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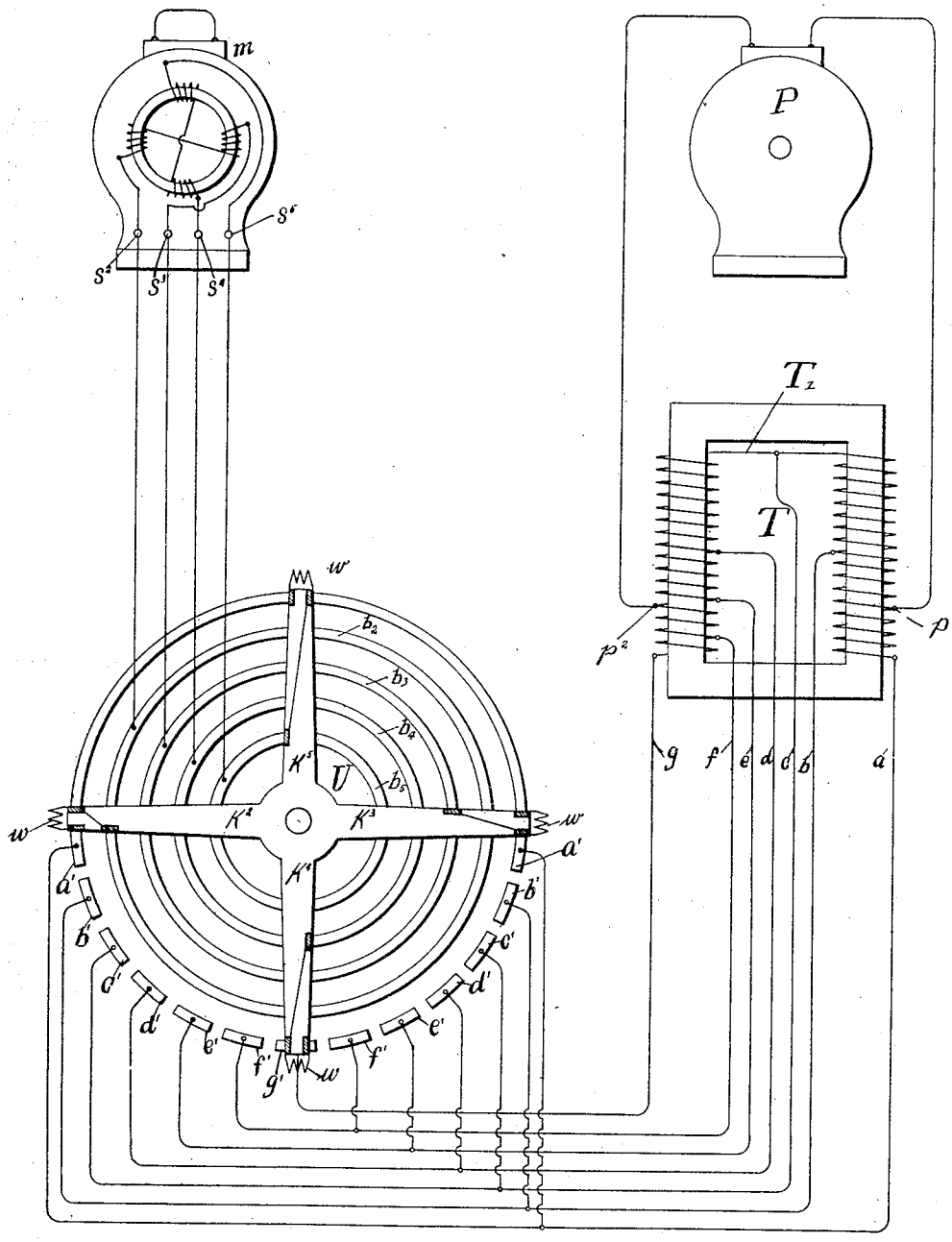
C. J. A. MICHALKE.

SYSTEM OF ELECTRIC DISTRIBUTION.

(Application filed Mar. 10, 1900.)

(No Model.)



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SYSTEM OF ELECTRIC DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 704,484, dated July 8, 1902.

Original application filed December 31, 1897, Serial No. 665,185. Divided and this application filed March 10, 1900. Serial No. 8,201. (No model.)

To all whom it may concern:

Be it known that I, CARL J. A. MICHALKE, a subject of the Emperor of Germany, residing at Charlottenburg, Germany, have invented a certain new and useful Improvement in Systems of Electrical Distribution, (Case No. 358,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to electrical systems of distribution, and has for its object to provide an improved means for transmitting synchronous motion from one point to another situated at a greater or less distance therefrom in such a manner that a determined movement at one point may be accurately reproduced at a distant point.

