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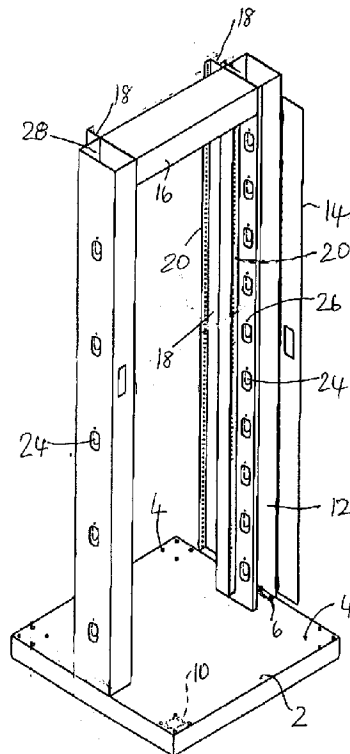
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(54) **LOGEMENT POUR MATERIEL ELECTRONIQUE MONTE SUR
UN RACK**

(54) **HOUSING FOR RACK MOUNTED ELECTRONIC EQUIPMENT**



(57) L'invention est un rack à modules électroniques comportant au moins deux éléments tubulaires verticaux espacés horizontalement, une base supportant ces éléments à leurs extrémités inférieures et un élément de dessus connectant ces membres à leurs extrémités supérieures, ces membres verticaux ayant généralement une section rectangulaire avec une ouverture verticale (qui peut être fermée par une porte) s'étendant sur un côté et une suite d'ouvertures espacées verticalement sur au moins l'un des autres côtés et faisant face à l'un des côtés d'un autre des éléments verticaux ayant une suite correspondante d'ouvertures espacées verticalement,

(57) A rack for rack-mount electronic modules has at least two horizontally spaced and vertically extending tubular members, a base supporting the members at their bottom ends and a top member connecting the members at their top end, the vertically extending members each being of generally rectangular cross section with a vertically extending opening (which may be closed by a door) extending the length of one side thereof and a series of vertically spaced openings in at least one other side thereof facing a side of another of the vertically extending members having a corresponding series of vertically spaced openings, at least two of the vertical



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deux des éléments verticaux au moins ayant des rebords s'étendant verticalement et supportés dans un plan commun aux côtés opposés des éléments verticaux pour recevoir les vis de fixation des modules. Dans la concrétisation privilégiée de l'invention, les éléments verticaux dont un côté fait face à une suite d'ouvertures espacées verticalement comme ci-dessus sont connectés par des conduits de traversée horizontaux entre les ouvertures de ces suites, de sorte que les câbles connectés aux modules électroniques peuvent être logés dans lesdits éléments verticaux et lesdits conduits de traversée. L'une des concrétisations de l'invention utilise une paire d'éléments verticaux faisant face aux rebords qui se trouvent dans un plan commun parallèle aux parois arrière des éléments verticaux qui font face aux ouvertures. Une autre concrétisation de l'invention utilise une paire additionnelle d'éléments verticaux placés derrière la première paire de façon à former avec ceux-ci les coins d'une colonne rectangulaire, la première et la seconde paires d'éléments verticaux supportant une porte avant et une porte arrière et la base et l'élément de dessus formant le dessus et le dessous d'une armoire à côtés amovibles placée entre les éléments verticaux de la première et de la seconde paires d'éléments verticaux de façon à former un rack fermé avec lesdites portes.

members having vertically extending flanges supported in a common plane from facing sides of the vertical members to receive screws for securing rack mounted modules. Preferably at least two of the vertical members having facing sides with said series of vertically spaced openings are connected by trough shaped conduits extending horizontally between openings in said series, so that cables connected to said electronic modules may largely be housed within said vertical members and said trough shaped conduits. In one embodiment a pair of vertically extending members is provided, the openings in the members extending the length of the members facing in a first, front direction with the flanges located in a common plane parallel to rear walls of the vertical members opposite the openings. In a second embodiment of the invention, an additional part of vertical members is provided spaced rearward of the first pair so that together the vertical members form corners of a rectangular column, the first and further pairs of vertical members supporting front and rear doors, and the base and top members forming top and bottom panels of a cabinet, detachable side panels of which extends between vertical members in said first and further pair of members to form together with said doors an enclosed rack.

