

[54] **FRAMEWORK FOR SUPPORTING AIR COOLED ELECTRICAL AND ELECTRONIC EQUIPMENT**

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[58] Field of Search.....**317/99, 100, 112, 117, 120, 317/122; 338/320**

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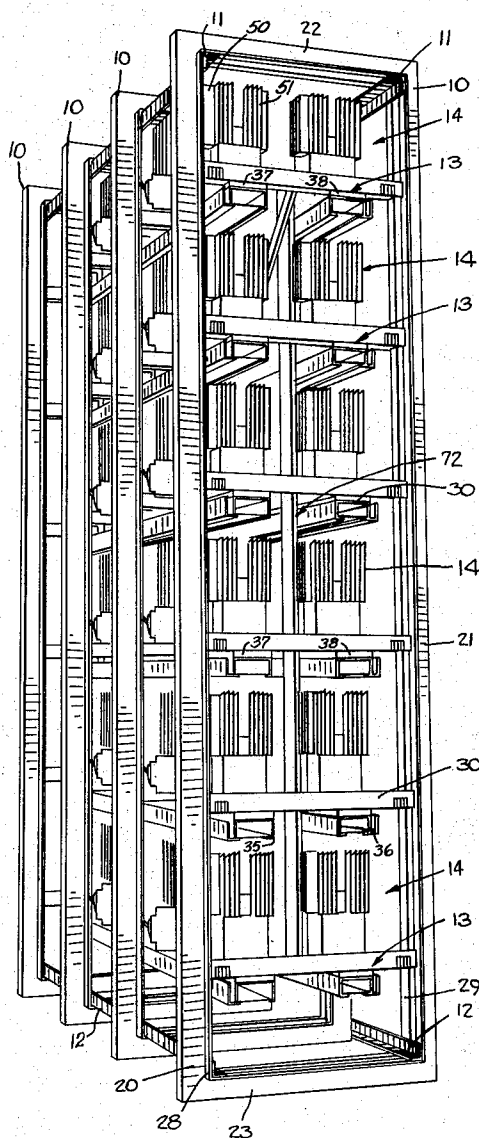
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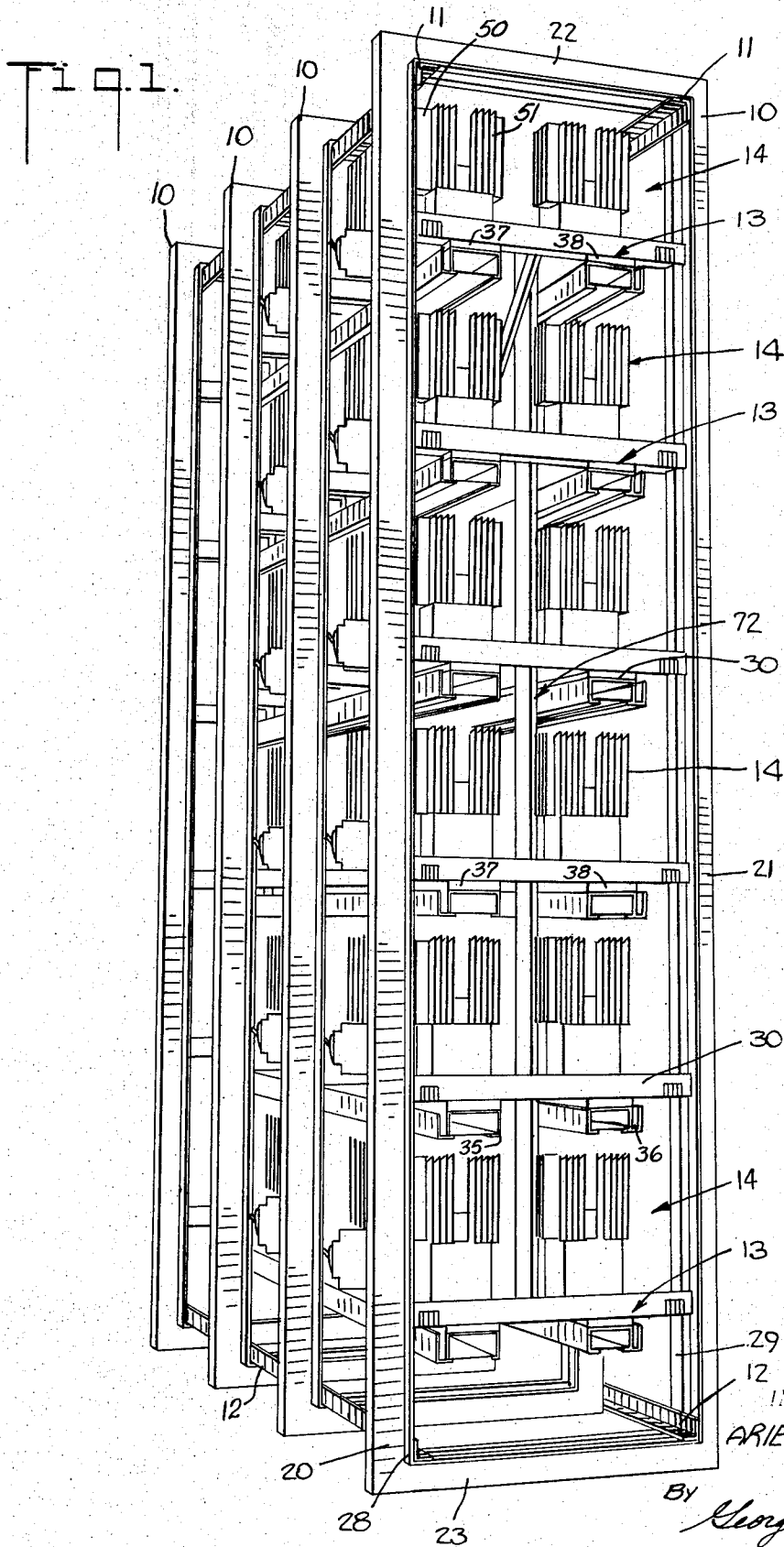
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[57] **ABSTRACT**

