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COPPER OR COPPER ALLOY BUS OR CONDUCTOR FOR ELECTRICAL CURRENTS

Original Filed Sept. 23, 1932

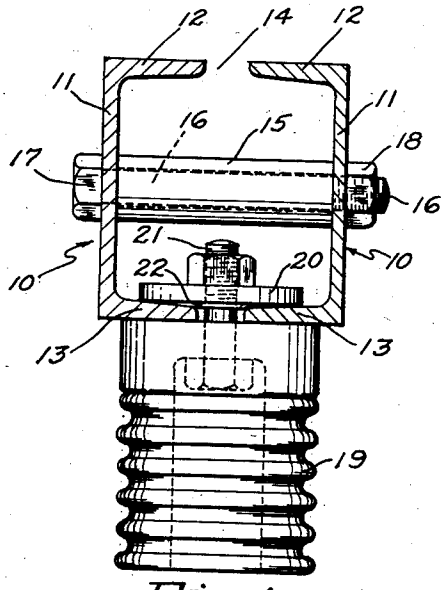


Fig. 1

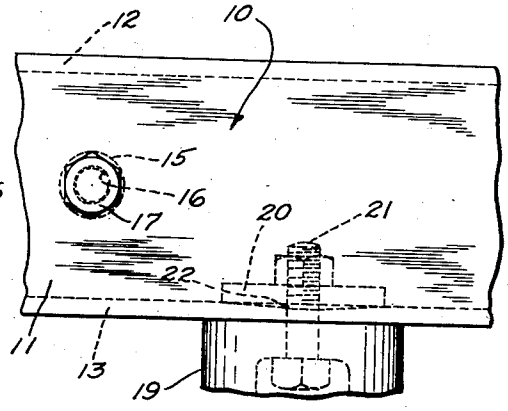


Fig. 2

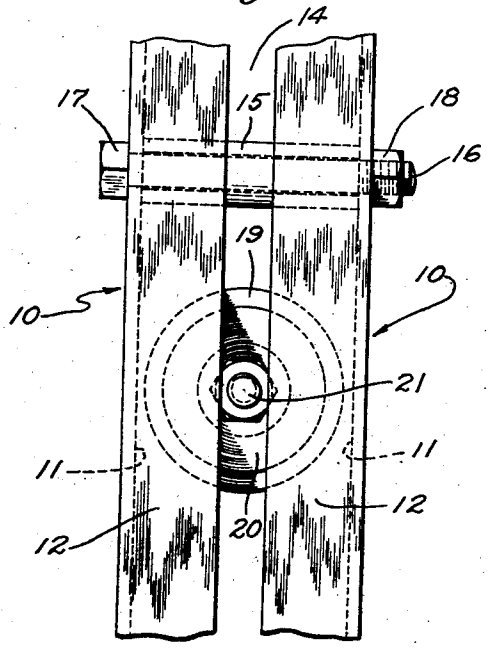


Fig. 3

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COPPER OR COPPER ALLOY BUS OR CONDUCTOR FOR ELECTRICAL CURRENTS

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Original application September 23, 1932, Serial No. 634,457. Divided and this application January 30, 1934, Serial No. 708,943

2 Claims. (Cl. 173—13)

This invention relates to busses or conductors for electrical currents, and more particularly to copper and copper alloy busses or conductors for carrying large currents, and the present application is a division of my application Serial Number 634,457, filed September 23, 1932.

The invention has for an object to provide conductors for this purpose which may be composed of channel sections so mounted and assembled as to provide a mechanically rigid bus or conductor for the efficient transmission and distribution of heavy electric currents.

It is also an object to provide a construction to permit free ventilation or circulation of air through the conductor to prevent overheating, and also which will give a conductor structure built up of sections which can be rolled, drawn or extruded, and will provide a conductor which in cross section will be of a substantially hollow square construction having desirable characteristics in that it will have high strength and rigidity compared with the area of cross section of the metal thus requiring a less number of supports, and will carry a maximum current for the amount of metal as the so-called skin effect is reduced to a minimum.

