Oct. 28, 1924. 1,513,340

D. F. MINER

BUS-BAR STRUCTURE

Filed Sept. 24, 1920

Fig. 1.

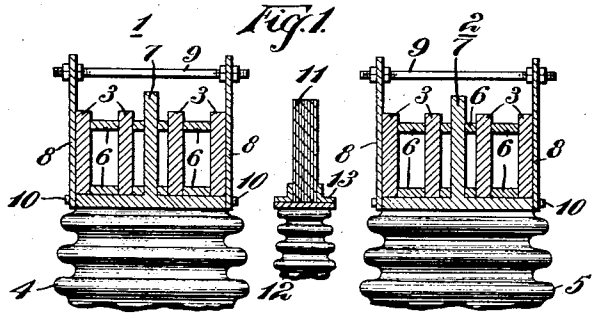


Fig. 2.

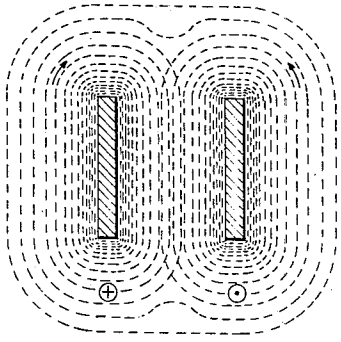


Fig. 3.

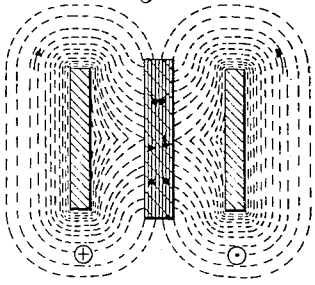
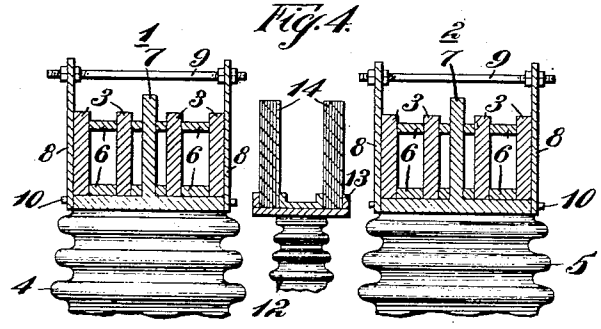


Fig. 4.



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Patented Oct. 28, 1924. 1,513,340

UNITED STATES PATENT OFFICE.

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BUS-BAR STRUCTURE.

Application filed September 24, 1920. Serial No. 412,530.

To all whom it may concern:

Be it known that I, DOUGLAS F. MINER, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Bus-Bar Structures, of which the following is a specification.

My invention relates to electrical conductors and particularly to parallel inductively related conductors such as bus-bars.

The object of my invention is to so modify the effects of mutual induction between a plurality of parallel conductors as to eliminate undue heating in the conductors and permit the same to be utilized more effectively and economically.

Where both lines of an alternating-current circuit, such as in bus-bar structures, comprise composite conductors disposed adjacent to each other, there is a relatively great mutual inductive effect. The effect upon the adjacent or inner component conductors of the composite conductors is to reduce the reactance thereof caused by the neutralizing fields of the conductors of opposite polarity. Because of the decreased reactance, more current flows through the adjacent conductors of the composite conductors than the others, with the result that they heat by greater amounts than the remaining component conductors. Also, the component conductors of the respective composite conductors decrease in heating characteristics in proportion to the distance between them. Thus, as the neutralizing effect of the fields of the composite conductors of opposite polarity decreases the reactance, the current increases and the most remote component conductors carry less current and operate at the lowest temperatures. This prevents the utilization of all of the conductors at their maximum efficiency, because the value of the total current is limited by the temperature of the hottest conductor. Therefore, only one component bar of each composite conductor is utilized at its maximum efficiency while the others are carrying less current than their capacities warrant for a temperature rise equivalent to that of the hottest bar.

In practicing my invention, I place a magnetizable member or members between, and in parallel relation to, parallel inductively related conductors of opposite polarity to divert and separate the flux lines of their respective fields and to thereby eliminate the neutralizing effect thereof. Thus, a more equal distribution of current between the conductors and a reduction in the heating characteristics of the adjacent component conductors of the composite conductors is effected. By reason of the uniform distribution of current thus effected, the watt loss, which is in proportion to the square of the current in each conductor, is equalized. Thus, the total watt loss of the combined conductors is reduced in accordance with well known principles.

