

April 27, 1926.

1,582,850

D. F. MINER
BUS BAR STRUCTURE
Filed Sept. 24, 1920

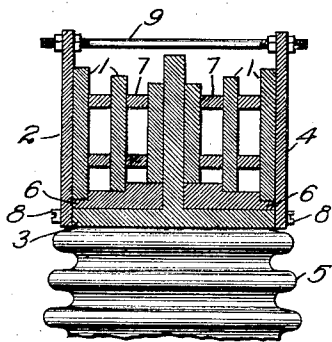


Fig. 1.

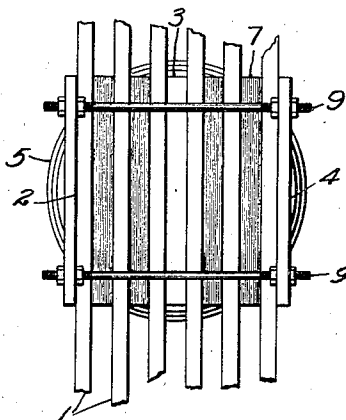


Fig. 2.

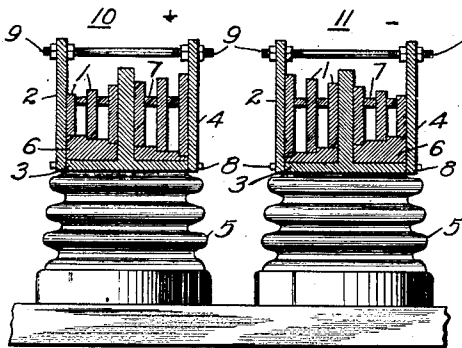


Fig. 3.

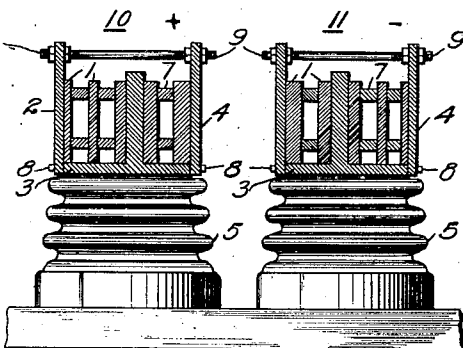


Fig. 4.

WITNESSES:

A. L. Jeffery
J. Miller

INVENTOR

Douglas F. Miner

BY

Wesley E. Carr

ATTORNEY

UNITED STATES PATENT OFFICE.

DOUGLAS F. MINER, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

BUS-BAR STRUCTURE.

Application filed September 24, 1920. Serial No. 412,531.

To all whom it may concern:

Be it known that I, DOUGLAS F. MINER, a citizen of the United States, and a resident of Wilkesburg, 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-related conductors, such as bus-bars.

The object of my invention is to provide means for balancing or equalizing the currents in parallel-related conductors.

In composite conductors comprising a plurality of parallel-connected component conductors, such as bus-bars for alternating-current circuits, it is well known that the inner component conductor or conductors are cut by a larger number of magnetic flux lines than the outer conductors. The inner conductors, therefore, have a greater reactance and, since the same potential exists between the ends of all the conductors, the current is greater in the outer conductors. It is also well known that adjacent groups of said conductors of opposite polarity also have mutual inductive effects on each other, causing the more closely related component conductors of the respective groups or composite conductors to carry a greater current than the more remote conductors thereof because of a reduction in impedance caused by the neutralizing fields of the conductors of opposite polarity. Both of these conditions are undesirable, inasmuch as they prevent the utilization of all of the conductors at their maximum efficiency.

In practicing my invention, I proportion the cross-sectional area of the individual members of an isolated group of parallel-connected conductors in accordance with the amount of current carried by each bar determined by the reactance thereof, thus utilizing substantially all of the material of each conductor to its maximum capacity for a given temperature rise and economizing in material.

