United States Patent

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[33] **Great Britain**
[31] **No. 21,750/67**

[54] **ELECTRICAL DISTRIBUTION SYSTEMS**
6 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** **174/72,**
174/68.5, 174/117; 317/118

[51] **Int. Cl.** **H02b 1/06,**
H02g 5/00

[50] **Field of Search** 174/72B,
88B, 68.5, 71B; 317/119, 99, 118, 120, 101CM,
101CX, 101B; 174/117.11; 339/18; 29/626, 628

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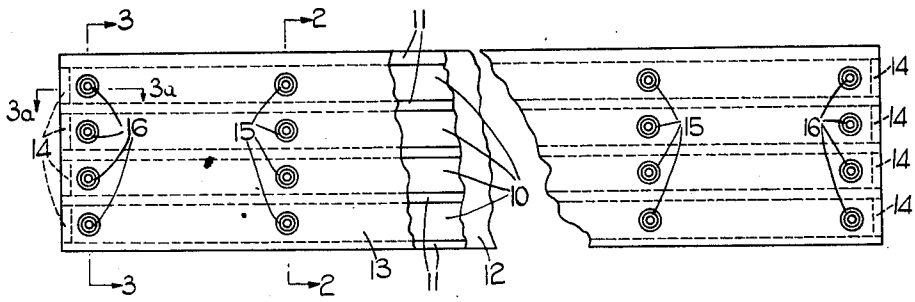
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Primary Examiner—Darrell L. Clay
Attorney—Holman, Glascock, Downing & Seebold

ABSTRACT: A laminated assembly for use in electric power distribution is laminated from two outer layers of insulating material adhesively bonded to an interlayer consisting of elongated conductive flat strips in spaced parallel coplanar relation separated by insulating strips. The assembly runs coolly and has high mechanical resistance to breakdown under magnetic loads. Connections to the conductors are made through holes in one of the outer layers.



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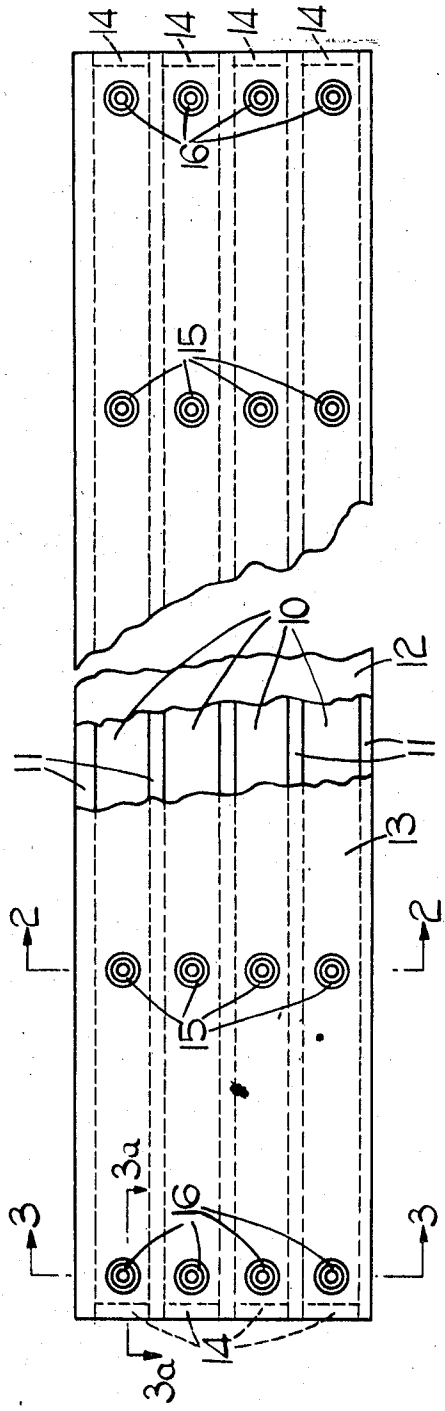


FIG. 1.