In my copending application, Serial No. 412,531, filed Sept. 24, 1920, is disclosed a structure for accomplishing results similar to those herein set forth by having the conductors of special forms and relations instead of by associating a magnetizable member with the conductor. Other devices appertaining to the distribution of current in conductors are set forth in my copending applications, Serial No. 410,896, filed Sept. 24, 1920, and Serial No. 412,529, filed Sept. 24, 1920, and in a copending application of C. F. Wagner, Serial No. 412,461, filed Sept. 24, 1920, and assigned to the Westinghouse Electric & Manufacturing Company.

Figure 1 of the accompanying drawings is a diagrammatic view, partially in elevation and partially in section, of a portion of a bus-bar structure embodying my invention, as viewed in the direction of the bus-bars.

Figs. 2 and 3 are similar diagrammatic views showing the magnetic fields of inductively related bus-bars as usually employed and as employed in accordance with my invention, respectively, and

Fig. 4 is a view, similar to Fig. 1, of a modified form of my invention.

In Fig. 1, two adjacent groups 1 and 2 of bus-bars 3 are mounted on insulators 4 and 5, respectively, and disposed in parallel relation with respect to each other. Each group constitutes a composite conductor employed as one conductor of an alternating-current circuit.

The several bus-bars 3 of each group may be spaced apart by members 6 and mounted in pairs on opposite sides of the central leg of a member 7 of substantially inverted T-shape to which they may be secured, as by plates 8, bolts 9 and screws 10.

A magnetizable member 11, preferably constructed of laminated iron or steel and of rectangular cross-sectional area, is supported intermediate the groups 1 and 2 in any suitable manner, as by being secured to an insulator 12 by metallic members 13, and extends parallel to the bus-bars 3 substantially throughout the length of the latter.

The effect of the above arrangement is somewhat as illustrated in Fig. 3 where, for simplicity, single bus-bars are employed to represent the groups 1 and 2. This effect is to form a path of low reluctance between the respective groups in contra-distinction to the usual method of mounting bus-bars, illustrated in Fig. 2. In the latter form, some of the magnetic flux encircles both groups of conductors and distorts and partially neutralizes the field, causing a reduction of the reactance of the adjacent or inner bars 3 of the respective groups 1 and 2. These conductors, therefore, carry more current than the others and consequently are heated to higher temperatures than the others. With the bus-bars and the magnetizable member 11 arranged in accordance with my invention, a low reluctance path is offered to the flux of each group of bus-bars so that very little flux encircles the two groups, and the field neutralizing effect is eliminated. By reason of this effect a better distribution of current is attained tending to equalize the heating and to render the whole structure more effective and economical in the manner previously defined.

In Fig. 4, in which similar parts are designated by similar reference numerals, instead of the single magnetizable member 11, a pair of spaced parallel magnetizable members 14 are similarly related to the bus-bars.

This arrangement separates the magnetic fields of the respective groups of bus-bars by a greater distance. In fact, the number of the groups of bus-bars and magnetizable members and the proportions of copper and iron therein may be variously modified to obtain any desired distribution of the magnetic field in accordance with the existing conditions.

While I have shown and described particular forms of my invention, changes may be effected therein, without departing from the spirit and scope thereof, as set forth in the appended claims.

I claim as my invention:

1. The combination with a plurality of inductively related groups of conductors of opposite polarity, each of which contains a plurality of separate conductors connected in parallel and adapted to be individually effected by the flux fields of the group of opposite polarity, of a magnetic means disposed between the groups for localizing the flux field of the groups.

2. The combination with a plurality of inductively related groups of conductors of opposite polarity, each of which contains a plurality of separate conductors connected in parallel and adapted to be individually effected by the flux fields of the group of opposite polarity, of a magnetizable bar disposed between the groups and extending substantially the full length of the conductors for reducing the inductive effects of the field of one group upon the conductors of the other group.

3. In a bus-bar structure, the combination with a plurality of inductively related groups of bus-bars of opposite polarity, each of which comprises a plurality of spaced parallel extending bus-bars, of a magnetizable bar disposed between the groups for providing a low reluctance path between the groups tending to localize the fields thereof.

4. In a bus-bar structure, the combination with a plurality of inductively related groups of bus-bars of opposite polarity, each of which comprises a plurality of spaced parallel extending bus-bars, of a pair of magnetizable bars spaced apart and disposed between the groups for providing low reluctance paths between the groups tending to localize the fields thereof.

In testimony whereof, I have hereunto subscribed my name this 17th day of September, 1920.

DOUGLAS F. MINER.