It is also an object to provide a construction of conductor for these heavy currents which is less costly to manufacture than the tubular conductors, and can be more easily mounted and with less complicated and costly supports than the old types of conductors.

A further object is to provide a conductor which can be fabricated of channel members rolled, drawn or extruded from copper or copper alloys and therefore secure the high electrical conductivity of these materials and the electrical advantages of the hollow construction at less cost than with the old types of conductors.

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 drawing, it being understood that certain modifications and changes may be used within the scope of the invention.

In the drawing:

Fig. 1 is a transverse section of my improved conductor showing the mounting means in elevation;

Fig. 2 is a side elevation thereof; and

Fig. 3 is a top plan view.

Heretofore rigid busses have been constructed of flat metallic bars used either singly or with several bars in multiple to form one conductor, or 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 cost of fittings.

My improved conductor consists of one or more channel sections and is preferably composed of a built up structure comprising two channel sections 10 of the desired metal, preferably copper or copper alloy, having relatively high electrical conductivity. These sections may be rolled, drawn or extruded and each comprises a web section 11 and longitudinal flanges 12 and 13 at the opposite edges of the web and extending substantially at right angles thereto. In building up the conductor these channel sections can be assembled in different positions, the preferred arrangement being with their open sides opposed and they are preferably of a height and width to provide a substantially hollow square cross section, although it is not necessarily a square but may be rectangular if this is more adapted for the space available.

The sections may be mounted with the edges of the flanges abutting, but it is preferred to mount them with their edges spaced somewhat to provide for free circulation of air through the conductors to prevent overheating and therefore permit of the use of less metal for a given current capacity. The sections may, of course, be mounted in a horizontal position if desired, but it is preferred to mount them with the webs 11 in the upright position as shown so that the longitudinal slots 14 between the spaced edges of the flanges are in the top and bottom walls of the conductor to give the maximum circulation of air through it.

This construction of conductor permits of the use of very simple mounting means and as illustrated the channels 10 are held in proper spaced relation by a spacer tube 15 abutting at its ends on the inner sides of the webs 11 while a bolt 16 passes through this spacer and the webs and holds the channels in place, the head 17 being the keeper at the outer side of one channel and a nut 18 being the keeper at the outer side of the other channel. The channels comprising the conductor can be mounted on any suitable support or mounting means such as an insulator 19 of any desired construction. The specific means shown for this purpose comprises a washer 20 resting on top of the lower flanges of the channels with a short bolt 21 passing through it and securing it and the channels to

the insulator. It is also noted that the bars or conductors need not necessarily be used with the channels in the upright position, although this is the preferred position but they may be arranged horizontally. The spacers 15 and bolts 16 may be located and spaced as desired. They are preferably not located directly over the mounting means 20, 21 but are to one side or between them so as not to interfere with installation and setting of the mounting means. Insulator supports for bus bars of this construction would ordinarily be five or six feet apart although this distance may be varied as desired, and therefore the spacing sleeve 15 and bolt 16 could be placed anywhere throughout the distance between the insulator supports.

The lower surface 22 of the washer 20 may be inclined or tapered as shown to more or less fit the inclined upper surface of the flanges 13 and thus more effectively secure the bar in its proper position on the insulator support.

It will be evident that this construction is an extremely simple one, can be easily and quickly assembled, and has numerous advantages over the old types of busses or conductors, either bars of rectangular cross section, tubular, or built up of a number of rectangular bars or sections. With this conductor high electrical characteristics are secured, and particularly the so called skin effect with alternating currents is greatly reduced. It also has low reactance by reason of the increase in diameter of the conductor. It has high strength and rigidity coupled with high electrical conductivity, and low resistance to the flow of direct and alternating currents. Because of the strength and rigidity it can be mounted with longer spans and fewer supports.

