Oct. 6, 1959 A. G. DALEY 2,907,977

MULTIPLE WIRE CONNECTORS

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Fig. 1.

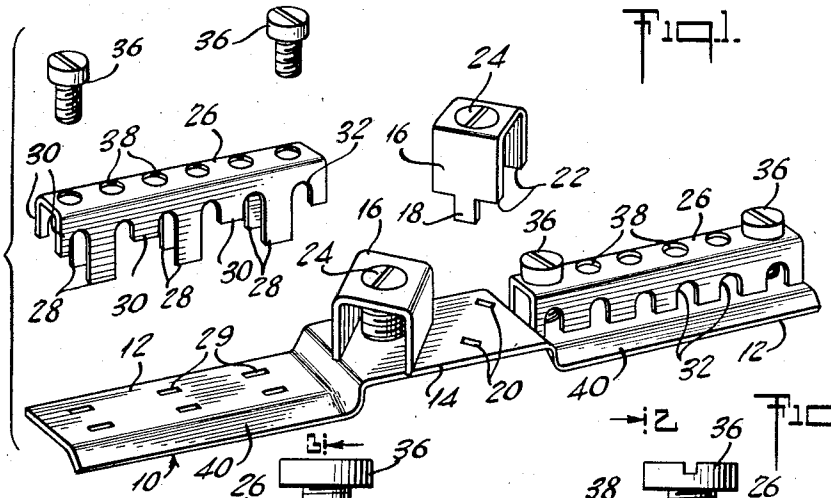


Fig. 2.

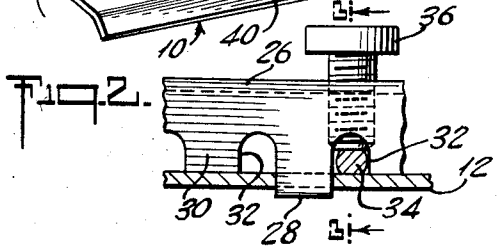


Fig. 3.

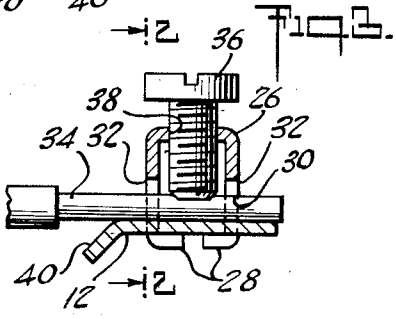


Fig. 4.

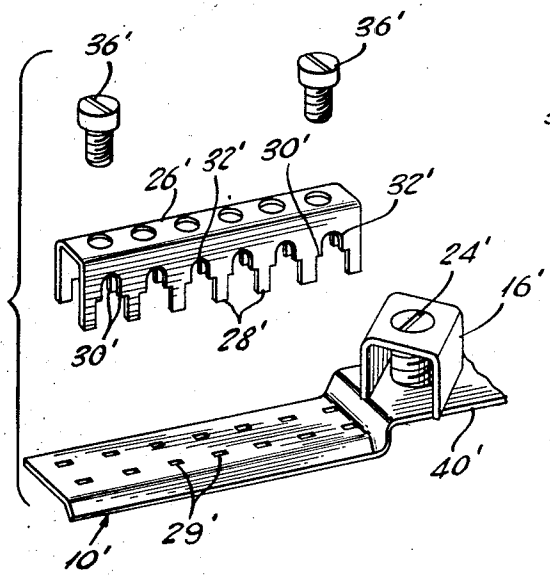


Fig. 5.

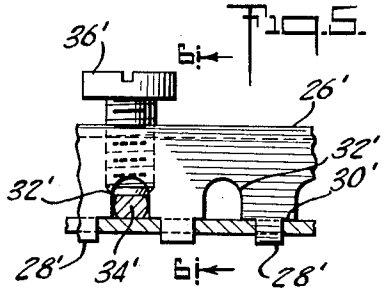
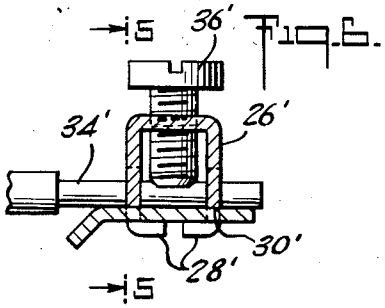


Fig. 6.