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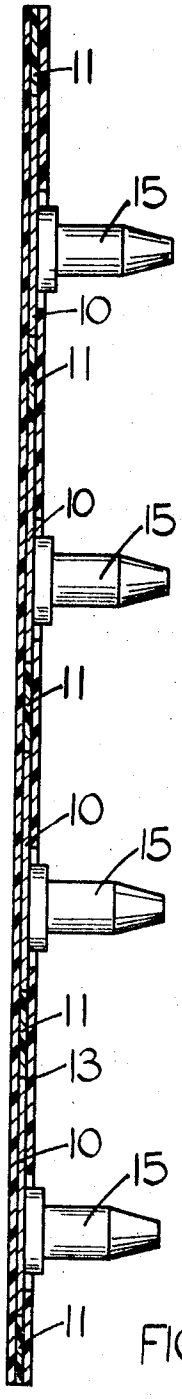


FIG.2.

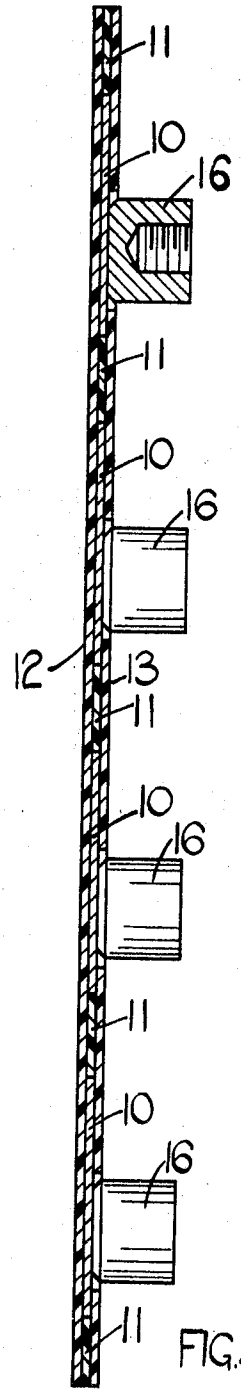


FIG.3.

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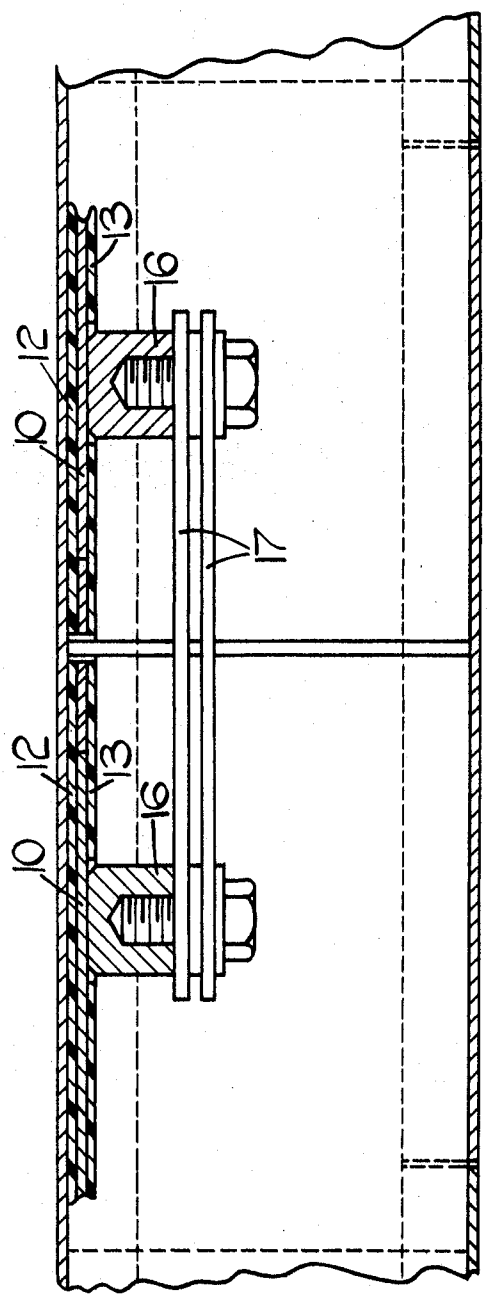


FIG. 3a.

