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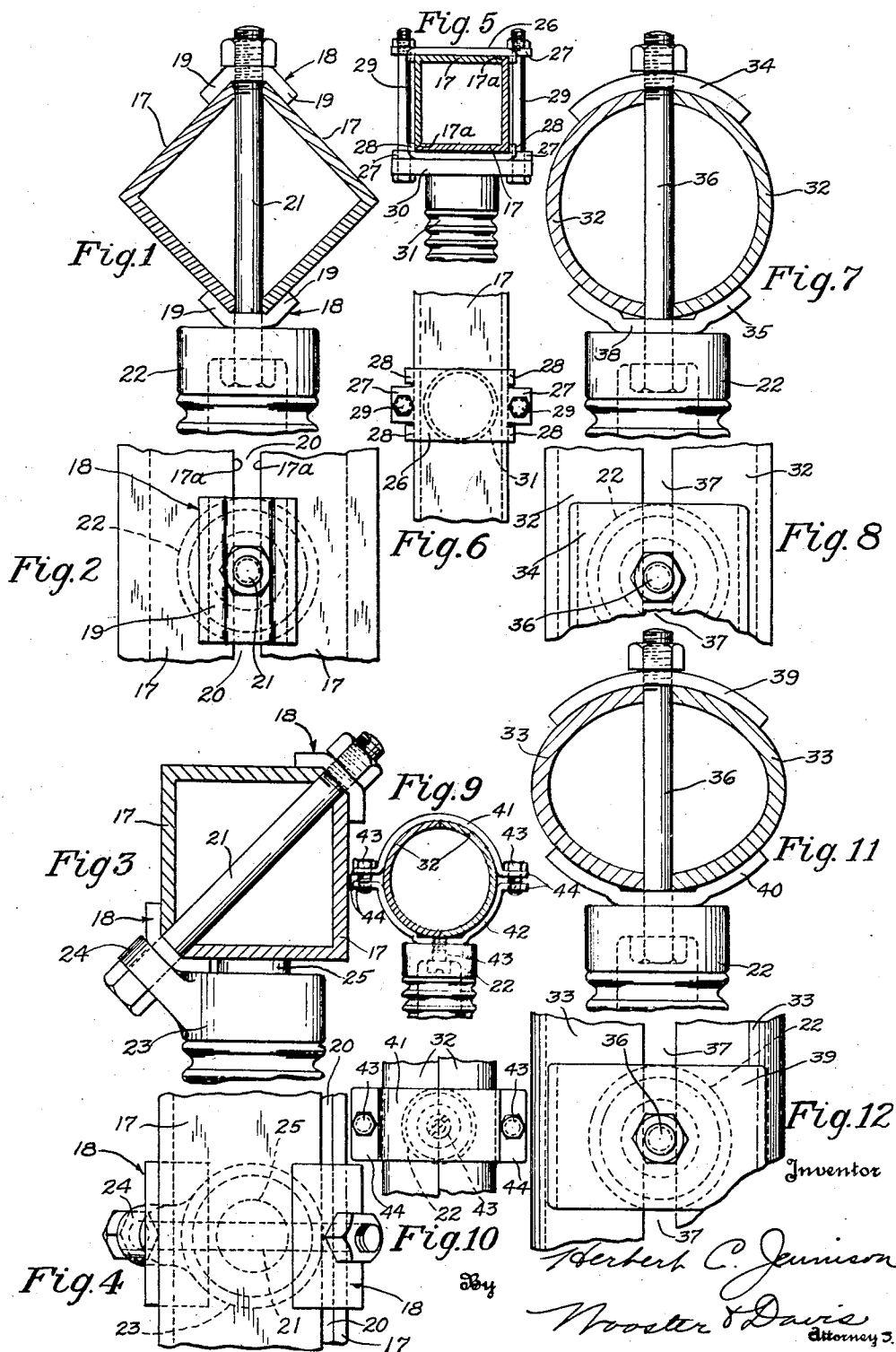
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2,053,561