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MULTIPLE WIRE CONNECTORS

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16 Claims. (Cl. 339—272)

The present invention relates to electrical connectors for joining multiple wires together.

Connectors of this type are commonly used with panelboards where a main power line is connected to multiple two-wire branch circuits. A separate control or protective device such as a switch, fuse or circuit breaker is connected between one wire of the power line and one wire of each branch-circuit, and the remaining wires of all the branch circuit pairs are directly connected to the power line by means of a multiple-wire connector. The panelboard and the connector are enclosed in a protective metal box.

An object of the present invention is to provide a new and useful connector for multiple wires. Another object is to provide a connector for joining multiple branch circuit wires to a common main bus. More specific objects include the provision of a common connector of reduced manufacturing cost; a connector free of all unnecessary metal-to-metal electrical joints; and a connector readily manufacturable without dependence upon supplies of special metal shapes.

This last aspect of the invention will be appreciated from the following. It has been common practice to form connectors of copper tubing having a rectangular or square cross-section and including a regular series of transverse openings for receiving branch circuit wires, and adjacent the transverse wire passages threaded openings are formed for receiving screws that lock the branch circuit wires to the copper connector. Such tubing is costly; but apart from cost, it is a special metal shape the supply of which is uncertain at times in contrast to ordinary flat strip stock that may be employed in the present invention.

The neutral wire of the input power line is of much heavier cross-section than the branch circuits. To carry the total current of all the branch circuits, the rectangular tubing is flattened, and a large fitting is joined to the flattened portion of the rectangular bus by a screw threaded connection. The connector according to the present invention makes unnecessary any separate fitting involving such threaded joint. The branch circuit wires are locked to a piece of strip stock, and the main bus is locked directly against the same strip.

The connector embodying features of the present invention which is described in detail below will be seen to include a strip of copper or equivalent highly conductive metal, to which the branch circuits are clamped by screws, this metal being inherently ductile. The screws are threaded into a separate element of steel or equivalent tough metal that is locked to the copper. Advantageously the steel element is a channel that embodies a series of lugs along the channel edges. These lugs extend through slots or holes in the conductive strip and are secured to the strip in such a manner as to withstand the great stress of the screws which clamp the branch circuit wires against the strip. The edges of the channel are also formed with shoulders which limit the penetration of the lugs through the strip. By virtue of the shoulders,

the channel can be rigidly locked by the lugs against the strip, but the notches that receive the branch circuit wires remain unobstructed and of predetermined size.

The nature of the invention and its further features and advantages will be better appreciated from the following detailed description of two illustrative embodiments which are shown in the accompanying drawings. In these drawings:

Fig. 1 is a partly exploded perspective view of a first embodiment of the invention;

Fig. 2 is a cross-sectional view of a portion of the connector in Fig. 1 along the line 2—2 of Fig. 3, additionally showing a branch circuit wire omitted from Fig. 1;

Fig. 3 is a fragmentary cross-sectional view along the line of 3—3 in Fig. 2.

Figures 4, 5 and 6 are views corresponding to Figures 1, 2 and 3 showing a modification of the embodiment in Figures 1, 2 and 3.

Referring now to Fig. 1 there is shown a metal strip usually of copper although any high-conductivity metal will do. Strip 10 includes end portions 12 and a central portion 14 interconnected by offsets that are convenient in a particular circuit breaker enclosure and junction box. A pair of U-shaped straps 16 are provided, one shown in Fig. 1 as joined in place and the other above its assembled position. These straps having lugs 18 which extend through slots 20 in connector portion 14 and (like other lugs in Fig. 3) lugs 18 are firmly turned in below strap portion 14, holding shoulders 22 tightly against strip portion 14 and forming a rigid assembly of parts 16 and 14. Set screws 24 are provided for clamping respective wires of the main power line (not shown) against strap 14.