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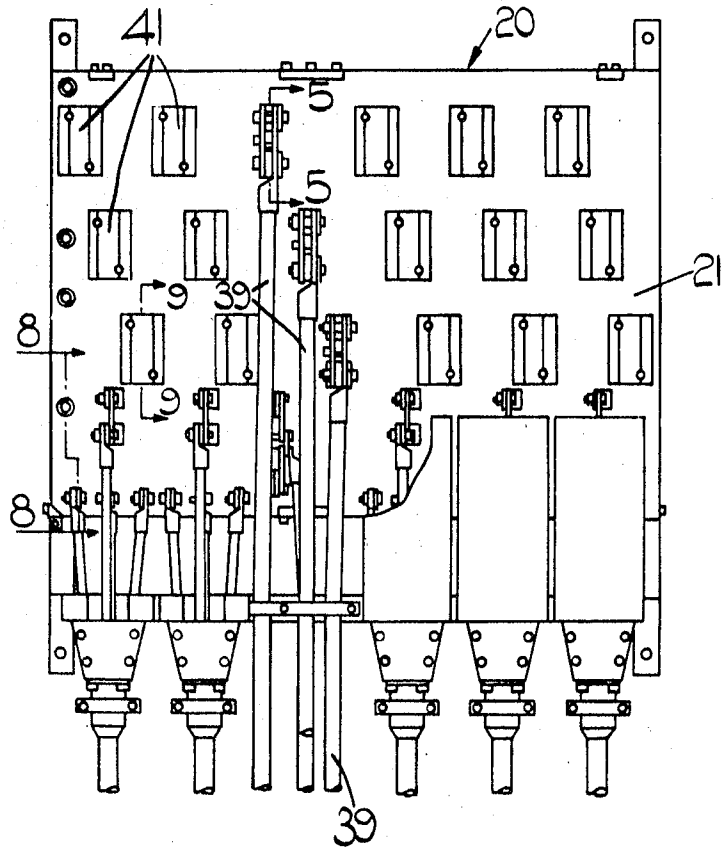


FIG. 4.

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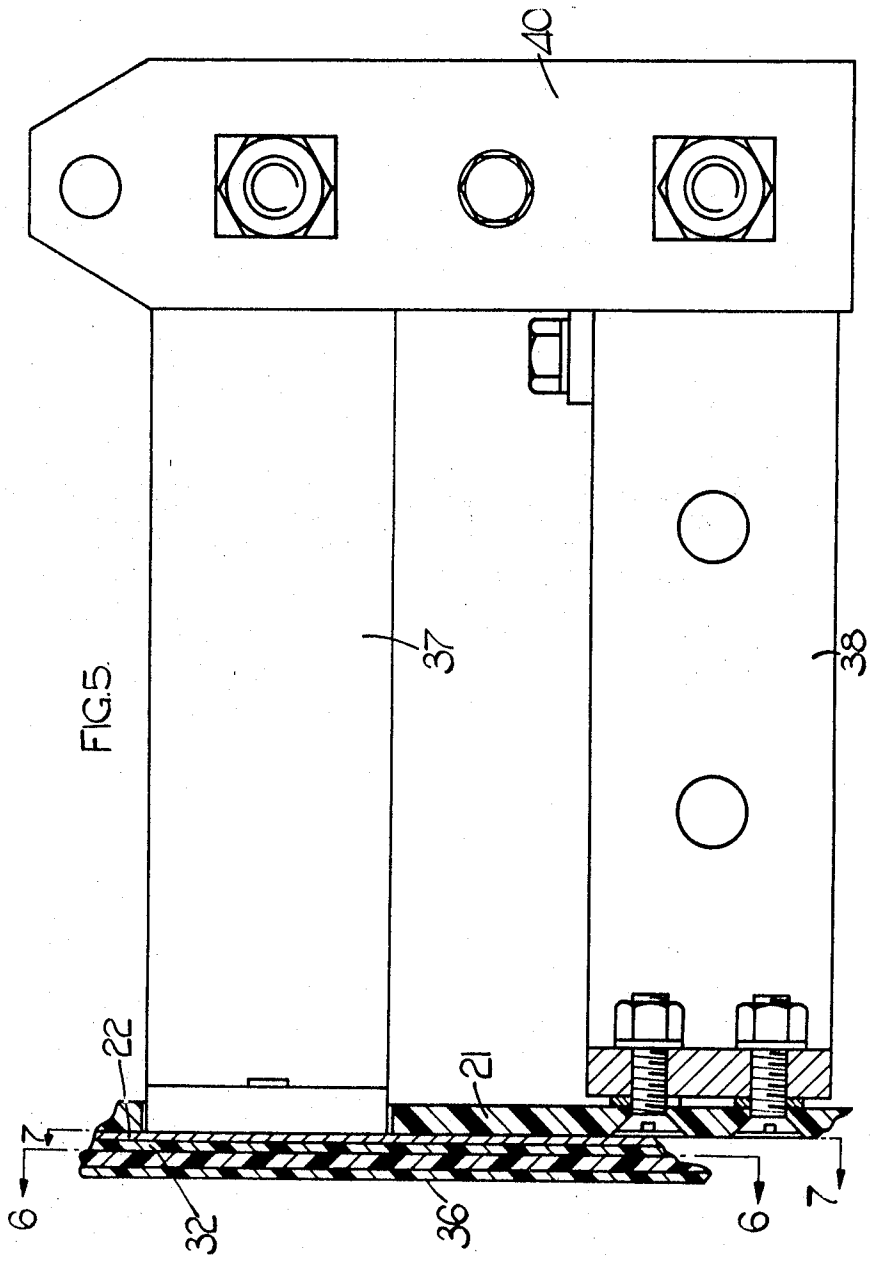