ABSTRACT

A rack for rack-mount electronic modules has at least two horizontally spaced and vertically extending tubular members, a base supporting the members at their bottom ends and a top member connecting the members at their top end, the vertically extending members each being of generally rectangular cross section with a vertically extending opening (which may be closed by a door) extending the length of one side thereof and a series of vertically spaced openings in at least one other side thereof facing a side of another of the vertically extending members having a corresponding series of vertically spaced openings, at least two of the vertical members having vertically extending flanges supported in a common plane from facing sides of the vertical members to receive screws for securing rack mounted modules. Preferably at least two of the vertical members having facing sides with said series of vertically spaced openings are connected by trough shaped conduits extending horizontally between openings in said series, so that cables connected to said electronic modules may largely be housed within said vertical members and said trough shaped conduits. In one embodiment a pair of vertically extending members is provided, the openings in the members extending the length of the members facing in a first, front direction with the flanges located in a common plane parallel to rear walls of the vertical members opposite the openings. In a second embodiment of the invention, an additional pair of vertical members is provided spaced rearward of the first pair so that together the vertical members form corners of a rectangular column, the first and further pairs of vertical members supporting front and rear doors, and the base and top members forming top and bottom panels of a cabinet, detachable side panels of which extend between vertical members in said first and further pair of members to form together with said doors an enclosed rack.

BACKGROUND OF THE INVENTION**FIELD OF THE INVENTION**

This invention relates to the housing of electronic equipment, particularly so-called rack-mounted equipment.

REVIEW OF THE ART

Rack-mounted equipment modules are provided with housings
5 having front walls with lateral extensions through which
the modules are secured to spaced vertical support members
of a rack. The rack may be either free standing or
enclosed. The equipment modules commonly have numerous
cable connections for power and signals to their rear
10 walls, and frequently also require cable connections such
as patch cords to plugs or sockets on their front walls.
These cable connections can present a considerable cable
management problem in a complex installation. In enclosed
racks, provision must usually be made for ventilation, and
15 cabling in the enclosures behind the modules acts as a dust
trap and may obstruct ventilation.

In my copending Canadian Patent Application No.
2,173,799, I describe a shelving system for supporting
electrical equipment making use of a combination of
20 specially configured vertical and horizontal elements which
assist in cable management.

SUMMARY OF THE INVENTION

I have now found that with some modifications,
elements of this shelving system may form the basis of
25 improved open or closed racks for supporting and enclosing

rack-mount electronic modules. According to the invention a rack for rack-mount electronic modules comprises at least two horizontally spaced and vertically extending tubular members, a base supporting said members at their bottom
5 ends and a top member connecting said members at their top ends, the vertically extending members each being of generally rectangular cross section with a vertically extending opening (which may be closed by a door) extending the length of one side thereof and a series of vertically
10 spaced openings in at least one other side thereof facing a side of another of the vertically extending members having a corresponding series of vertically spaced openings, at least two of the vertical members having vertically extending flanges supported in a common plane from facing
15 sides of the vertical members to receive screws for securing rack mounted modules. Preferably at least two of the vertical members having facing sides with said series of vertically spaced openings are connected by trough shaped conduits extending horizontally between openings in
20 said series, whereby cables connected to said electronic modules may largely be housed within said vertical members and said trough shaped conduits.

In one embodiment of the invention a pair of vertically extending members is provided, the openings in
25 the members extending the length of the members facing in a first, front direction with the flanges located in a common plane parallel to rear walls of the vertical members opposite the openings, and the horizontal conduits extend between openings in side faces of the vertical members
30 adjacent the flanges.