A pair of additional channels 26 are also provided for receiving and locking multiple branch-circuit wires to the end portions 12 of strip 10. Each channel, advantageously of a tough metal such as steel, has a series of lugs 28 formed in each of its edges and correspondingly there is provided a series of shoulders 30 along each edge of channel 26. The edges of the channel are also formed with notches 32 for receiving a branch wire 34 (Figs. 2 and 3). Each notch 32 in one edge of the channel is paired with an aligned notch 32 directly opposite it at the other side of the channel. A screw 36 in threaded hole 38 flattens wire 34 and grips it with firm pressure against conductive strip portion 12. The heavy pressure developed by screw 36 naturally tends to separate channel 26 from portion 12, but this stress is effectively resisted by the in-turned lugs 28. Each portion 12 of the strip 10 has a curved edge portion 40 so as to present a rounded surface to wire 34, to guide the wire to the proper level when that wire is to be inserted. This also avoids the possibility of a sharp cutting edge of such a strip of metal being pressed against wire 34, with the possibility of a resulting weakening notch being formed in the wire.

When channel 26 is assembled to portion 12 of strip 10, lugs 28 extend through slots 29 and are staked or swaged or bent against one face of portion 12 so as to hold shoulders 30 along the edges of the channel against the opposite face of portion 12. Many wires 34, as many as there are paired notches 32, can be received and held in place by screws 36. By making channel 26 and strip 12 as separate parts, each part can be made of a different metal appropriate to the separate functions accomplished. Thus the threaded holes 38 are formed in tough metal whereas the wire is pressed against the strip 12 of highly conductive metal. If the screws and the channel 26 were all of highly conductive metal, the connector would have some increased conductivity in the path from the various wires 34 to the central portion 14 of the connector; this is rendered unnecessary simply by making strap 10 of

appropriate thickness and width. On the other hand the firm screw pressure required for good connection of wire **34** to strap portion **12** is realized by forming the screw holes **38** in the tougher metal used in forming the channel **26**.

It should be noted that the passage extending along channel **26** is in no way relied upon to receive a lengthwise extending wire such as that which is to enter the passage between channel **16** and strip portion **14**. It would not be feasible to have a wire extend transverse of the channel **16**, for to form such a transverse passage in such a way as to allow the screw to press the wire flatly against the strip would necessarily weaken or eliminate lugs **18**, unless channel **16** were formed with shoulders, lugs and notches as in the case of channel **26**.

It is observed that, by replacing the previously employed rectangular tubing with a fabricated assembly of the tough metal channel **26** and the conductive strip **10**, the desirable metal qualities of high conductivity and toughness are realized at the points where they are needed. In addition there is no waste of the costly copper where its conductivity is not utilized (in the region of channel **26**) and, further, there is no dependence upon continued supply of a special size of the rectangular copper tubing previously used for this connector. Ordinary strip stock is used in forming both strip **10** and channels **26**.

The embodiment of Figs. 1 to 3 is shown in modified form in Figs. 4 to 6 where corresponding primed numerals are applied to corresponding parts. The differences will be noted between these two forms by comparing the channel **26** of Figs. 1 and 2 with channel **26'** of Figs. 4 and 5. There is one notch **32'** in Fig. 4 flanked by a pair of lugs **28'** where, in Fig. 1, lugs **28** and shoulders **30'** are separate from each other. In Fig. 4, each lug **28'** has at least one adjacent shoulder **30'**. While two shoulders **30'** adjacent each notch **32'** are shown, it is apparent that this symmetry is not essential and that only one shoulder **30'** would also prevent the lugs **28'** of channel **26'** from being driven too far through the slots **29'** in the strip portion **14'**. It is an advantage to employ lugs **28'** at both sides of each notch **32'**, where the wire to be gripped may be of substantial stiffness and cross-section and where the pressure to be developed by each screw **36'** is considerable. Where two notches **32'** and two screws **36'** are provided between each pair of lugs **28'** along each of the channels, there is a possibility of the channel being bowed upwardly by the pressure developed by the screws. The construction of Figs. 1 to 3 is preferabe, however, where the size of the wire **34'** is small and where the size of the lugs **28'** might become too small to be practical.