A framework comprising a plurality of vertical rectangular open frames interconnected at the top and bottom by tie beams and intermediately by a plurality of vertically spaced shelves. The shelves have horizontal cross members mounted on the frames and current-carrying connecting support beams mounted on the cross members in electrically isolated relation therewith. Cables in the frame, crossmembers and beams supply low current to current controlled units mounted on these connecting support beams and electrically connected thereto. Vertical bus bars are connected to said connecting support beams for supplying current thereto and said current-control units.

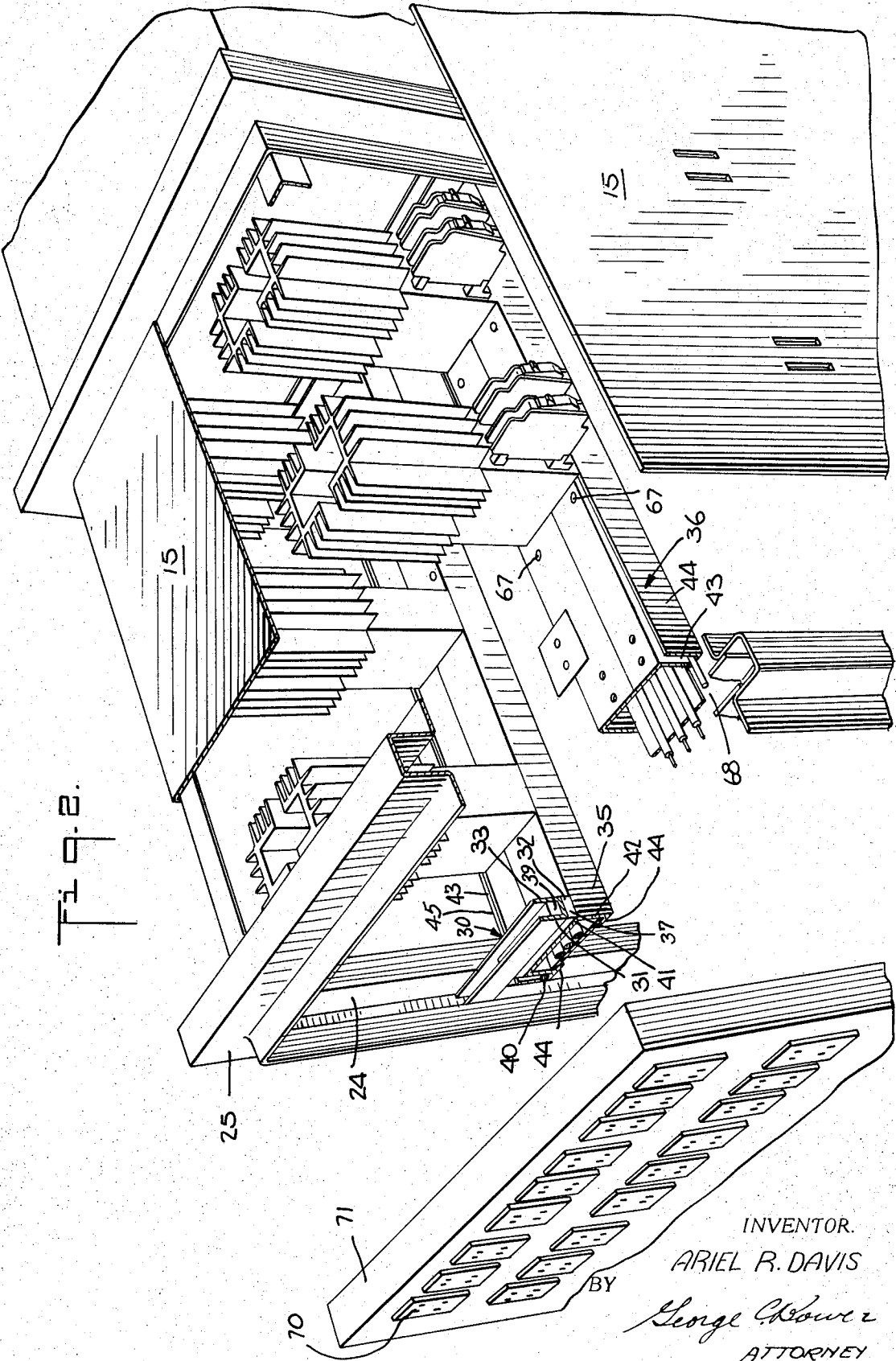
11 Claims, 7 Drawing Figures





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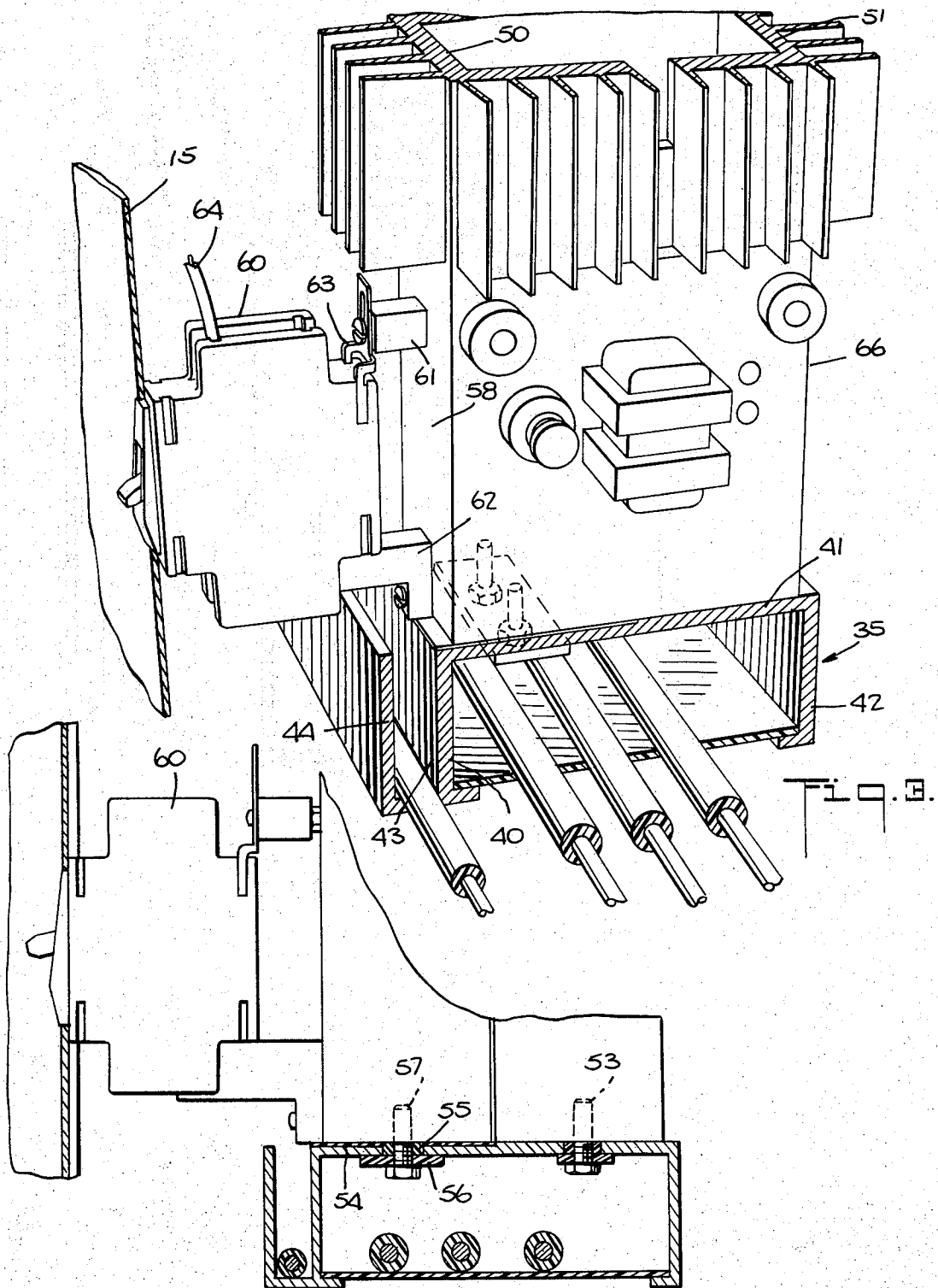
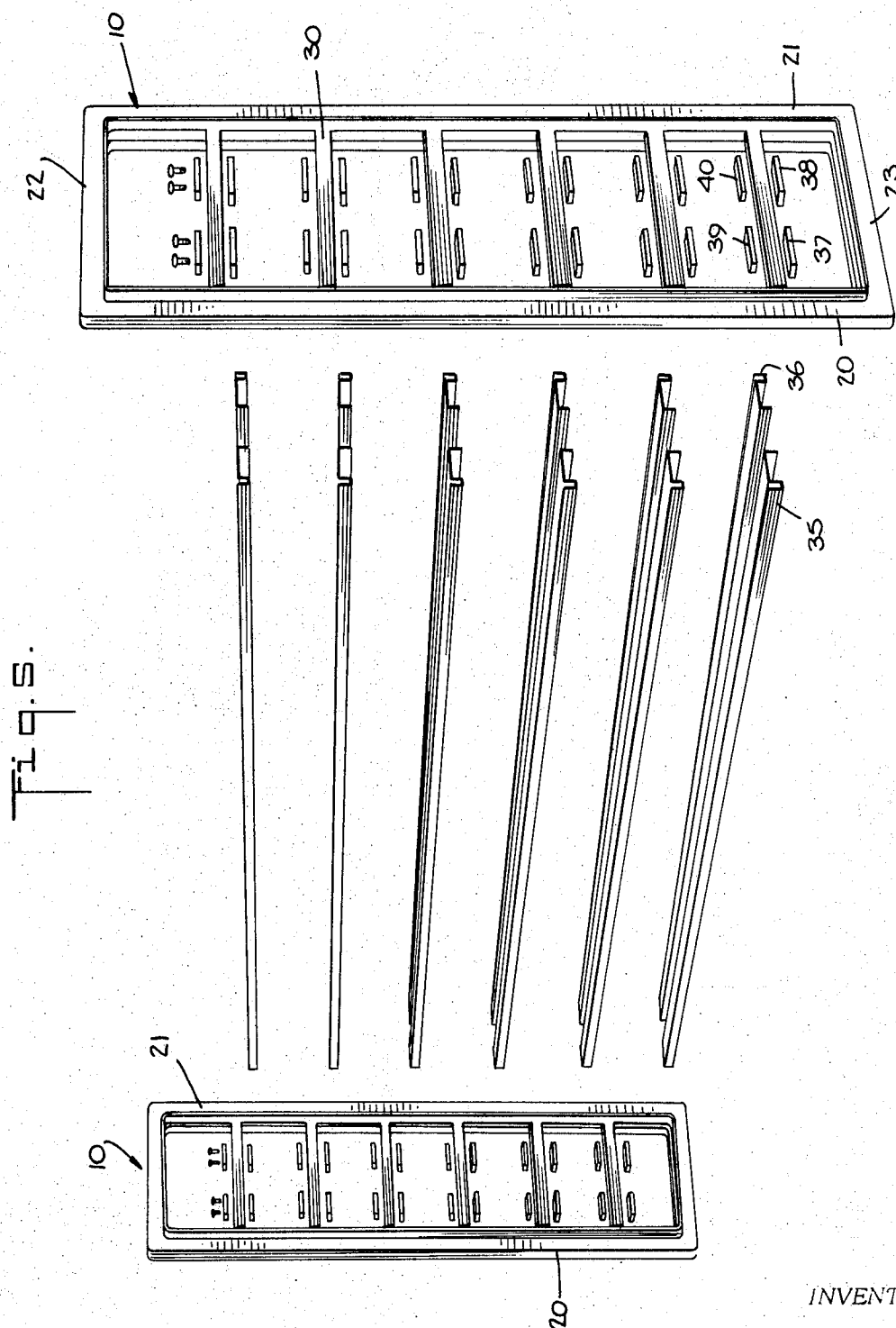