In a second embodiment of the invention, an additional part of vertical members is provided spaced rearward of the first pair so that together the vertical members form corners of a rectangular column, the first and further
35 pairs of vertical members supporting front and rear doors, and the base and top members forming top and bottom panels

of a cabinet, detachable side panels of which extends between vertical members in said first and further pair of members to form together with said doors an enclosed rack. Horizontal trough shaped conduits extend between vertical
 5 members in said first and further pairs within said side panels, and optionally between the vertical members of each pair within said doors.

The flanges may be comprised by members selectably secured to the rearward members to provide a selected
 10 degree of offset relative to the vertical members in a fore-and-aft direction.

Further features of the invention will be apparent from the following description.

SHORT DESCRIPTION OF THE DRAWINGS

15 In the accompanying drawings, Figure 1 is an isometric view from in front, one side and above of a first embodiment of the invention;

Figure 2 is a similar isometric view of a second embodiment of the invention with front and rear doors and
 20 side panels removed;

Figure 3 is a view corresponding to Figure 2 with the doors and side panels in place;

Figure 4 is a detail of a bottom corner of the structure shown in Figure 2, illustrating the attachment of
 25 the front door;

Figures 5A, 5B and 5C show opposite side and end elevations of a horizontal conduit member; and

Figure 6 illustrates a connection between the conduit member of Figures 5A, B and C and a vertical member.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

30 Referring to Figure 1, this shows an open rack for supporting rack-mount electronic modules, for example in a relay room or other equipment room in which there is no need to enclose the modules. A base unit 2 is formed of

sheet metal, and may be drilled as shown at 4 to receive bolts 6 securing vertical members 8 to the base.

Alternatively, the members 8 may be welded to the base.

Additional drillings are provided at the corners of the

5 base so that the same base may be used for the second embodiment described below. Knock-out or cut-out portions 10 may be provided in the locations for receiving vertical members so as to permit cables to pass from beneath the base into the vertical members.

10 The vertical members 8 are in the form of hollow column of generally rectangular, preferably square, cross section. A front side of each member has an opening 12 extending essentially the entire height of the member, which opening provided with a door 14 hinged at one edge.

15 The top ends of the vertical members are connected by a top member 16 which is bolted or welded in place. In a typical rack for accommodating standard 19 inch rack mount modules, the vertical members are spaced 19 inches apart, and angle members 18 are bolted or welded to the vertical members to

20 provide inwardly extending flanges 20 extending in or parallel to the plane of rear walls of the vertical members. The flanges have threaded holes 22 to receive screws for securing modules to the flanges. The vertical members are provided in their side walls with vertical

25 series of openings 24 through which cables may pass to and from the interior of the members. Unused openings may be closed by blanking plates (not shown) secured by screws (not shown) entering screw holes 26. In order to provide additional guidance for cables, channel section horizontal

30 conduits similar to the conduits 200 described in my application no. 08/630,740 may be secured by screws between openings 24 in the vertical members 8. The provision of openings 24 in the outward side walls of the vertical members 8 may not always be strictly necessary, but

35 simplifies manufacture and parts inventory and provides facilities for passing cables between adjacent racks. Cables to and from modules mounted in the rack may pass up

the members 8 from the base or down from the open tops 28, and hence out through the openings 24, guided if required by conduits 200. Likewise, cables between units may be routed up or down the members 8 between openings 24. The
5 doors 14 provide access for arranging the cables.

In order to provide an alternative securement plane for units supported by the housing, Z section flanges 18 providing alternative flanges 20 may be used to provide a selected offset for the units in a fore-and-aft direction.

10 As best seen in Figure 2, the columns 8 may also in the Figure 1 embodiment include openings 30, to provide access for cable from the rear of the modules.

