



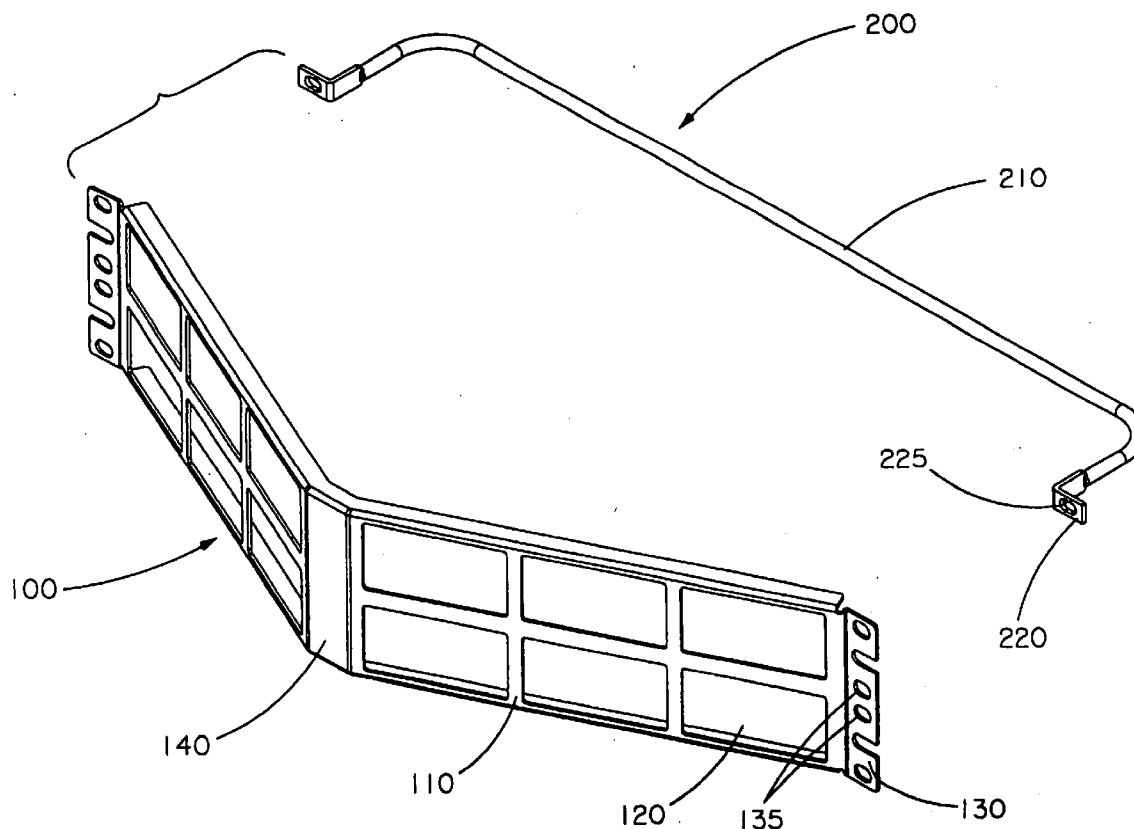
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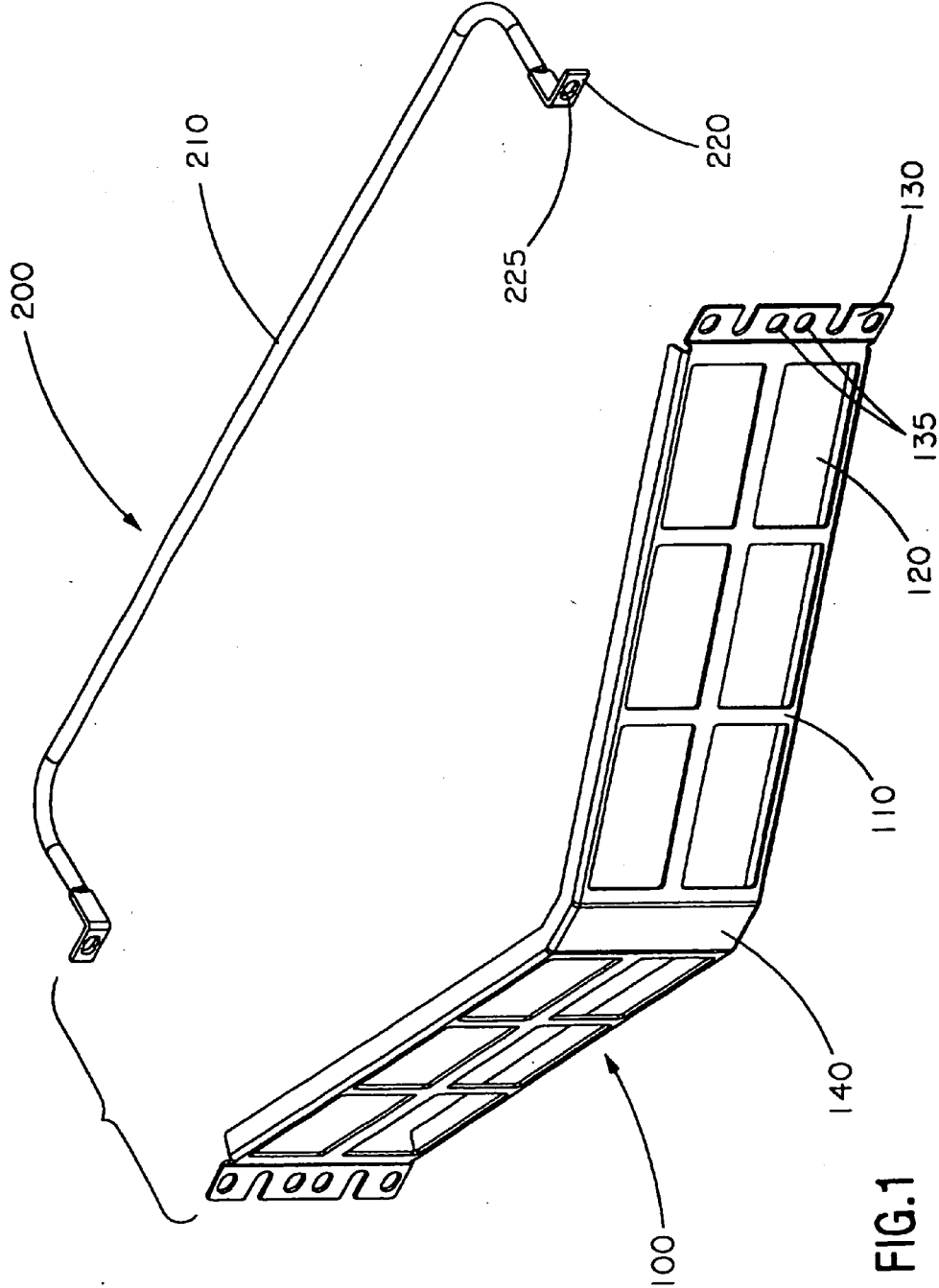
(19) **United States**(12) **Patent Application Publication****Barker et al.**(10) **Pub. No.: US 2006/0154513 A1**(43) **Pub. Date: Jul. 13, 2006**(54) **ANGLED PATCH PANEL WITH CABLE
SUPPORT BAR FOR NETWORK CABLE