In application, Serial No. 665,184, filed December 31, 1897, I have shown a system for transmitting a synchronous motion over long distances in which dynamo-electric machines are used for both the transmitting and receiving devices, any movement of the transmitting device causing a corresponding movement of the movable element of the receiving device. In an application, Serial No. 665,185, filed December 31, 1897, I have likewise shown a system for accomplishing the same result; but in this system the transmitting device comprises a transforming device constituting a subdivided source of multiphase current, together with switching means interposed between the transforming device and the receiving device, the contacts of the switching means being arranged to so vary the connections between the subdivided source and the winding on one of the elements of the receiving device that the said receiving device will be caused to move by a predetermined amount whenever the contacts of the switching device are shifted.

In my present application I provide a system for the transmission of motion in which the number of transmission-conductors is greatly reduced below the number required in this system disclosed in my application No. 665,185. The transforming device and the switching means are also of an improved and simplified construction and their interconnections are greatly reduced.

Generally speaking, the system constituting my present invention comprises a receiving device one of the members of which is provided with a plurality of angularly-displaced windings and a subdivided source of single-phase current connected thereto through a switching means in such a manner that the rotation of the device constituting the switching means will cause the currents supplied to the angularly-displaced windings to be varied in such a manner as to produce a continuous progression of the magnetic field generated thereby. The switching means which I prefer to employ comprises a plurality of circular contact-rings, one of the rings being subdivided into sections and connected to the subdivided source, the remaining undivided rings being in electrical connection with the terminals of the angularly-displaced windings of the receiving device, the revolutions of which are to be governed through the agency of said switching means. The other member of the switching means consists of a rotatably-mounted spider carrying contacts adapted to connect the undivided rings in various combinations with the sections of the subdivided ring. The sections of the subdivided ring are united to corresponding points in the winding of the transforming device in such a manner that by a rotation of the spider the angularly-displaced windings of the receiving device will have inversely-varying electromotive forces impressed thereon, so that the phase of the field created thereby will be progressively shifted, the arrangement preferably being such that the total amount of power which the windings are capable of developing will be constant throughout all the positions of the switching means.

I will describe my invention more in detail by referring to the accompanying drawing, illustrating an embodiment thereof.

I have herein shown a single-phase source P, supplying current to the winding of a transformer T, the source being connected to the transformer-winding at the points p' p^2. I

have in this instance shown the transformer as constructed in the shape of a hollow rectangle; but, as is well understood, the same may be of any desired construction. The connections of the single-phase source to the winding of the transformer are made at points p' p^2 instead of at the terminals of the winding, so that an increased pressure may be obtained above that supplied by the single-phase source. The transformer is provided with a set of secondary terminals $a\ b\ c\ d\ e\ f\ g$, constituting a subdivided source of single-phase alternating current.

In connection with the transforming device I employ my improved switching means U, consisting of a plurality of circular contact-rings b_2 b_3 b_4 b_5 and another contact-ring a portion of which is divided into sections a' b' c' d' e' f' g', the said sections comprising one-half of the total circumference of the outer contact-ring and being connected, respectively, to the terminals $a\ b\ c\ d\ e\ f\ g$ of the transformer-winding T_1. Contact-rings b_2 b_3 b_4 b_5 are connected, respectively, to collector-terminals s^2 s^3 s^4 s^5 of a receiving device m, whose rotations are adapted to be governed by the said switching means U. To establish contact between the contact-rings b_2 b_3 b_4 b_5 and points of different potential along the periphery of the outer ring a', I employ a rotatably-mounted contact-spider provided with four arms k^2 k^3 k^4 k^5, the said arms supporting contacts upon the outer extremities thereof which are adapted to engage the ring a' and the sections thereof b' c' d' e' f' g', resistances w being provided, so that the circuit need not be broken in passing from section to section, as is well understood in the art. The contact upon the arm k^2 is in electrical connection with a circular contact-ring b_2, the contacts upon arms k^3 k^4 k^5 being also in electrical engagement with the circular contact-rings b_3 b_4 b_5, respectively. Opposite contact-arms support the contact-terminals for one of the windings of the receiving device. A second winding, in this instance shown as stationary, is provided upon the receiving device m, the said winding being preferably short-circuited.