It will be appreciated that a range of applications and variations of the connectors described will occur to those skilled in the art and that certain features may be employed without necessarily employing others.

What I claim is:

1. A multiple wire connector including a channel of a tough metal such as steel having pairs of aligned notches in its opposite side walls, inwardly directed screws extending through the bottom of the channel adjacent each pair of aligned notches, and a strip of high conductivity metal such as copper joined lengthwise to the edges of the channel and, with said channel, forming a tube with a series of transverse passages for admitting wires to be clamped by the screws against the strip.

2. A multiple wire connector including a channel of a tough metal such as steel having a bottom wall and two side walls, said side walls being formed with pairs of opposite notches, a series of shoulders adjacent said notches and a series of lugs projecting beyond said notches, a strip of high conductivity metal such as copper formed with a series of apertures penetrated by said lugs and joined by the lugs to the sides of the channel, said notches and said strip coacting to form transverse passages for admitting wires to be interconnected, and wire clamping screws in the bottom of the channel adjacent each of said transverse passages.

3. A multiple wire connector including a channel of a tough metal such as steel having a series of screw threaded openings in the channel bottom, paired notches in the edges of the side walls adjacent the respective screw threaded openings, said edges embodying shoulders and lugs projecting beyond said shoulders, a strip of a high conductivity metal such as copper having apertures penetrated by said lugs, the portions of said lugs projecting through said strip being deformed against one side of said strip and holding said shoulders against the opposite side of the strip and thereby forming transverse passages for admitting multiple wires to be clamped against the surface of the strip.

4. A multiple wire connector including a channel of a tough metal such as steel having a series of paired edge notches, in the opposite channel walls, said edges embodying shoulders adjacent the notches and lugs projecting beyond the shoulders, a strip of a high conductivity metal such as copper locked against said shoulders by said lugs, and the notches forming with said strip a series of transversely extending passages for receiving the wires to be interconnected, and screw threaded openings in said channel adjacent each pair of notches for receiving screws to clamp such wires against said strip.

5. A multiple wire connector including a strip of high-conductivity metal such as copper, a U-shaped terminal element joined to said strip and having a screw therein for locking a main conductor against the copper strip, and a channel of a tough metal such as steel having its edges locked to said strip, the edges of the channel also having paired notches forming transverse passages for admitting branch circuit wires, and screw threaded openings in the bottom of said channel for receiving screws to clamp branch circuit wires against the copper strip.

6. A multiple wire connector in accordance with claim 5 wherein a shoulder and a lug projecting beyond the shoulder is formed at respective sides of each notch, said strip having slots receiving said lugs and said lugs being deformed against said strip with the shoulders butted tightly against the strip.

7. A multiple wire connector in accordance with claim 5 including shoulders formed at both sides of each of said notches and lugs between pairs of shoulders thus formed, said strip having slots penetrated by said lugs and said lugs being deformed against one face of the strip to lock the shoulders tightly against the opposite face of the strip.

8. A multiple wire connector including a channel of a tough metal such as steel having pairs of notches in the edges of the opposite side walls thereof, said edges embodying abutment shoulders and projecting lugs, and a strip of high conductivity metal such as copper having a series of openings to receive said projecting lugs, said strip having an edge curved away from said channel.

9. A multiple wire connector including a composite tube formed of a channel of a tough metal such as steel having edge notches, shoulders, and projecting lugs extending beyond the shoulders, and a strip of high conductivity metal such as copper having a series of openings receiving said lugs, said notches forming transversely extending passages through the tube, and said strip embodying an edge portion curved away from said channel and presenting a smoothly curved surface to wires inserted into said transverse passages.

