L. W. CHUBB.

VENTILATING MEANS FOR REACTANCE COILS.

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1,236,675. Patented Aug. 14, 1917.

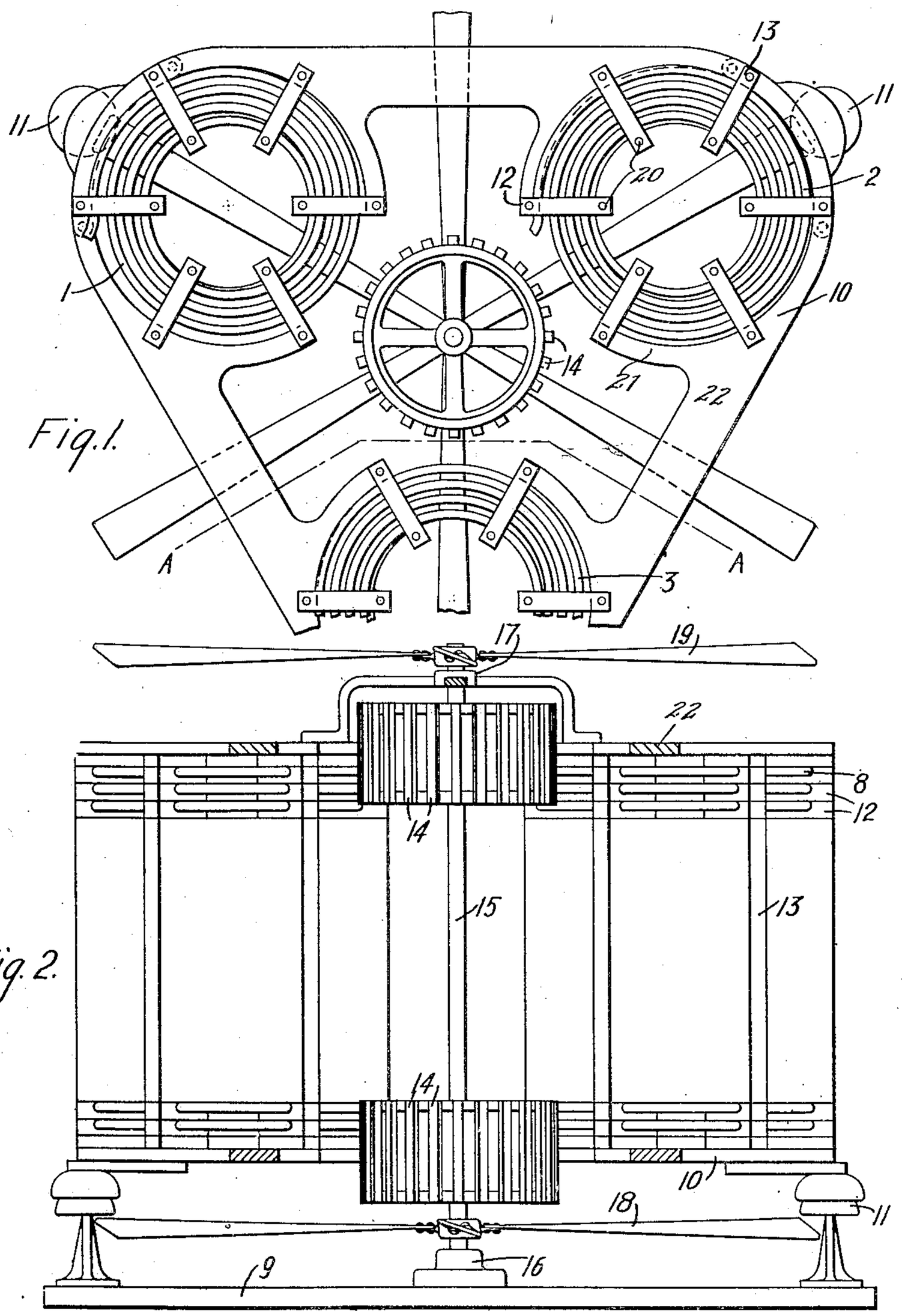
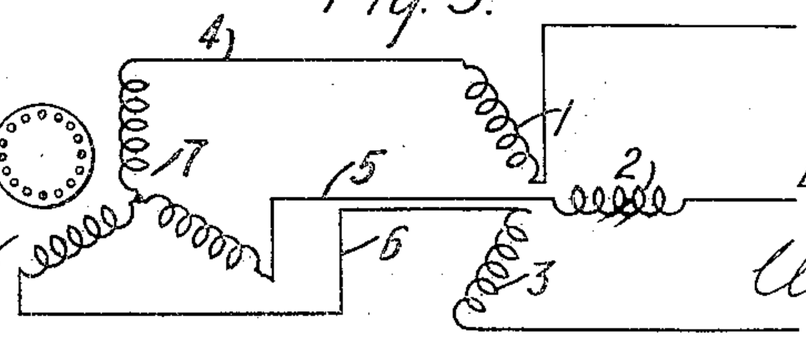


Fig. 1.