BUS OR CONDUCTOR FOR ELECTRICAL CURRENTS

Filed Aug. 11, 1932

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

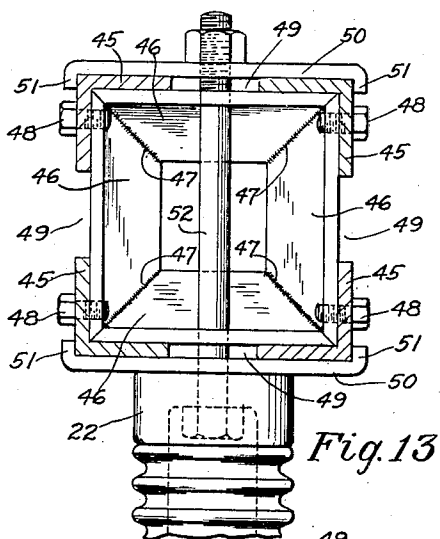


Fig. 13

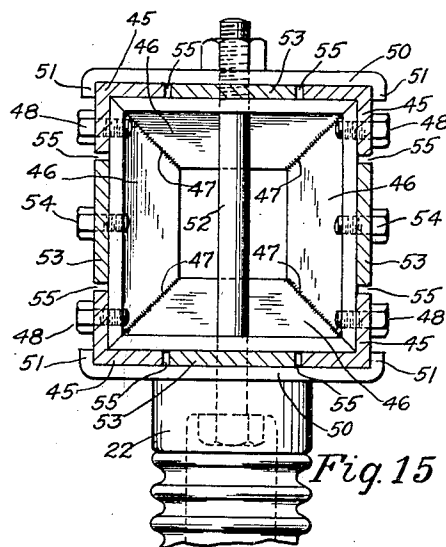


Fig. 15

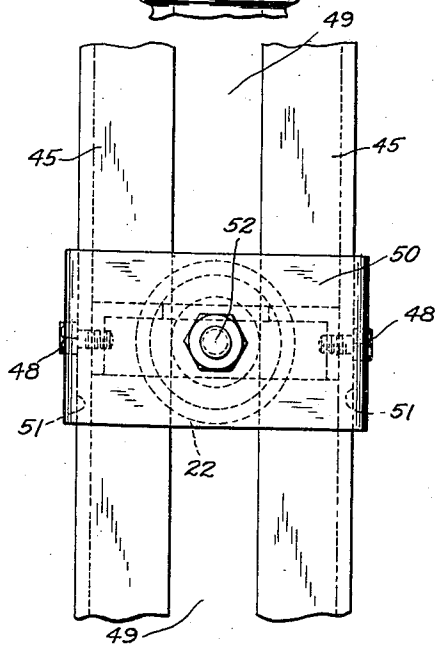


Fig. 14

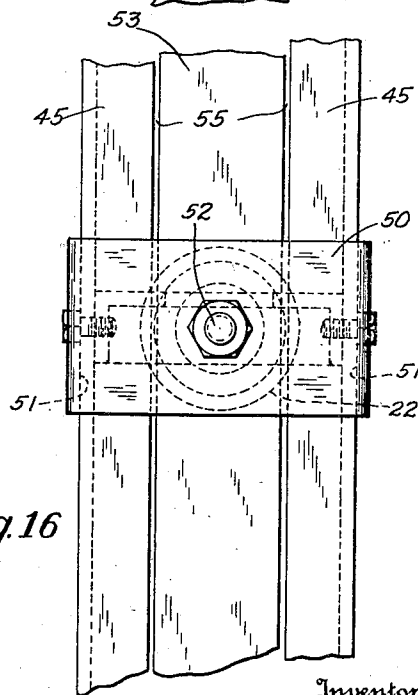


Fig. 16

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UNITED STATES PATENT OFFICE

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BUS OR CONDUCTOR FOR ELECTRICAL CURRENTS

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4 Claims. (Cl. 172-13)

This invention relates to busses or conductors for electric currents, and more particularly to busses or conductors for carrying heavy alternating currents, although of course they are also adapted for direct current, and has for an object to provide an improved built up conductor which is strong and rigid, and therefore requires a minimum number of supports in the mounting, which may be ventilated to prevent overheating and permit carrying of maximum current for a given amount of metal, and a particular object of the invention is to provide a conductor in which the so-called skin effect of alternating currents is reduced to a minimum so that the conductors may carry the maximum alternating current.

Another object is to provide a construction by which large effective conductors can be manufactured from the use of simple sections, which may be rolled, extruded, bent or drawn by the ordinary methods.