FIG.5

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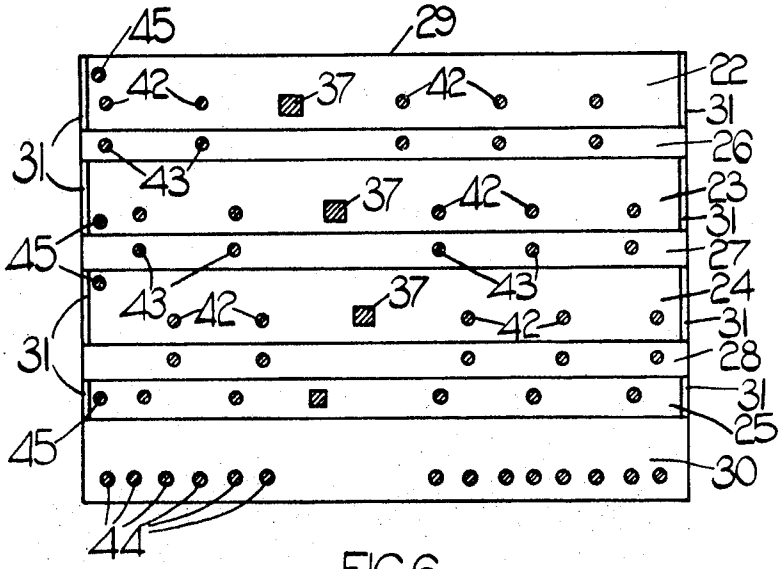


FIG. 6.

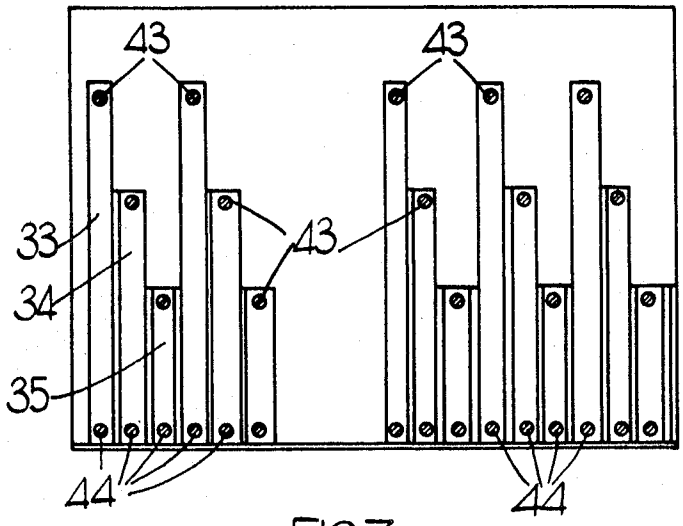


FIG. 7.