10. A multiple wire connector including a strip of a high conductivity metal such as copper having two lines of slots and an additional pair of slots displaced from said lines of slots, a main line connector having lugs extending through said additional pair of slots and having a threaded passage for a screw to lock a wire of the main line against said strip, a channel of tough metal such as steel formed with paired edge notches,

shoulders, and projecting lugs, said lugs extending through the lines of slots in said strip and deformed against one face of the strip so as to lock the shoulders against the opposite face of the strip, and a series of screw-threaded openings in said channel adjacent each of said notches for screws to clamp the inserted wires against the strip when received into the transverse passages formed by the paired notches and the strip.

11. A multiple wire connector including an elongated channel of a tough metal such as steel and of U-shaped cross-section having a bottom and two side walls adjoining the bottom and further having an open side opposite said bottom, a separate strip of a high-conductivity metal such as copper assembled lengthwise to the channel to close the open side thereof, said channel having a series of pairs of opposed openings formed in the respective side walls thereof, portions of said strip extending across each of said openings and with said openings defining passages across the channel through which multiple wires may be inserted, and screw-threaded openings in the bottom of said channel respectively in alignment with said pairs of opposed openings for clamping screws to hold wires inserted in said passages against said high-conductivity strip.

12. A multiple wire connector including a strip of high conductivity metal such as copper, a relatively large U-shaped element of a tough metal such as steel assembled to said strip so that the strip extends across the open side of the U and a threaded aperture in the bottom of the U-shaped element opposite said strip for a screw to hold a relatively heavy main-current wire against the strip, an elongated channel of a tough metal such as steel and of relatively small U-shaped cross-section assembled to a portion of said strip so that the strip forms a tube with the channel, said channel having pairs of openings in the respective side walls thereof, and portions of said strip extending across said pairs of openings and with said openings defining passages transverse of the tube for receiving multiple relatively light branch circuit wires, and said channel having a series of threaded openings in the bottom thereof aligned with said pairs of openings for screws to hold the respective branch circuit wires against said high-conductivity strip.

13. A multiple wire connector including a tube having transversely extending passages for receiving wires to be interconnected, said tube being formed of a channel of a tough metal such as steel, the portions of the side walls of said channel remote from the bottom of the channel being locked to a strip of a high conductivity metal such as copper, each of said passages including paired openings in the opposite walls of the channel, each of said openings having edges formed in part of the wall of the channel and formed in part of the face of said strip of high conductivity metal, said channel having a series of screw-threaded openings for receiving screws to clamp wires extending through the passages against the high conductivity strip.

14. A multiple wire connector including a tube having transversely extending passages for receiving wires to be interconnected, said tube being formed of a channel of a tough metal such as steel, the portions of the side walls of said channel remote from the bottom of the channel being locked to a strip of a high conductivity metal such as copper, each of said passages including paired openings in the opposite walls of the channel, each of said openings having edges formed in part of the wall of the channel and formed in part of the face of said strip of high conductivity metal, said channel having a series of screw-threaded openings for receiving screws to clamp wires extending through the passages against the high conductivity strip, the side walls of the channel having laterally offset portions extending across the surface of said high conductivity strip remote from said screws.

15. A multiple wire connector including a tube having transversely extending passages for receiving wires to be interconnected, said tube being formed of a channel of a tough metal such as steel, the portions of the side walls of said channel remote from the bottom of the channel being locked to a strip of a high conductivity metal such as copper, each of said passages including paired openings in the opposite walls of the channel, each of said openings having edges formed in part of the wall of the channel and formed in part of the face of said strip of high conductivity metal, said channel having a series of screw-threaded openings for receiving screws to clamp wires extending through the passages against the high conductivity strip, the side walls of said channel having in-turned edge portions underlying said strip.

16. A multiple wire connector including an elongated channel of a tough metal such as steel and a strip of high-conductivity metal such as copper across the open side of the channel in the form of a tube, said tube having transverse passages provided by paired transversely aligned openings in the sidewalls of the channel, each of said openings having an outline constituted in part by the edges of one of the walls of the channel in which that opening is formed and the outline of each opening being completed by a face of said strip, the bottom of said channel having a series of screw-threaded openings for receiving screws to clamp wires extending through said passages against said high-conductivity strip which thereby interconnects such wires, and said channel and said strip having interlocking formations for resisting the pressure of the wires clamped against the strip.

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