In view of the thorough ventilation of the inside as well as the outside of the conductor heat is quickly dissipated preventing overheating of the conductors and permitting the use of less metal for a given current capacity. This cooling effect is increased by the increase in radiating surface. It has high electrical characteristics over solid busses or conductors with the same cross section of area, and is much more easily mounted and at less cost than tubular or solid busses or conductors, although at the same time providing a substantially closed or hollow cross section. It has maximum current carrying capacity per unit of cross sectional area, for when assembled in the form of a square as described the distribution of metal is such that extremely high current densities are permitted with minimum temperature rise. This also gives minimum exposure to ice and wind loads for a given current capacity, as since high current densities are possible with a minimum cross sectional area a minimum surface in proportion to current capacity is exposed to these loads in outdoor installations. Minimum cross sectional area for a given current also requires a minimum space for mounting.

It is more particularly intended for carrying large alternating currents as the so called skin effect is greatly reduced over that of a solid conductor, but because of the ventilating characteristics and its strength and rigidity permitting the use of long spans and fewer supports, it is also very desirable for direct currents. The use of copper or copper alloys for these channel sections gives great rigidity and strength with high electrical conductivity, and as copper and copper alloys have a low coefficient of expansion they impose a minimum strain on supporting insulators and clamps and require a minimum provision for expansion during temperature changes. Furthermore, the means of mounting this improved conductor permits the necessary movement of the channel sections under expansion and contraction without breaking these supports or buckling the conductors.

This channel construction may be bent to conform to changes in direction of the bus alignment. This feature also eliminates the necessity for using expensive clamps under these conditions.

Copper and copper alloy channel busses as described have a high melting point. This is a material advantage as under conditions of electrical fires a high melting point metal has the ability to withstand higher temperatures for longer periods of time thereby reducing the hazard which molten metal may become to life and property. Also, copper and copper alloy channel busses are less liable to damage from electric arcs. Under conditions of short circuits or flash overs an electric arc will have less tendency to damage the high melting point high conductivity metal.

Copper and copper alloy busses have a high modulus of elasticity and are highly resistant to bending and sagging with the added feature of high electrical conductivity. These higher strengths of the channel sections permit wider separation between the supports, and as the required supports are therefore reduced in number there are fewer electrical failures.

It will further be evident that the square or rectangular construction provides flat surfaces greatly facilitating the making of bolted connections of high electrical conductivity for take off and supply leads thus eliminating the necessity for the use of expensive clamps.

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

1. An electrical bus-bar conductor comprising a pair of channel sections arranged with their webs in an upright position and their flanges extending toward each other so that the open sides of the channels are opposed to form a hollow rectangular conductor, a transverse bolt extending through the webs of the sections and cooperating with the outer walls of the webs to hold the sections against separation, a spacer tube on the bolt between the sections and with its respective ends engaging the webs and holding them in position with the edges of their flanges in spaced relation to form longitudinal slots in opposite walls of the conductor to permit of circulation of air through the conductor, a fastener resting on the inner surfaces of one pair of adjacent flanges, and including a bolt extending through the slot between the flanges for mounting the conductor on a support.

2. An electrical bus-bar conductor comprising a pair of channel sections arranged with their webs in an upright position and their flanges extending horizontally toward each other so that the open sides of the channels are opposed to form a hollow conductor with upright flat outer side walls, a transverse bolt extending through the webs of the sections and having means engaging the outer walls of the webs to hold the sections against separation, a spacer tube on the bolt between the sections and cooperating with the webs at its ends to hold the sections in position with the edges of their flanges in spaced relation to form longitudinal slots in the top and

bottom walls of the conductor to permit circulation of air through the conductor, a support for the conductor against which the outer surfaces of a pair of the flanges rest, a fastener engaging the inner surfaces of said flanges, and a bolt extending through the fastener and between the edges of the flanges into the support to press the fastener against the flanges to secure the conductor to the support, said fastener and bolt constituting the sole means of securing the conductor to the support.

THOMAS J. LITTLE.