With the foregoing and other objects in view the invention consists in certain novel features of construction, combinations and arrangement of parts as will be more fully disclosed in connection with the accompanying drawings, it being understood that certain modifications and changes may be used within the scope of the invention.

In these drawings:

Fig. 1 is a transverse section of a conductor constructed according to my invention with certain elements shown in elevation;

Fig. 2 is a top plan view thereof;

Fig. 3 is a section similar to Fig. 1 showing the conductor mounted in a somewhat different manner;

Fig. 4 is a top plan view thereof;

Fig. 5 is a section similar to Fig. 1 using the same sections of conductors but arranged somewhat differently;

Fig. 6 is a top plan view thereof;

Fig. 7 is a section in side elevation of a modified construction using conductors of different cross section;

Fig. 8 is a top plan view thereof;

Fig. 9 is a section similar to Fig. 7 showing a somewhat different arrangement of the conductor elements of Fig. 7;

Fig. 10 is a top plan view thereof;

Fig. 11 is a view similar to Fig. 7 showing a slight modification;

Fig. 12 is a top plan view thereof;

Fig. 13 is a transverse section of the conductor built up of four of the conductor elements as used in Fig. 1;

Fig. 14 is a top plan view thereof.

Fig. 15 is a section similar to Fig. 13 showing the construction of Fig. 13 combined with filler elements to increase the current carrying capacity; and

Fig. 16 is a top plan view thereof.

Heretofore rigid busses or conductors for heavy currents have been constructed of flat metal bars used either singly or with several bars in multiple form to form a composite conductor, or they have been of metal tubing. These types of busses or conductors have many limitations, the most outstanding of which are in current carrying capacity, mechanical strength and rigidity and in the high cost of fittings for mounting the separate elements and also mounting the conductor.

With the view of overcoming these objections, I have devised a built up structure or a hollow conductor, several modifications of which are shown in the accompanying drawings, and which construction of conductor has many material advantages over the old type.

Referring first to the form shown in Figs. 1 and 2, the conductor is made up of a pair of substantially V-shaped angle members or sections which are in the form of bars, preferably of copper or copper alloy, having relatively high electrical conductivity, and these sections, as will be apparent, are extremely simple and may be drawn, rolled, bent or extruded by any of the usual processes. It will be seen that these sections can be said to be generally trough shape in cross section, and the sides are straight instead of curved, and in making up the conductor these sections are placed side by side with their opened or concave sides opposed so that the completed conductor is substantially square or rectangular in cross section if the angle between the flanges of the sections is a right angle. Of course, if this angle is greater or less than a right angle, the cross section and shape of the conductor will be changed accordingly. By angle bar is meant a bar composed of two flanges integrally united along one longitudinal edge of each so that the two flanges extend at an angle to each other. This is generally a substantially right angle but is not necessarily so.

The convenient way of securing the sections together is by means of clamps on the top and bottom of the conductor and having its opposite end portions bent laterally to rest on the outer surfaces of the sections as shown in the drawings. These end portions are spaced apart so that the edges of the sections are spaced from each other to form a longitudinal slot

both in the top and bottom of the conductor. The clamps are secured on the section by the means of a bolt 21 running through the clamps 18, also the slots 20. This bolt therefore not only acts as a means for clamping the clamps 18 against the sections 17 but also acts as a means for holding the sections 17 separated to form the slots 20. The bolts may also be used for mounting the conductor on any suitable support, such as an insulator 22. It will be evident that the laterally bent portions 19 of the clamps 18 hold the sections 17 from separating laterally.

It will be evident that this built up construction of conductor is composed of various simple elements which can be manufactured at a relatively low cost and can be easily assembled. It also makes a very strong and rigid construction for the amount of metal used and one that is stronger and more rigid than would be a solid conductor containing the same amount of metal in cross section. Furthermore, it produces a hollow conductor in which most of the metal is at or adjacent the outer surface of the conductor and therefore the so-called skin effect caused by alternating currents is reduced to a minimum. These conductors therefore have great current carrying capacity in proportion to the amount of metal used. This carrying capacity is also increased because of the thorough dissipation of heat permitted by the slots 20 which permits the air to circulate freely through the conductor. Therefore the heating of the conductor by the currents is reduced so that there is a greater current capacity for a given cross section of area of the conductor. These angle sections also provide flat surfaces which facilitate the making of bolted connections of high electrical conductivity for supply and take off leads thereby eliminating the necessity of using expensive clamps.