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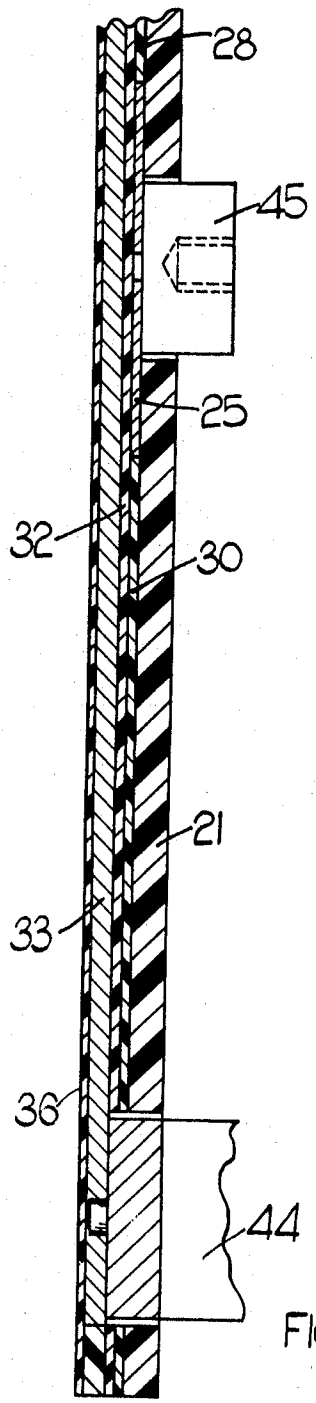


FIG. 8

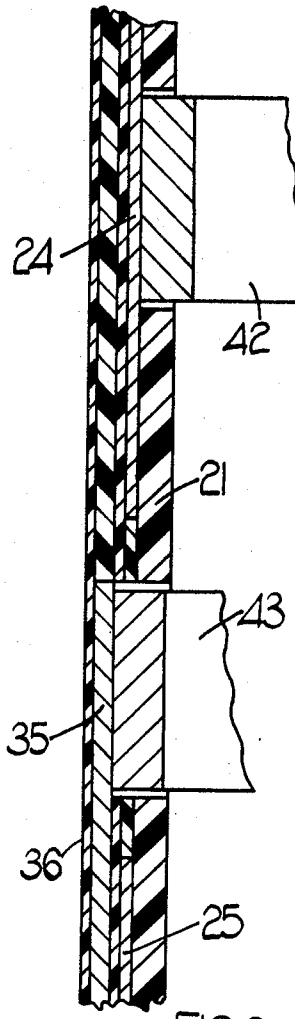


FIG. 9.

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ELECTRICAL DISTRIBUTION SYSTEMS

This invention relates to electrical distribution systems and has as one object to provide, in a convenient form, a fully insulated assembly of conductors for use in such a system.

A laminated assembly in accordance with the invention comprises a plurality of flat strips of conductive material arranged in a spaced coplanar relationship and separated by strips of insulation material, and a pair of separate sheets of insulation material bonded to the faces of the strips of conductive and insulation material, at least one of said insulating sheets having a plurality of holes exposing areas of said conductive sheets for the purpose of making electrical connections thereto.

In the accompanying drawings:

FIG. 1 is an elevation, partly broken away, showing one example of an assembly in accordance with the invention;

FIGS. 2 and 3 are enlarged sections on the lines 2–2 and 3–3 respectively in FIG. 1;

FIG. 3*a* is a section on line 3 in FIG. 1 but showing a joint between two of the assemblies of FIGS. 1 to 3;

FIG. 4 is an elevation of another example of the invention;

FIG. 5 is an enlarged fragmentary section on line 5–5 in FIG. 4;

FIGS. 6 and 7 are sections taken respectively on lines 6–6 and 7–7 in FIG. 5 and showing layers of the assembly on the same scale as FIG. 4;

FIG. 8 is an enlarged fragmentary section on line 8–8 in FIG. 4 and

FIG. 9 is an enlarged fragmentary section on line 9–9 in FIG. 4.