The operation of the machine will now be understood. In the position shown in the drawing the sliding contact-terminals s^2 s^3 are not having any pressure impressed thereon, while the contact-terminals s^4 s^5 are having a maximum pressure impressed thereon equal to the tension between the terminals $a\ g$ of the transformer T. With the particular transformer shown the potential at these terminals is larger than the potential of the single-phase source. The current flowing in the winding connected to the contact-terminals s^4 s^5 creates in the movable member of the receiving device a field along a certain line or lines, and the reaction between this field and field due to the winding on the fixed member produces a movement in such a direction as will reduce the reaction to a minimum. In the particular arrangement illustrated the winding on the fixed member of the receiving device is short-circuited, and with such a winding the relative motion between the movable and the stationary parts of the receiving device will be of such a character as to bring the movable member into that position in which the least amount of current will be induced in the short-circuited winding. If now the contact-spider be moved until the contact-arm k^3 engages with the segment b' and the arm k^4 with the segment f', a potential equal to the potential between the terminal $a\ b$ will be impressed upon the winding connected to the terminal s^2 s^3 and the potential impressed upon the winding connected to the terminals s^4 s^5 will be slightly reduced. A resultant field will now be created in the movable member of the receiving device, which field will be displaced in position with the particular arrangement illustrated by the same angular amount as the angle of displacement of the contact-spider. The spacing of the terminals $a\ b\ c\ d\ e\ f\ g$ upon the transformer-winding is preferably so chosen that the magnitude of the resultant field developed by the angularly-displaced windings of the receiving device will always be the same irrespective of the position of the contact-spider. The field generated in the rotating member of the receiving device having been displaced by a certain amount, a relative motion will take place between the movable and the stationary parts until a minimum current again flows in the short-circuited winding, the movement of the rotating part of the receiving device therefore corresponding to the movement of the switch-arm. Any desired power may be exerted by the receiving device m, while the power necessary to operate the switching mechanism will be only that which is necessary to overcome the friction of the contact portions upon the contact-rings.

While I have herein shown and particularly described the preferred embodiment of my invention, I do not wish to limit myself to the precise arrangement shown, as modifications thereof may readily be made by those skilled in the art without departing from the spirit thereof; but,

Having thus described my invention, I claim as new, and desire to secure by Letters Patent, the following:

1. In combination, a dynamo-electric machine, one member of which is provided with a plurality of angularly-displaced windings, and means for inversely varying the supply of effective current from a single-phase source to said angularly-displaced windings.

2. In combination, a dynamo-electric machine, one member of which is provided with a plurality of angularly-displaced windings, the winding on the other member being adapted to be traversed by single-phase alternating currents, a subdivided source of single-phase alternating current, and a switching device interposed between said source and

said angularly-displaced windings, the switching device being constructed and arranged to inversely vary the potentials at the terminals of the said windings.

3. In combination, a dynamo-electric machine, one member of which is provided with a plurality of angularly-displaced windings, the winding on the other member being short-circuited, a subdivided source of single-phase alternating current, and a switching device constructed and arranged to supply current from said source to said windings in such a manner as to produce a progressive shifting of the field produced by said windings.

4. In combination, a dynamo-electric machine, one member of which is provided with a plurality of angularly-displaced windings, the winding on the other member being adapted to be traversed by single-phase alternating currents, a single-phase transforming device provided with a plurality of secondary terminals, and a switching device arranged to successively vary the connections between the terminals of the transforming device and the angularly-displaced windings of the receiving device in such a manner as to produce a progressive shifting of the field generated in the member on which the angularly-displaced windings are mounted.

5. In combination, a dynamo-electric machine, one member of which is provided with a plurality of angularly-displaced windings, the winding on the other member being adapted to be traversed by single-phase alternating currents, a subdivided source of single-phase alternating current provided with a plurality of terminal leads, and a switching device arranged to successively vary the connection between the said leads and the angularly-displaced windings of the receiving device in such a manner as to produce a successive shifting of the field generated in the member upon which the angularly-displaced windings are mounted.

6. In combination, a dynamo-electric machine, one member of which is provided with a plurality of angularly-displaced windings, the winding on the other member being adapted to be traversed by single-phase alternating currents, a subdivided source of single-phase alternating electromotive force, and a switching device comprising two relatively movable sets of contacts, the contacts of one set being connected to said subdivided source, and the contacts of the other set to the angularly-displaced windings of the receiving device.

7. In an alternating-current system of distribution, the combination with a source of current, of a single-phase transformer provided with a winding adapted to be connected to said source, a switching means provided with contact-terminals, said contact-terminals being in electrical engagement with points of different potential upon the winding of the said transformer, a dynamo-electric machine, one of the members of which is provided with a plurality of angularly-displaced windings, and means for interconnecting the said windings with different contact-terminals of the said switching means, substantially as described.

8. In a system of distribution, the combination with a source of alternating current, of a single-phase transformer-winding, said winding being adapted for inclusion in circuit with the said source, contact-terminals, said contact-terminals being in electrical engagement with points of different potential upon the said winding, a dynamo-electric machine, one of the members of which is provided with a plurality of angularly-displaced windings, the other member being provided with a short-circuited winding, and means for interconnecting the said angularly-displaced windings with the said contact-terminals, substantially as described.

In witness whereof I hereunto subscribe my name this 14th day of February, A. D. 1900.

CARL J. A. MICHALKE.

Witnesses:
WOLDEMAR HAUPT,
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