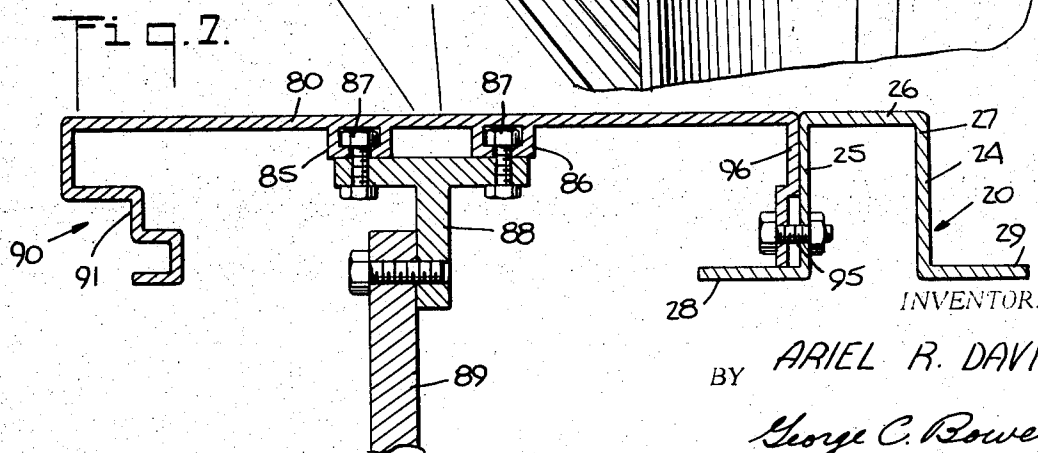
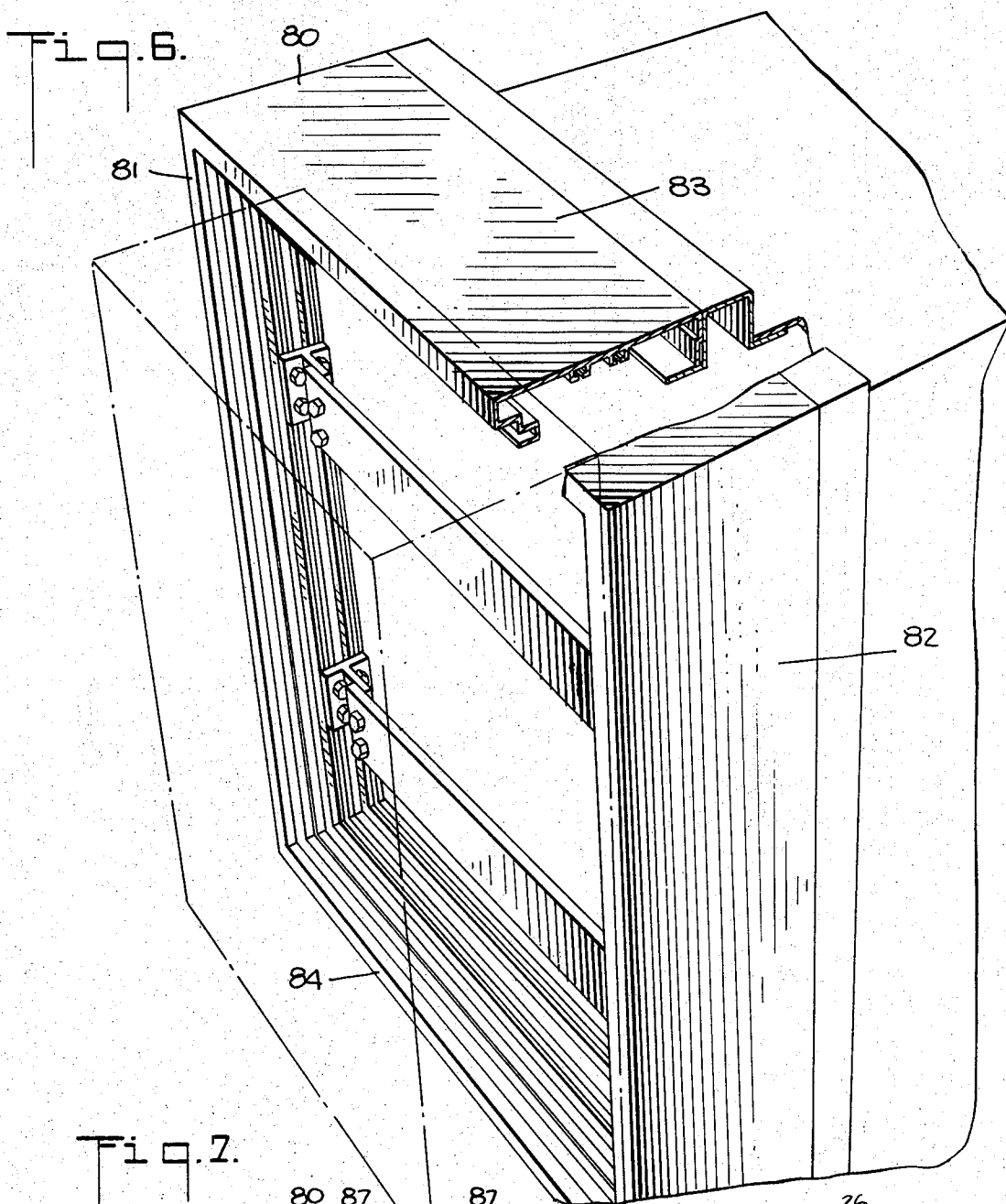
Fig. 4.