Turning now to the embodiment of Figures 2 and 3, there is shown an enclosed rack assembly, although in
15 Figure 2, side panels and doors are omitted so as to show the internal construction. In this embodiment, two pairs of vertical members 8 are provided, each similar to the pair already described with reference to Figure 1, except that the members of the second part (to the left and top of
20 Figure 2) have their doors 14 facing to the rear, and the vertical members are secured to the corners of the base 2 so that the latter forms the base of a cabinet. The top member 16 of Figure 1 is replaced by a generally rectangular member 32 which forms the top of the cabinet 34
25 shown in Figure 3. Cross members 36 secured to front and rear faces of the base member 2 and top member 32 provide support for front and rear cabinet doors 38 and 40, pivoted as shown in Figure 4 to the cross members 36 by pivot pins 42. The structure is further stiffened by cross members 37.
30 In order to provide ventilation within the cabinet, extraction fans (not shown) may be mounted in cut-outs 44 in the top member 32. Air may enter the cabinet through filters installed in other of the cutouts 44, or through a filter 46 installed in the base 2.

Horizontal conduits may be installed between the vertical members of the front pair or rear pair as already described with reference to the first embodiment. While similar members could be utilized to connect between
5 vertical members 8 in the front and rear pair inside side panels 46 (see Figure 3), an alternative form of conduit is preferred as shown in Figure 2, and in more detail in Figures 5A, B and C and 6. This conduit 50 has a channel section as best seen in Figure 5C which is of U-shape as
10 shown, or J-shape with the right hand arm 52 lower than the left hand arm 54. At opposite ends of the wall 54 are formed hooks 56, which are of sufficient length that the distance from the extremities of the hooks at one end to the roots of the hooks at the other end is less than the
15 spacing between the front and rear pairs of vertical members 8, while the distance between the barbs of the hooks at opposite ends is greater than that spacing. This enables the conduits 50 to be readily engaged between or removed from slots 58 in the vertical members 8. Each
20 opening 30 in the vertical members 8 has two sets of slots 58 so that the conduits 50 may be inserted with the wall 52 facing either inward or outwards, depending on whether it is convenient to arrange cables in the conduit from within the cabinet, or by access through the side panels 46, which
25 are easily installed or removed using cam-lock fasteners 60 engaging the top member 32, and clips entering slots 62 in the base member 2. Cam-locks or other locks or latches 64 are also provided to secure the doors 38 and 40.

In use, in both embodiments, conduits 200 or 50 are
30 installed in appropriate locations having regard to the intended location and cabling requirements of rack-mount modules to be installed, and required cables are inserted through the vertical members 8 and conduits, making use of the openings at top and/or bottom of the vertical member
35 and the openings 24 and 30. Openings 24 and 30 which are not used are closed by blanking plates. Not only do the arrangements described provide built-in cable management,

but the induction of unfiltered air through the vertical members 8 in the embodiment of Figures 2 and 3 can readily be minimized, thus helping reduce dust accumulation within the cabinet.

CLAIMS:

1. A rack for rack-mount electronic modules comprising at least two horizontally spaced and vertically extending tubular members, a base supporting said members at their bottom ends and a top member connecting said members at their top ends, the vertically extending members each being of generally rectangular cross section with a vertically extending opening extending the length of one side thereof and a series of vertically spaced openings in at least one other side thereof facing a side of another of the vertically extending members having a corresponding series of vertically spaced openings, at least two of the vertical members having vertically extending flanges supported in a common plane from facing sides of the vertical members to receive screws for securing rack mounted modules.

2. A rack according to Claim 1, wherein at least two of the vertical members have facing sides with said series of vertically spaced openings are connected by trough shaped conduits extending horizontally between openings in said series, whereby cables connected to said electronic modules may largely be housed within said vertical members and said trough shaped conduits.

3. A rack according to Claim 1, wherein the vertically extending members have doors to close the vertically extending openings.