Where two or more groups of said conductors of opposite polarity are subjected to the inductive effect of each other, the conductors are similarly proportioned to distribute the material in accordance with the different amounts of current carried by the bars.

In my copending application, Serial No. 412,530, filed Sept. 24, 1920, is disclosed a structure for accomplishing results similar to those herein set forth by associating a magnetizable member with the conductors instead of by having the conductors of special forms and relations. Other devices appertaining to the distribution of current in conductors are set forth in my copending applications, Serial No. 412,529, filed Sept. 24, 1920, and Serial No. 410,896, filed Sept. 17, 1920, and in a copending application of C. F. Wagner, Serial No. 418,461, filed Sept. 24, 1920, and assigned to the Westinghouse Electric & Manufacturing Company.

Figure 1 of the accompanying drawings is an end view, partially in elevation and partially in section, of a portion of a bus-bar structure embodying my invention.

Fig. 2 is a plan view of the device shown in Fig. 1.

Figs. 3 and 4 are diagrammatic end views, partially in elevation and partially in section, of modified forms of my invention for use in connection with adjacent groups of conductors.

In Figs. 1 and 2, a plurality of component bus-bars 1, constituting a composite conductor, are supported by metal clamping members 2, 3 and 4 at the outer end of an insulator 5. The bus-bars 1 are of usual strap formation, and are of gradually decreasing widths from the outer to the inner thereof. The bars 1 may be positioned by suitably formed members 6, having outer surfaces disposed at different levels to accommodate the respective bars and may be spaced apart by members 7. Screws 8 and bolts 9 serve to hold the bars 1 and the spacing members 7 together.

In a bus-bar structure of usual form where all of the component bars are of the same cross-sectional area, the skin effect of alternating current causes the central bars to carry a small portion of the current and the outer bars a correspondingly greater portion. Therefore, the outer bars become hottest and constitute the limiting feature of the capacity of the group of bars. By proportioning the bars, so that the cross-sectional areas thereof increase from the inner base toward the outer base as in Figs. 1 and 2, in accordance with the current distribution, an effective and economical structure is obtained.

In Fig. 3, instead of grading the bus-bars as in Fig. 1, two groups of conductors or bus-bars 10 and 11 of opposite polarity are graded in accordance with the mutual effects of induction between the two groups. Since in two such groups of usual bus-bars, the adjacent bars of the respective groups become the hottest, proportioning the bars so that the cross-sectional areas thereof decrease toward the outer bars of each group as in Figs. 3 and 4 provides a construction wherein the conducting metal is distributed substantially in proportion to the current carried by the respective bars. The amount of material necessary to carry the total current with a substantially uniform temperature rise in each bar or conductor is therefore reduced.

In Fig. 4, the bus-bars have been graded by varying the thickness thereof.

Since the inner bars of a single isolated group of bus-bars normally carry less current than the outer bars and the adjacent bars of two groups of bus-bars of opposite polarity carry more current than the remote bars, the cross-sectional area of each bar may be proportioned in accordance with the current distribution caused by the resultant action of the different flux lines in the combined system of bars. Bus-bars may thus be designed having a minimum amount of material for carrying a given current with a predetermined current rise.

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. In combination in a circuit system, a plurality of inductively related conductors of different cross-sectional area arranged with the conductors having the least cross-sectional area disposed adjacent the region of greatest flux density of the system.

2. In combination in a circuit system, a plurality of inductively related conductors of different cross-sectional area so arranged with respect to the fields of associated conductors that the current in said conductors is distributed in substantial accordance with their capacity to carry the current with a predetermined temperature rise.

3. In combination in a circuit system, a plurality of spaced parallel inductively related conductors disposed in predetermined relative positions and having current-carrying capacities, for a predetermined temperature rise, substantially corresponding to the amount of current flowing therein and determined by their respective positions in the field of the system.

In testimony whereof, I have hereunto subscribed my name this 11th day of September 1920.

DOUGLAS F. MINER.