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FRAMEWORK FOR SUPPORTING AIR COOLED ELECTRICAL AND ELECTRONIC EQUIPMENT

BACKGROUND OF THE INVENTION

This invention relates to frameworks for supporting air cooled electrical and electronic equipment.

In housing and supporting the dimming units for controlling the current supplied to stage equipment and stage lighting individual dimming units have been mounted in supporting housings. The frameworks are made of steel and the dimming units are enclosed in casings and mounted in the frameworks. This type of structure has many disadvantages, including excessive weights and problems of ventilation. Also, the entire structure would be custom made and often for large installations result in a cumbersome and difficult piece of equipment to ship.

It is the purpose of this invention to reduce the number of parts, to use light weight metals and to modulate the framework. It is a further purpose to simplify the electrical connection of the various circuits and the supply of current to the dimmers supported by the framework.

OBJECTS AND SUMMARY OF THE INVENTION

An object of this invention is to provide a light weight framework for supporting and housing air cooled electrical equipment.

Another object of this invention is to provide a modular or unit type framework for standardized cabinets which are formed from multiples of the modules or units.

Another object of this invention is to manufacture the members of the framework from light weight aluminum.

Another object of the invention is to provide a support framework that is interiorly open to circulate air.

Another object of the invention is to utilize supporting members for the conduction of the load current.

Another object of the invention is to provide a simple installation and support of the electrical wires.

Another object of the invention is to provide means for mounting a patch panel on the framework.

In summary, the framework comprises vertical rectangular open spaced frames connected by the tie member at the corners and shelf-like means extending between and through the frame and said shelf-like means having cross members mounted on respective frames and having connecting support beams insulatingly attached to the cross members for supporting electrical dimmers in conductive relation with the support beams.

Other objects and advantages will be apparent from the following description taken in connection with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an end perspective view of the framework with dimmers.

FIG. 2 is a perspective top view of the framework with portions of the framework and covering fragmentized and the connecting panel separated from the framework.

FIG. 3 is a fragmentary sectional view of a support beam and a dimmer thereon.

FIG. 4 is a sectional view of a support beam supporting a dimmer fragmentarily shown with a circuit breaker.

FIG. 5 is an exploded perspective view of the framework.

FIG. 6 is a perspective view of the patch panel frame.

FIG. 7 is a sectional view of the patch panel frame taken along lines 7—7 of FIG. 6.