Fig. 2.

Fig. 3.



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VENTILATING MEANS FOR REACTANCE-COILS.

1,236,675. Specification of Letters Patent. Patented Aug. 14, 1917.

Application filed May 14, 1915. Serial No. 28,229.

To all whom it may concern:

Be it known that I, LEWIS W. CHUBB, a citizen of the United States, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Ventilating Means for Reactance-Coils, of which the following is a specification.

My invention relates to current-limiting reactance coils, and it has special reference to means for ventilating reactance coils of the above-mentioned character which are inserted in polyphase circuits to limit to safe values the abnormal current flow therein arising from short circuits and other abnormal conditions.

It is usual to insert current-limiting reactance coils in the conductors comprising a polyphase power system, the several coils being arranged in straight-line formation in order to minimize and balance the mutual inductive effects between the coils during the existence of short circuits and heavy overloads upon the system. Reactance coils, as commonly used, are devoid of iron core members, and comprise copper conductors or strands which are spaced from one another in order to provide an open construction for ventilating purposes. Inasmuch as the currents flowing through power limiting reactance coils are usually high in value, the magnetic fields arising therefrom are appreciable. Since it is usually uneconomical to provide a separate cooling system for power limiting reactance coils, it has heretofore been necessary to make them of large size in order to have normal heat radiating capacities that are sufficient to preclude dangerous temperature rises in the coils. They have, accordingly, occupied a large amount of space and have been expensive to manufacture and use.

By means of my invention, the individual current-limiting reactance coils of a polyphase system are ventilated by automatic means which is operated by reason of the joint or resultant magnetic field generated by the flow of the line currents through the coils. In utilizing my invention, the several coils inserted in the system are so disposed with respect to one another that the mutual inductive effects between the coils during short circuits and heavy overloads are substantially balanced. Again, the magnetic-fields arising from the currents flowing through these reactance coils are so utilized as to produce a resultant rotating field by means of which a fluid propeller may be operated for cooling simultaneously all of such coils embodied in this arrangement.

Inasmuch as my invention provides an automatic means for ventilating and cooling the current limiting reactance coils inserted in a polyphase system, the size of the conductors comprising the coils may be substantially decreased because of the increased heat-radiating capacity of each coil. As a result of the decreased size of the conductors, as above mentioned, reactance coils embodying my invention will occupy less floor space than heretofore when inserted in polyphase circuits. The increased power consumption resulting from the joint utilization of the magnetic fields arising from these several power limiting reactance coils, will be usually inconsiderable. Again, it will be unnecessary to rely upon an operator to attend to the ventilation of the current-limiting reactance coils, because the cooling system embodied in my invention will operate automatically and require very little attention.

In order to understand my invention more fully, reference may be had to the following description and the accompanying drawing in which Figure 1 is a plan view of a portion of a current-limiting reactance coil arrangement embodying a form of my invention; Fig. 2 is a view, partially in elevation and partially in section, of the device shown in Fig. 1, and Fig. 3 is a diagrammatic representation of a polyphase system showing my method of arranging current-limiting reactance coils in the line conductors comprising the system.

To illustrate my invention, I have employed a three-phase current-limiting reactance coil, and, throughout the specification, my description is limited to a three-phase distributing system. It will be understood, however, that my invention is applicable to a two-phase system, a four-phase system, a six-phase system, etc., the several current-limiting reactance coils connected to the line conductors of these systems being so disposed with respect to one another that a rotating magnetic field is produced which may be utilized to operate various kinds of fluid propellers for cooling the several coils.

It being understood, as mentioned above,

that the present description is limited to three-phase systems, reference may be had to the drawing in which reactance coils 1, 2 and 3 are so disposed with respect to one another that a rotating magnetic field is produced when three-phase currents traverse the coils. The particular arrangement of the current-limiting reactance coils 1, 2 and 3 is shown in Figs. 1 and 3, the reactance coil 1 being inserted in series circuit with a line conductor 4, the reactance coil 2 being inserted in series circuit with a line conductor 5, and the reactance coil 3 being inserted in series circuit with a line conductor 6. The line conductors 4, 5 and 6 comprise a distributing system which is furnished electric power from a three-phase alternator 7. The coils 1, 2 and 3 are symmetrically disposed about a common point and are represented diagrammatically in Fig. 3 as being displaced 120 mechanical degrees from one another.