If it is preferred that the flat sides of the conductor be vertical and horizontal the same arrangement of sections and clamps may be turned through an angle of 45 degrees as indicated in Fig. 3. In this case the clamping bolt 21 extends at an angle of approximately 45 degrees and the supporting bracket or insulator 23 may have an inclined lug 24 to which the bolt extends. If desired, the insulator may be extended as indicated at 25 to form a support under the conductor. Otherwise the construction of conductor is the same as in Fig. 1 and has the same desirable characteristics, and has free circulation of air through the conductor because of the slots 20 for cooling purposes, the same as in the first form.

Although it is preferred that the sections 17 be separated to provide these slots 20 for circulation of air, I am not limited to such a construction, but may mount the sections 17 so that their free edges 17a abut as indicated in Figs. 5 and 6. With this arrangement a somewhat different form of clamp and mounting means is provided. As shown upper and lower clamps 26 extend transversely over and under the sections 17 and are slit at their opposite ends to provide ears 27 and 28. The ears 28 are bent laterally from the plane of the clamp to engage the outer walls of the sections as indicated. The clamping bolts 29 are passed through the ears 27 to secure the clamps on the sections to hold them together. These bolts may also be passed through slots 30 secured to insulator 31 to mount the conductor thereon.

In Figs. 1 to 6 the general concavo-convex or trough shaped sections have straight side flanges,

but they need not be straight but may be curved as shown in Figs. 7 and 11 but are still of general concavo-convex or trough shape. In these figures the sections 32 and 33 are continuous curves in cross section, the sections 32 being substantially semi-cylindrical or half round, and when assembled with their open sides opposed form a substantially round tubular section. The sections 33, however, are flattened somewhat so that they are half-elliptical sections and when assembled with their open sides opposed form a tubular conductor of elliptical cross section. Both of these forms of conductors are mounted substantially the same as those shown in Figs. 1 and 2.

In Figs. 7 and 8 curved clamps 34 and 35 extend across the opposed edges of the sections 32 and are curved to fit the outer surfaces thereof. A bolt 36 passes through these clamps and the slots 37 formed between the spaced edges of the sections 32. The curved clamps prevent the sections 32 separating laterally while the bolts 36 hold them in the proper separated relation to form the ventilating slots 37. The bolts 36 besides securing the clamps on the conductor section may also be used to secure the conductor to any suitable support, such as the insulator 22. The lower clamp 35 preferably has a central flattened portion 38 to form a more stable seat on the support 22.

In Figs. 11 and 12 the clamps 39 and 40 are similar to the clamps 34 and 35 of Fig. 7 except that they are shaped to correspond with the shape of the sections 33.

In Figs. 7, 8, 11 and 12 the sections 32 and 33 are mounted in spaced relation to permit ventilation or air circulation through slots 37, and although this is the preferred construction I am not necessarily limited thereto, but may mount the sections 32 and 33 with their opposed edges abutting. This arrangement for the sections 32 is illustrated in Figs. 9 and 10, and the same arrangement may be used for the sections 33. This arrangement requires a somewhat different form of clamp for securing the sections together and mounting them on their supports. In the present instance two curved clamps 41 and 42 embrace the sections and are clamped thereon by screws 43 passing through the extending ears 44. The clamp 42 may be secured to the insulator 22 by any suitable means, such as the screw 43.

Figs. 1 to 12 show the conductor built up of two concavo-convex sections or bars. I am, however, not confined to the use of two sections only, but may use different numbers of sections.

In Figs. 13 and 14 I have shown how the conductor can be built up of four of the V-shaped angle members similar to the members 17 of Figs. 1 to 6. These angles, indicated at 45, embrace the corners of the frame 46 built up of four pieces of angle bar with mitred ends welded together as indicated at 47. The angle sections 45 embrace the corners of this frame and are secured thereto by any suitable means, such as the screws 48. It will be noted that these bars together form a hollow conductor of substantially square or rectangular cross section and if the edges of their opposing flanges are separated as indicated they form ventilating or air circulating slots 49. This conductor can be mounted in a manner similar to that used in the other figures, as by means of clamps 50 extending across the top and bottom of the conductor and having laterally turned ends 51 to form shoulders engaging the outer surfaces of the sections. These clamps therefore assist in

holding the angle sections against separating and in conjunction with the bolt 52 can be used to mount the conductor on any suitable support, such as the insulator 22.