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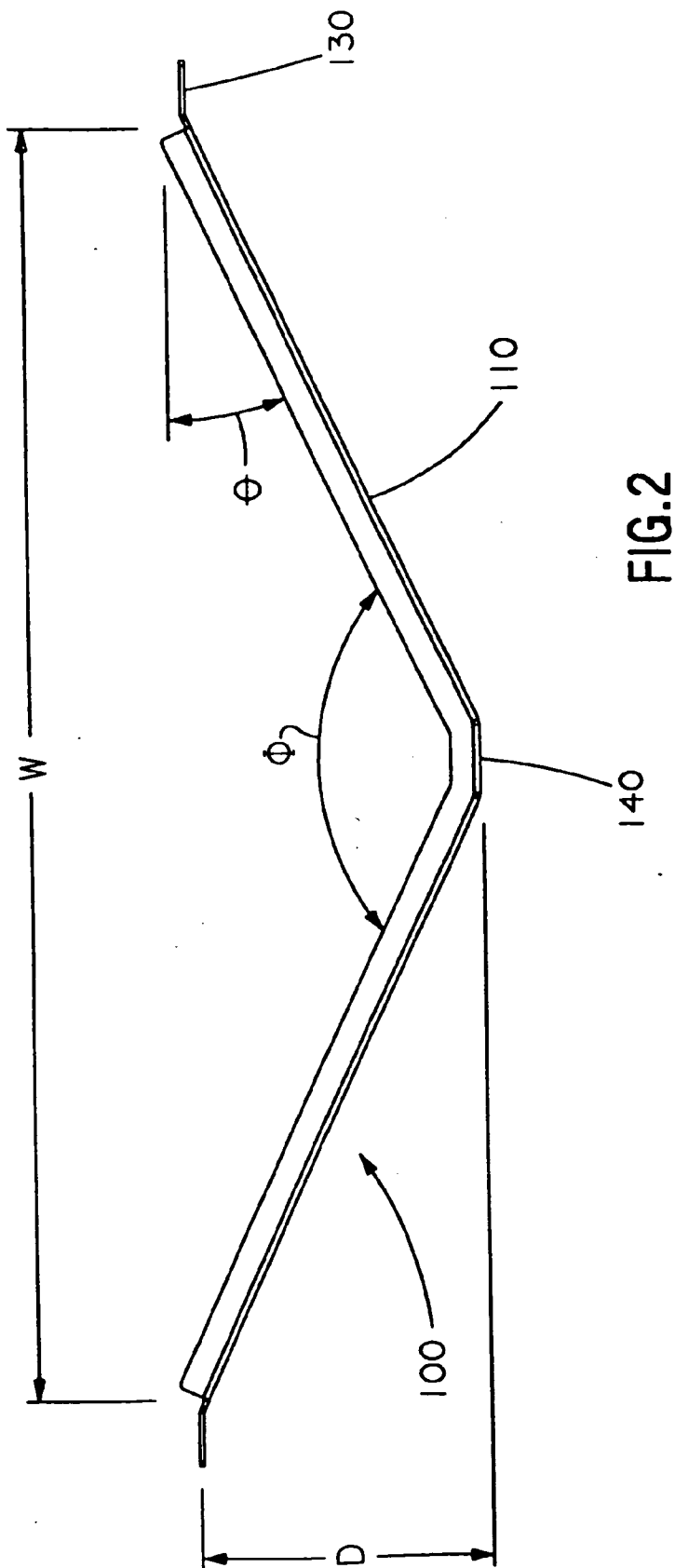
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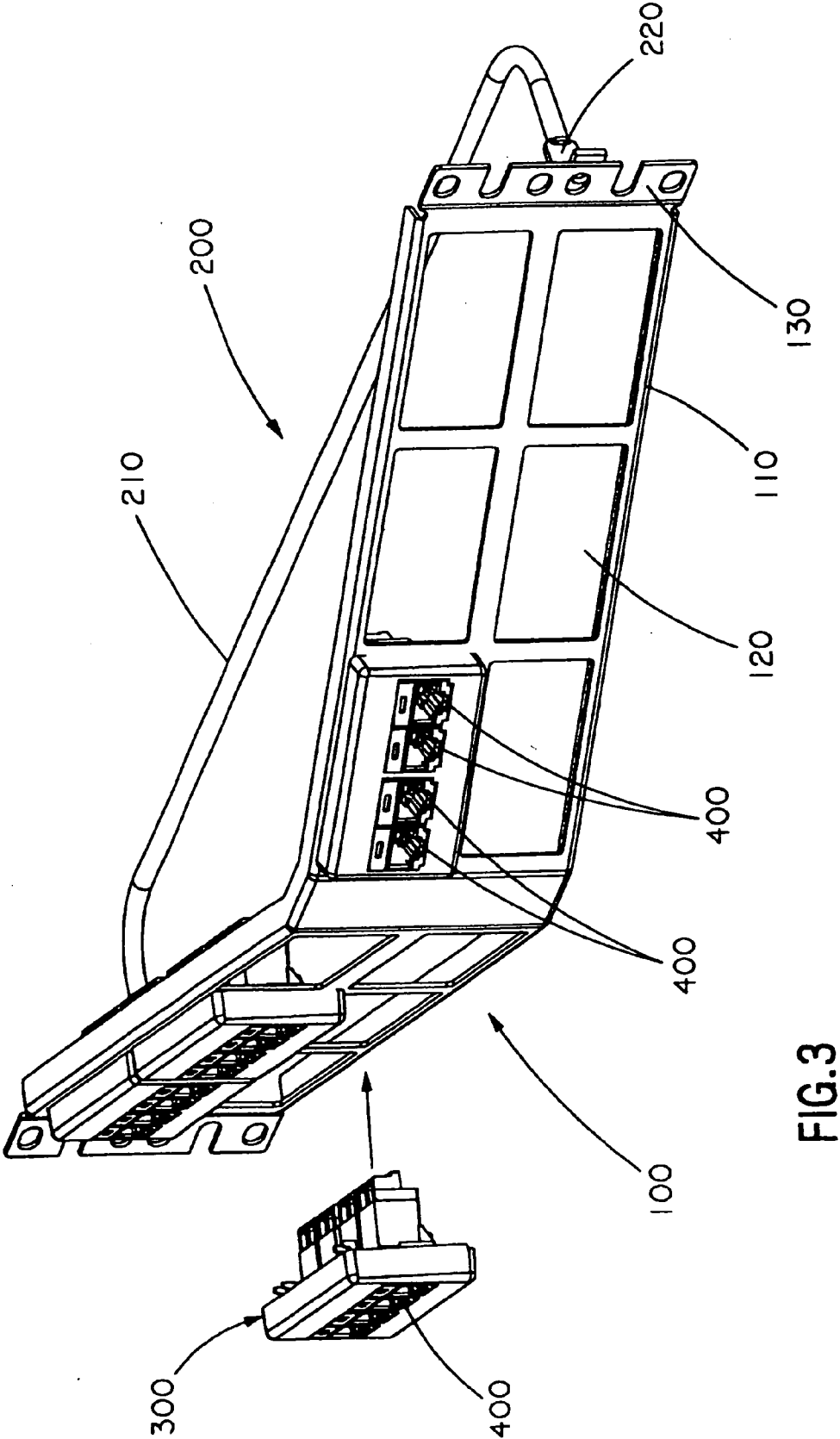
PANDUIT CORP.**LEGAL DEPARTMENT - TP12****17301 SOUTH RIDGELAND AVENUE****TINLEY PARK, IL 60477 (US)**(21) Appl. No.: **11/369,803**(22) Filed: **Mar. 7, 2006****Related U.S. Application Data**(63) Continuation of application No. 11/353,703, filed on