The assembly shown in FIG. 1 to 3*a* is intended for incorporation into busbar trunking, i.e., a system by means of which a polyphase electrical supply is carried around a building to enable tappings from some or all of the phases to be taken where required.

The assembly consists basically of four elongated conductive strips 10 and five strips 11 of insulation material, all of these strips lying in a coplanar relationship with the conductive strips 10 interposed, in edge-to-edge relation, between the insulating strips 11. The assembly also includes two flat sheets 12, 13 of insulating material, which are respectively adhesively bonded to the strips 10, 11 on opposite sides thereof. At the ends of the assembly the sheets 12, 13, and the strips 11 project beyond the strips 10 and insulating strips 14 are interposed between the sheets.

Connections to the strips 10 are made via holes in the sheet 13. These holes are, in the example described, arranged in longitudinally spaced groups extending across the sheet 13. At a corresponding position on each of the strips 10 there is affixed a contact stem 15 which projects through a hole in the overlying sheet 13.

Connectors 16 are affixed to the strips 10 at their ends and project through further holes in the sheet 13. These connectors have screw-threaded bores for the purpose of the bolting in position of conductive links 17 to interconnect the conductors of adjacent assemblies in the trunking. Thus, in use, the assemblies extend in an end-to-end coplanar relationship with the conductive links interconnecting the assemblies lying in a different plane. Where it is required to take the trunking around a corner bent links may be employed. FIG. 3*a* also shows the sheet metal enclosure for the assemblies.

The construction described has the advantage, over conventional busbar trunking constructions, that the conductors, being separated from the surrounding air only by thin insulating sheets and having considerable surface area, tend to run extremely cool. As a result the amount of copper or aluminum used can be reduced. In addition, in fault condition the magnetic stresses in the conductors tend to bend these in their own planes. Thus the assembly has high mechanical strength to resist breakdown owing to magnetic stress. This enables the mounting of the conductors to be effected simply and cheaply since the spacing of the conductors is quite independent of the mounting of the assembly.

The assembly described above is made up using insulation material cut from preformed sheets. The material is preferably a rigid laminated material consisting of a phenolic resin reinforced by paper or other layers. One such material is sold under the name "Tufnol" (RTM).

The invention may also be applied to distribution boards incorporating fuses, fused switches or circuit breakers, the assembly serving to connect the main incoming terminals of the board to the individual input terminals of the fuses, fused switches, or circuit breakers.

As shown in FIGS. 4 to 9 the invention is applied to a fuse distribution board. The assembly 20 consists of five layers. The layer 21 visible in FIG. 4 is a relatively thick sheet of insulating material formed with holes at a plurality of positions. The adjacent layer is made up of four strips 22, 23, 24 and 25, of conductive material extending horizontally across the assembly and separated by strips 26, 27 and 28 of insulating material. Further strips 29, 30 of insulating material lie beside the conductive strips 22 and 25 respectively and further insulating pieces 31 insulate the ends of the conductive strips.

The next adjacent layer is a complete sheet 32 of insulating material with holes aligned with some of the holes in the sheet 21, such holes also being aligned with holes in the insulating strips 26, 27, 28 and 30. The next adjacent layer includes groups of vertically extending conductive strips separated from each other and from the edges of the assembly by insulating material of appropriate size and shape. Each group of vertical conductive strips comprises a long strip 33 terminating at one end behind the strip 26, and strip 34 of intermediate length terminating at one end behind the strip 27 and a short strip 35 terminating at one end behind the strip 28. The strips 33, 34 and 35 all terminate at their opposite ends adjacent the lowermost edges of the assembly. The final layer of the assembly is a complete insulating sheet 36. All the layers are firmly bonded together utilizing a suitable adhesive.

In the example shown there are, in fact, five groups of conductive strip 33, 34, 35. Two of these groups are separated from the other three and the space is employed for making incoming connections to the conductive strips 22, 23, 24 and 25. Such connections are made by means of blades 37 (see FIG. 5) which are secured, e.g., by brazing, to the respective strips 22, 23 and 24. Each blade 37 is associated with a further blade 38 to which the appropriate incoming cable 39 is electrically connected. The blade 38 is supported on the front insulating sheet 21. A link 40 is used to interconnect the blades 37, 38.