5 If it is desired to have more conducting metal for the same cross-sectional dimension of conductor as in the construction of Fig. 13, flat bars 53 may be secured to the frame 46 between the angle members by any suitable means, such as the screws 54. These flat bars may be of substantially the same thickness as the webs of the V angle members 45 and they may either entirely fill the space between these angle members or they may be spaced somewhat therefrom as indicated at 55 to form ventilating slots and permit circulation of air.

It will be apparent from the above description that in all of the arrangements shown the individual sections 17, 32, 33 and 45 are all of substantially or generally concavo-convex form in cross section and that in building up the conductor they are arranged with their open or concaved sides opposed. These built up structures can be made at less cost than could a similar section of a continuous tube, and can be used to build or fabricate busses or conductors of practically any size, and therefore for any desired current carrying capacity. As practically all the metal is located at or adjacent the outer surface of the conductor, the objectionable skin effect with alternating currents is reduced to a minimum. Also due to the shape of the conductor it is very strong and rigid and therefore can be mounted with very long spans, or that is, with increased distances between the mounting clamps or brackets over the old types containing the same amount of metal, and therefore as fewer clamps or mountings are required liability of failure or shorts at the fittings is greatly reduced. They can also be arranged to secure thorough ventilation and circulation of air for a desirable cooling effect. Although as indicated above this conductor is a very great improvement and has many desirable characteristics making it particularly adaptable for carrying heavy alternating currents, it is by no means limited thereto, but may be used for carrying heavy direct currents. The sections may, of course, be made of any suitable metal, but are preferably made of copper or copper alloys as these metals have high electrical conductivity, strength and rigidity, resistance to corrosion, and other desirable characteristics.

Having thus set forth the nature of my invention, what I claim is:

55 1. An electrical bus bar conductor comprising a pair of substantially V-shaped angle bars arranged with their inner sides opposed to form a

hollow bus bar and with their adjacent edges spaced from each other to form longitudinal ventilating slots in the upper and lower portions of the bus bar, fastenings extending across said edges and formed to engage the outer walls adjacent the slots to prevent the bars separating, and a bolt passing through the fastenings and diagonally across the bus bar to connect the fastenings and retain them against the bars, and said bolt passing through said slots and engaging the edges of the angle bars to hold the bars separated.

2. An electrical bus bar conductor comprising a pair of angle bars arranged with their inner sides opposed to form a hollow rectangular bus bar conductor, the adjacent edges of the bars being spaced to form longitudinal ventilating slots at diagonally opposite corners of the bus bar, fastenings extending across the slots and having walls arranged at an angle to each other to engage the adjacent outer walls of the angle bars to prevent their separating laterally, a support for the bus bar and means for securing the bars to the support comprising a bolt secured to the support and extending diagonally across the conductor between the fastenings to connect the fastenings and retain them against the bars, said bolt also passing through the slots and engaging the edges of the angle bars to hold the bars separated.

3. In a device of the character described, two angle bar members substantially V-shaped in cross section arranged to form a hollow bus bar with the free edges of the legs adjacent, means spacing the free edges of the legs apart to provide ventilating slots, and said bars being mounted with the diagonal between the free edges vertical.

4. An electrical bus bar comprising a pair of angle bars arranged with their inner sides opposed to form a hollow bus bar, the adjacent edges of the bars being spaced to form longitudinal ventilating slots at diagonally opposite corners of the bus bar, a support for the bus bar, means for securing the bar to the support comprising a bolt secured to the support and extending diagonally across the bus bar and through the slots and engaging the edges of the angle bar flanges to hold the bars separated, and fastenings extending across the slots and having walls arranged at an angle to each other to engage the outer walls of the angle bars at opposite sides of the slots, said bolt extending through the fasteners and clamping them against the bars to prevent the bars separating laterally, said fastenings also acting on the walls of the bars to draw them toward each other and against the bolt.

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