4. A rack according to Claim 1, wherein a pair of vertically extending members is provided, the openings in the members extending the length of the members facing in a first, front direction with the flanges located in a common plane parallel to rear walls of the vertical members opposite the openings, and the horizontal conduits extend between openings in side faces of the vertical members adjacent the flanges.

5. A rack according to Claim 1, wherein an additional part of vertical members is provided spaced rearward of the first pair so that together the vertical members form corners of a rectangular column, the first and further pairs of vertical members supporting front and rear doors, and the base and top members forming top and bottom panels of a cabinet, detachable side panels of which extends between vertical members in said first and further pair of members to form together with said doors an enclosed rack.

6. A rack according to Claim 5, wherein horizontal trough shaped conduits extend between vertical members in said first and further pairs of vertical members within said side panels.

7. A rack according to Claim 6, including horizontal trough shaped conduits extending between the vertical members of each pair of vertical members within said doors.

8. A rack according to Claim 1, wherein the flanges are comprised by members selectably secured to the rearward members to provide a selected degree of offset relative to the vertical members in a fore-and-aft direction.

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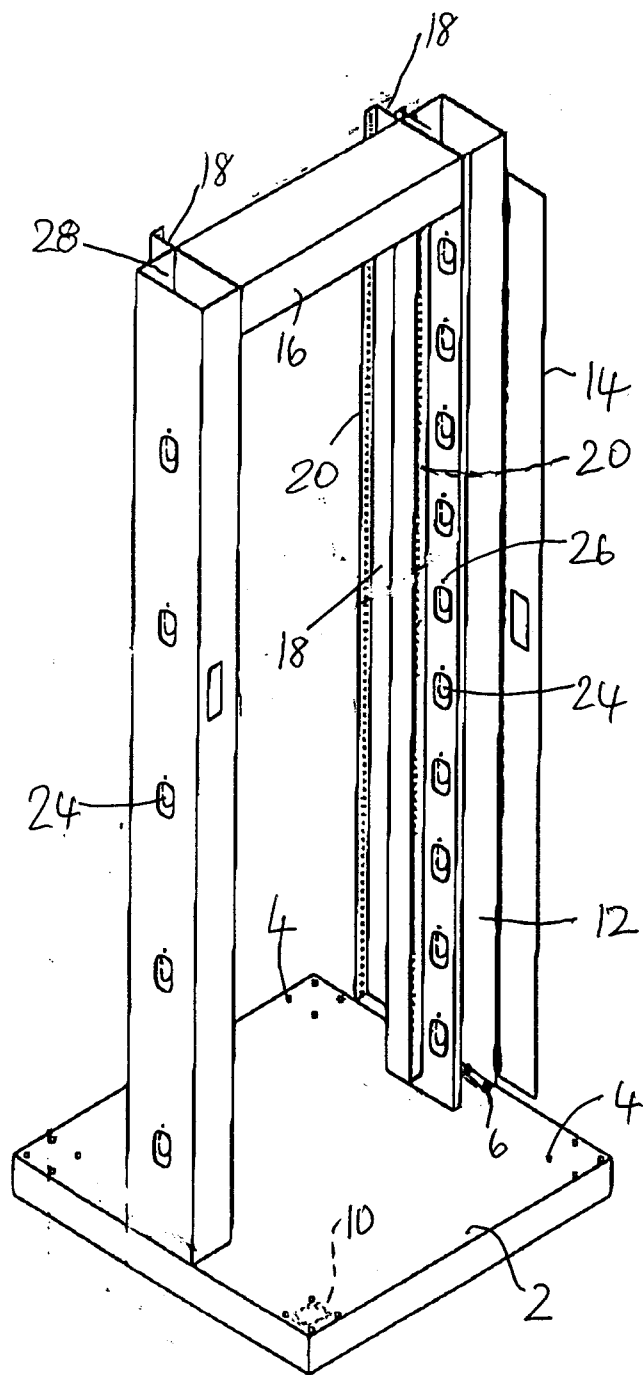


FIG 1