Feb. 14, 2006, which is a continuation of application
No. 11/256,798, filed on Oct. 24, 2005, which is a
continuation of application No. 11/139,327, filed onMay 27, 2005, now Pat. No. 6,981,893, which is a
continuation of application No. 10/941,472, filed on
Sep. 15, 2004, now Pat. No. 6,918,786, which is a
continuation of application No. 09/916,923, filed on
Jul. 26, 2001, now Pat. No. 6,866,541.**Publication Classification**(51) **Int. Cl.**
H01R 13/58 (2006.01)(52) **U.S. Cl.** **439/450**(57) **ABSTRACT**

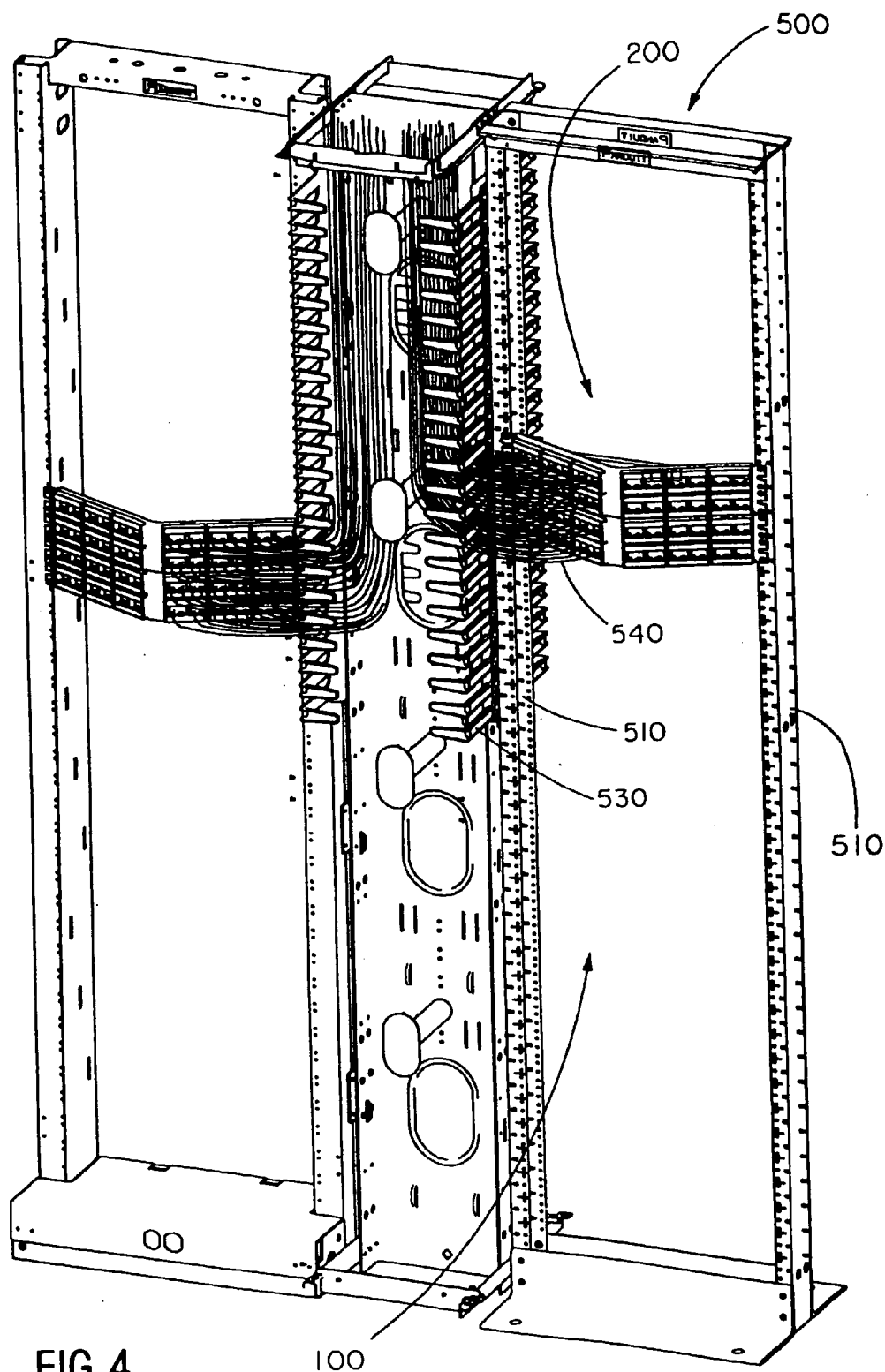
A patch panel mountable to a network rack includes a patch panel frame and rack mounting plates. The frame forms a central section having a longitudinal width sized to fit within the network rack. The rack mounting plates are provided on opposite longitudinal ends of the central section and allow the panel to be mounted to a network rack. The central section includes two panel sections angled outwardly in an inverted V-shape and the central section has mounted thereon a plurality of cable connectors that receive cabling on the front side and the rear side of the patch panel frame. Each connector has a horizontal axis.