The framework comprises a plurality of vertical frames 10 (FIG. 1) connected at top and bottom by L-shaped tie bars 11 and 12, respectively, and shelves or shelf-like means 13. Banks of electrical, air-cooled, dimmers 14 are mounted on the shelves for controlling load current in response to control signals. Panels 15 (FIG. 2) fitting between the frames encloses the framework.

The frames are open and rectangular in shape. Each frame has two long vertical columns 20, 21 and top and bottom members 22, 23 welded to the respective columns 20, 21 at the ends to form the frames as single pieces. The columns and members each comprise a U-shaped channel 24 (FIG. 7) with sides 25, 26, 27 and two flanges 28, 29 extending perpendicularly from the free longitudinal edges of the facing sides 25, 27, respectively. These flanges are on the inner edges of the frames and provide stiffness and rigidity to the frame. The L-shaped tie bars 11 and 12 are attached to these flanges on each of the frames horizontally spacing the vertical frames.

The horizontal shelves or shelf-like means 13 are fastened to the frames and are vertically spaced to support a large number of dimmers or current controlled units. The shelves have U-shaped cross members 30 with sides 31, 32, 33. The members fit in between the sides 25, 27 of the columns and are welded to the columns. The members are positioned with the opening facing upwards. Each frame has one of these cross members for each shelf. The shelves have two support beams 35, 36 extending horizontally through the frames and attached to the sides 32 of the cross members. The beams are underneath the cross members and spaced therefrom by insulating blocks 37, 38. Insulating blocks 39, 40 are fitted between the sides 31, 33 to receive bolts extending downwardly through the associated insulating blocks for securing the support beams to the cross members by nuts threading on the bolts. The insulating blocks 37—40 electrically isolate the support beams from the cross members 30 and the blocks in the cross member carry the load from the beam to the frame. The support beams in cooperation with the tie bars 11 and 12 rigidly secure the frames together through the respective cross members. The framework is sturdy and rigid with the flanges on the columns as stiffening members.

The columns 20, 21; top and bottom members 22, 23; cross members 30, support beams 35, 36 and tie bars 11 and 12 are extruded aluminum.

The support beams 35, 36 are generally U-shape in cross section formed by walls 40, 41, 42. Narrow inwardly extending flanges 44 are on the free ends of the sidewalls 40, 42. On the wall 40 is the L-shaped portion or flanges 44 attached to the outside of the free end of the wall 42 to form a channel 43 along the side of the wall 42.

The dimmers 14 are two units 50, 51 of the type described in my co-pending patent application, Ser. No. 775,014 filed on Nov. 12, 1968 issued as U.S. Pat. No. 3,541,433 and entitled "Current Supply Apparatuses With Inductive Winding and Heat Sink for Solid State Devices". As best shown in FIGS. 3 and 4 the unit 51 is fastened and electrically connected to the connecting walls of the support beams 35 or 36 by bolts 53. The unit 50 is electrically isolated from the support beams 35 or 36 by the insulating strip 54, insert 55 and washer 56. The bolt 57 electrically isolated by the washer and insert fastens the unit 50 to the beam.

The circuit breaker 60 is mounted on the side of the unit 50 facing towards the side of the framework by two posts 61, 62. The post 61 is bolted to the side of the unit 50 above the winding 58 and the circuit breaker bracket 63. The lower post 62 is electrically bolted to the unit 50 below the winding 58 and to a terminal (not shown) of the bracket. The cable 64 is connected to the other terminal (not shown) of the bracket. The current passes serially through the two units between the cable 64 and the supporting beams 35 or 36. The passage of load current is controlled by silicon controlled rectifiers (not shown) mounted on the units and fired by the circuit 66 secured to the side of the units. The front of the circuit breaker 60 is mounted in the front panel of the walls 15 for easy access.

The cable 64 passes through opening 67 in the respective support beam. An insulating support strip 69 is held by the flanges 44. The outer channel 43 carries the signal wires 68 for the firing circuits.

On the end of the framework a panel 71 is mounted on the flanges with receptacles 70 connected to the signal wires 68. The signal wires from a control console are plugged into a respective receptacle for controlling the respective dimmers.

Vertical strips or bus bars 72 are attached to the support beams 35, 36 and have terminals for connection to a power line. The cables 64 from the circuit breakers are connected to the cross connect panel (not shown).