In order to generate a revolving magnetic field which may be utilized for actuating the fluid propeller to be hereinafter mentioned, the three reactance coils 1, 2 and 3 are so disposed that their centers coincide with the vertices of an equiangular triangle. Each of the reactance coils 1, 2 and 3 comprises a group of flat parallel spirals 8 (shown in Fig. 1) that are superposed upon, and spaced from, one another substantially as shown in Fig. 2. Each spiral comprises a plurality of convolutions.

The coils 1, 2 and 3 are supported upon a common platform 9 to which is secured a triangular-shaped lower supporting member 10 that is insulated from the platform 9 by means of insulating supports 11. Built-up columns 12 of cleats 13, which space the conductor convolutions from one another, are secured to the lower supporting member 10 by means of tie-rods 20 that engage the peripheral walls of recessed portions 21 formed therein and similar recessed portions formed in a corresponding upper supporting member 22. In this manner, the copper strands comprising the coils are firmly supported and insure rigidity to the coil structure. It will be noted that the coils 1, 2 and 3 are spaced from one another to provide for the admission of secondary elements or short-circuited secondary windings 14. The elements 14 are shown as squirrel cage rotors that are devoid of all iron structures and core members, and are mounted upon the ends of a common centrally-disposed shaft 15. The squirrel cage rotors 14 may project a short distance within the space between the coils 1, 2 and 3, as shown in Fig. 2. The shaft 15 engages a lower bearing 16, that is mounted upon the lower platform 9, and an upper bearing 17 that is supported by the upper supporting member 22. Adjacent to each of the bearings 16 and 17 fluid propellers or fan members 18 and 19, respectively, are disposed. These fans are so constructed that their blades extend entirely across each of the reactance coils 1, 2 and 3 in order to insure the circulation of adequate air currents through the coils.

When the coils 1, 2 and 3 are connected in the three phase circuit, as shown in Fig. 3, the polyphase currents flowing through these coils will generate a rotating magnetic field within the space occupied by the squirrel-cage rotors 14. As a consequence, the secondary currents induced in the rotors 14 will cause them to rotate. Inasmuch as the fan members 18 and 19 are rigidly secured to the rotatable shaft 15 to which the squirrel cage rotors 14 are secured, the said fan members will set up circulating air currents which will flow through the open spaces provided in the reactance coils 1, 2 and 3. As mentioned above, the heat-radiating capacity of the coils is substantially increased by reason of the increased flow of cooling air currents through the coils.

While I have shown fluid propellers as the fan elements 18 and 19, it will be understood that other devices which are effective in cooling the coils 1, 2 and 3 may be utilized, the power necessary for operating such devices being derived through secondary elements 14 that, in turn, are actuated by reason of the rotating magnetic field generated by the polyphase currents flowing through the symmetrically-disposed current-limiting reactance coils 1, 2 and 3.

While I have herein shown and described an embodiment of my invention, it will be understood by those skilled in the art that many modifications may be made without departing from the spirit of the appended claims.

I claim as my invention:

1. The combination with a plurality of reactance coils symmetrically arranged about a common point, and means for supplying polyphase currents to said coils, of a squirrel-cage rotor disposed in the rotating magnetic field that is generated by the currents flowing through the reactance coils, and an air propeller attached to said rotor for directing air currents on said coils.

2. The combination with a plurality of reactance coils symmetrically arranged about a common point, and means for supplying polyphase currents to said coils, of a short-circuited secondary element disposed in the rotating magnetic field arising from the currents flowing through the reactance coils, and a fluid propeller attached to said secondary element for cooling the reactance coils.

3. The combination with a plurality of symmetrically-disposed reactance coils which are supplied with polyphase currents, of a rotatable secondary element disposed in the

rotating magnetic field arising from the currents flowing through the reactance coils, and a fluid propeller attached to said secondary element for cooling said current-limiting reactance coils.

4. The combination with a plurality of current-limiting reactance coils severally connected in series relationship with the line conductors of a polyphase system, said reactance coils being symmetrically disposed about a common point, of a rotatable secondary element under the influence of the resultant magnetic field arising from the currents flowing through the reactance coils, and means driven by said secondary element for cooling the several current-limiting reactance coils.

5. The combination with three current-limiting reactance coils severally connected in series relationship with line conductors of a three-phase system and triangularly disposed so as to generate a resultant rotating magnetic field when alternating currents flow therethrough, of a rotatable secondary element disposed in said rotating magnetic field, and a fluid propeller attached to said secondary element for cooling the several current-limiting reactance coils.

6. The combination with three current-limiting reactance coils severally connected in series relationship with line conductors of a three-phase system and symmetrically disposed about a common point, of a rotatable secondary element under the influence of the resultant magnetic field arising from the current flowing through the reactance coils, and a fluid propeller attached to said secondary element for cooling the current-limiting reactance coils.

In testimony whereof, I have hereunto subscribed my name this 30th day of April 1915.

LEWIS W. CHUBB.