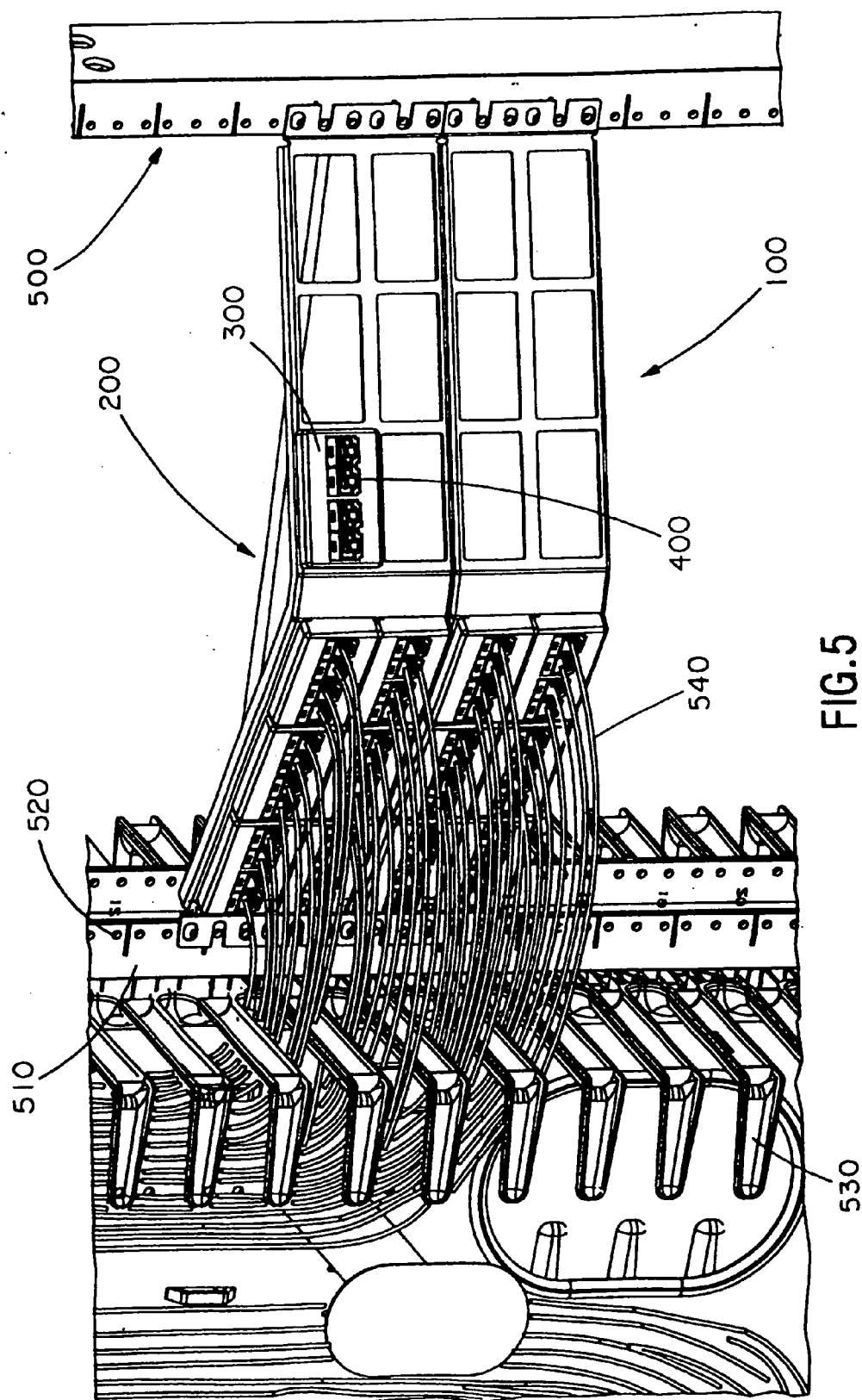












