In this way the transformers will be correspondingly smaller and at the same time the motors can be better and more cheaply constructed.

5 Were the two pole systems thus superposed one above the other, as shown in Fig. 5, the corresponding field Z could be obtained with one pole system, suitable notches being placed in the middle of the broad pole-pieces.

10 If it be wished to use the double harmonic as superposed current above two-phase and four-phase main systems and in the same manner as the triple harmonic is superposed above three-phase and six-phase systems, such currents can also be generated in a single armature-winding; but this result can only be attained by specially-constructed coils which are wound previously on a former and then placed on the armature.

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20 What we claim as our invention, and desire to secure by Letters Patent, is—

In a system of electrical distribution for the simultaneous transmission of alternating electrical currents of different character, the method of the simultaneous generation of a polyphase and a single-phase current in one

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and the same armature-winding, whereby the single-phase current is of a frequency, which is a multiple of that of the polyphase current, and which is used as the superposed current, 30 which method consists in the operation of two pole systems on one armature, of which pole systems the first possesses a number of poles corresponding to the frequency of the polyphase current, while the second possesses 35 a number of poles corresponding to the frequency of the superposed current, which pole systems are so arranged relatively to each other, that in each phase of the armature electromotive forces are induced, which possess the same wave form, as if both pole systems were arranged side by side. 40

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ENGELBERT ARNOLD.  
OLE SIVERT BRAGSTAD.  
JENS LASSEN LA COUR.

Witnesses:

JACOB ADRIAN,  
H. W. HARRIS.