The horizontal conductors 22, 23, and 24 are connected to the vertical conductors by means of known fuse carriers 41 mounted on blades 42, 43 (see FIG. 9), in known manner. FIG. 9 actually shows the blades 42, 43 associated with the connection between the strip 24 and one of the strips 35.

Outgoing connections from the assembly are provided by blades 44 on the lower ends of the vertical conductive strips 33, 34 and 35. For extending the distribution board to enable further groups of outgoing connections to be added without utilizing separate incoming connections there are conductive bosses 45 on the strips 22, 23, 24 and 25 respectively. These can be electrically connected by links to similarly bosses on another laminated assembly of similar construction (but lacking the blades 37, 38).

Connections to and from the strip 25, which serves as a neutral conductor, are made direct so that there are no vertical conductive strips associated with this strip 25.

As in the case of the busbar trunking described above the assembly used in the distribution board has the advantages of being extremely cool running —thereby enabling the amount of copper used to be reduced —and of having high mechanical strength to resist breakdown owing to magnetic stress —thereby enabling saving in labour and material to be made in the mounting of the assembly. In addition to the individual conductive strips in the assembly are fully insulated from one another, thereby enabling cable connections to the board to be made whilst the board is live, the appropriate fuse carriers 41 being removed to allow the connections to be made.

We claim:

1. A laminated assembly for use in electrical distribution systems comprising a plurality of flat strips of conductive material arranged in spaced coplanar relationship, a plurality of flat strips of rigid insulation material coplanar with and interposed between said conductive strips, and a pair of separate sheets of rigid insulation material adhesively bonded to the faces of the strips of conductive and insulation material, at least one of said insulating sheets having a plurality of holes exposing areas of said conductive strips for the purpose of making electrical connections thereto.

2. An assembly as claimed in claim 1 in which said conductive strips have permanently attached thereto connectors which project through said holes in said one insulating sheet.

3. An assembly as claimed in claim 1 in which the strips of conductive and insulation material have a total width less that the widths of said sheets and are of a length less than the lengths of said sheets, further strips of insulation material being interposed between said sheets around the marginal edges of the assembly and being adhesively bonded to said sheets completely to enclose the edges of said conductive strips.

4. An assembly as claimed in claim 1 in which the assembly is of elongated form with the conductive strips extending longitudinally of said assembly, said one sheet of insulation material being formed with two rows of holes arranged across the width thereof adjacent the respective ends of said one sheet, and with further rows of holes arranged across the sheet at a plurality of locations spaced along the length of the sheet.

5. A laminated assembly for use in electrical distribution systems comprising a plurality of flat strips of conductive material arranged in a spaced coplanar relationship and separated by strips of insulation material, a pair of separate sheets of insulation material bonded to the faces of said strips

of conductive and insulation material, one of the insulating sheets having a plurality of holes exposing areas of said conductive sheets, connectors permanently attached to said conductive strips and projecting respectively through said holes, a plurality of further conductive strips bonded to the other of the insulating sheets on the face thereof remote from said first-mentioned strips, said further strips extending transversely relative to said first-mentioned strips, a further insulating sheet bonded to and enclosing said further conductive strips, and means connecting selected ones of said first-mentioned conductive strips to selected ones of said further conductive strips.

6. A system of electrical conductors for electrical power distribution comprising a plurality of laminated assemblies each comprising a plurality of elongated flat strips of electrically conductive material arranged in a coplanar spaced, parallel relationship, a plurality of elongated, flat strips of insulation material coplanar with and interposed between said conductive strips and a pair of elongated flat sheets of rigid insulation material adhesively bonded to the faces of said strips of conductive and insulation material, one of said sheets having formed therein adjacent the ends of the laminated assembly, holes exposing areas of said conductive strips and being also formed at series of spaced positions along its length with rows of further holes exposing areas of the conductive strips; said assemblies being arranged in a coplanar end-to-end relationship; and conductive links lying in a plane spaced from the common plane of the assemblies and interconnecting the conductive strips of each assembly with the corresponding conductive strips of adjacent assemblies, through said first-mentioned holes in said holes in said one sheet of insulation material.