As illustrated in FIGS. 6 and 7 a rectangular casing 80 may be mounted on the end frame for housing and supporting a patch panel such as described in my co-pending patent application, Ser. No. 883,099 filed on Dec. 8, 1969 and entitled "Cordless Electric Cross Connect Panel" and now issued as U.S. Pat. No. 3,603,747. The casing 80 has vertical side walls 81, 82 and top and bottom walls 83, 84 corresponding in dimensions to the outer walls of the columns and top and bottom members for a flush mating. The side walls longitudinally extending bosses 85, 86 with slots for receiving the heads of the bolts 87 to which the T-shaped brackets 88 are fastened. Straps 89 are bolted to the T-shaped brackets to strengthen the casing.

The cross connect panel (not illustrated) is mounted on the casing in front of the straps. The main support members of the panel cross connect fit in the groove 90 formed by the generally L-shaped flange 91. The panel has lugs connected to bus bars selectively connectible to lights and other devices. The cables 64 from the circuit breakers are connected to these lugs.

At the rear, the casing is bolted to the end frame by fastening means 95 extending through the flange 96.

Various modifications or change in this embodiment may be made. The firing circuits 66, instead of being

bolted on the side of the windings of the dimmer, may be mounted on the end of framework for easy access to replace defective circuits.

The framework may be made of one, two, three or more modules, depending on the number of dimmers. This provides for easy standardization.

As seen, the members of the framework are made from extruded aluminum pieces and the mounting of the dimmers is compact. The units 50, 51 have vertical cooling fins which provide a flow of air for the dissipation of heat created by the passage of the load current. The units 50 and 51 are also made of extruded aluminum thus the total weight of the dimmer bank is such that shipment by air freight is competitive with other modes of transportation. The prompt delivery by air offsets any additional expense for shipment by that means of transportation.

Only three dies are required to form the pieces from which the framework is made. One die is required for the framework, a second for the support beams and a third for the cross members. The dimmer units are also formed by extruded aluminum. Another advantage of the framework is the ease of assemblage. The members in the columns of the frame are welded at the corners and the cross members are welded to the frame. The support beams as previously described are bolted to the cross pieces. The tie bars are also welded. By fitting sheet metal and fastening to the flanges 28 and 29 a pleasing exterior appearance is provided. The space between the support beams and the divisions of openings in the bottom and top of the walls provides for a circulation of air vertically through the dimmer bank.

Various modifications and changes may be made in the foregoing embodiment without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A framework comprising at least two vertical frames horizontally spaced apart and each having spaced vertical columns and top and bottom members connected to said columns, a plurality of horizontal shelf-like means mounted on said frames, each of said shelf-like means having cross members with each, respectively, extending horizontally between said columns of one said frame and each of said shelf means having horizontal support beams extending in spaced relation to one another and between said cross members, said support beams each having a generally flat U-shape formed by each having spaced, facing side walls and a connecting wall extending between said side walls, dimmer units for controlling load current passing therethrough and said dimmer units mounted on said connecting walls for cooling by air currents flowing through said framework.

2. The framework as set forth in claim 1 wherein said frames are connected by tie bars.

3. A framework as set forth in claim 1 wherein said connecting wall faces upwardly and said dimmer units are mounted on said walls.

4. A framework as set forth in claim 1 wherein said support beams have L-shaped members mounted on one side of said beams and forming a groove with the mounted side of said support beam.

5. A framework as set forth in claim 1 wherein said support beams are connected by vertical bus means.

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6. A framework as set forth in claim 5 wherein one bus means is attached to a vertically spaced support beams position one above the other and a second bus is attached to said other support beams vertical position above one another.

7. A framework as set forth in claim 3 wherein means are provided for supporting power cables between the side walls of respective connecting support beams.

8. A framework as set forth in claim 1 wherein said support beams are electrically insulated from said cross members.

9. A framework as set forth in claim 1 wherein casing means are provided mounted on an end frame member for supporting a cross connected panel.

10. A framework as set forth in claim 1 wherein sheet metal covering is provided between said frames.

11. A framework comprising at least two vertical frames each having spaced vertical columns with

passages therein and top and bottom members welded to said columns, a plurality of shelf means mounted on said frames, each of said shelf means having two cross members with passages therein, each cross member extending horizontally between said columns of said respective frames with the passages of said cross members connected to the passages of said columns and said shelf means having horizontal support beams extending in spaced relation to one another and between said cross members, means securing said support beams to and electrically isolating said beams from said cross members, means connected to said beams for supplying load current thereto, dimmer units mounted vertically on said beams and electrically connected thereto for passing load current therethrough and cables in said passages connected to said dimmer units for controlling the load current.

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