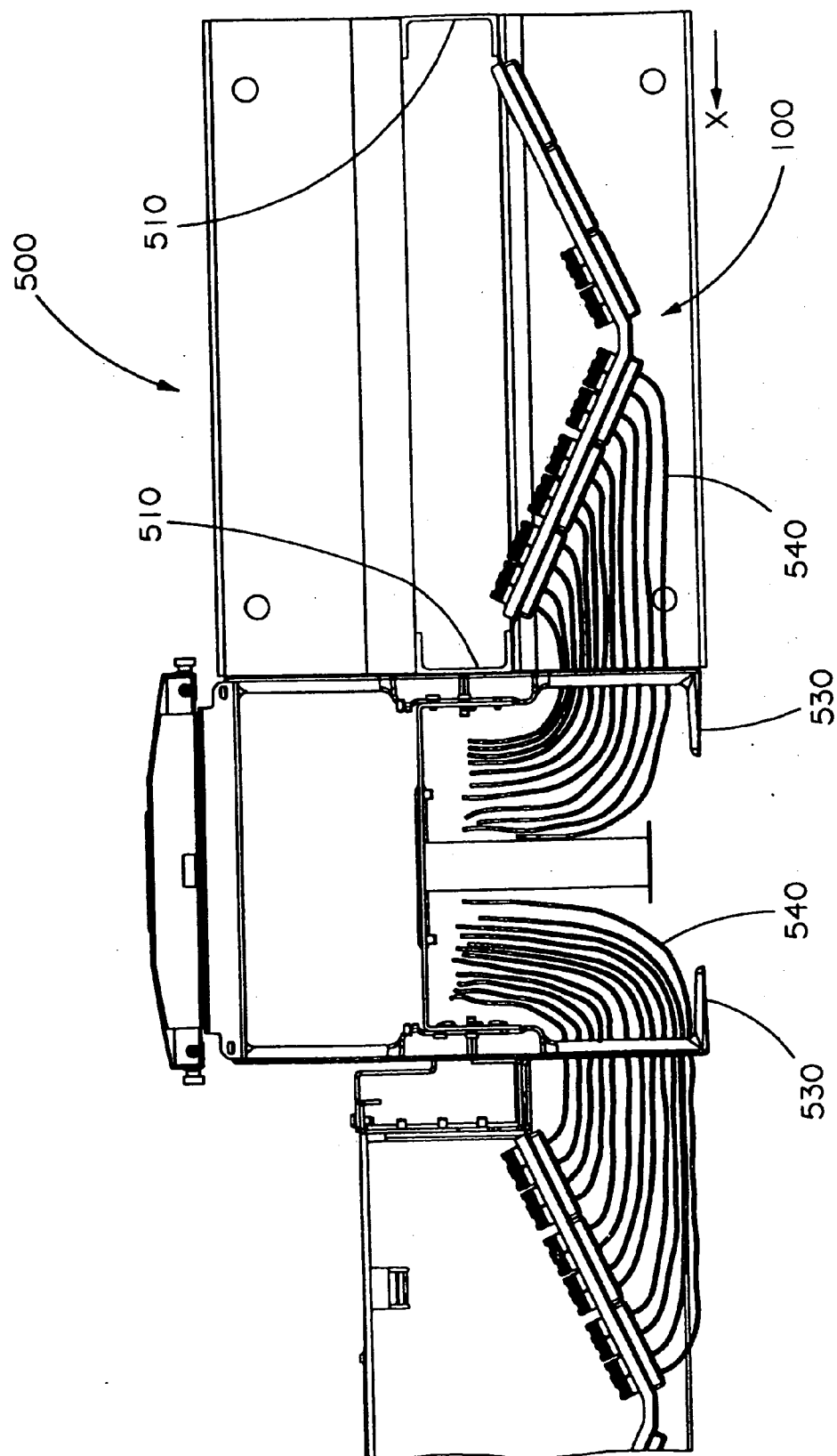


FIG. 6

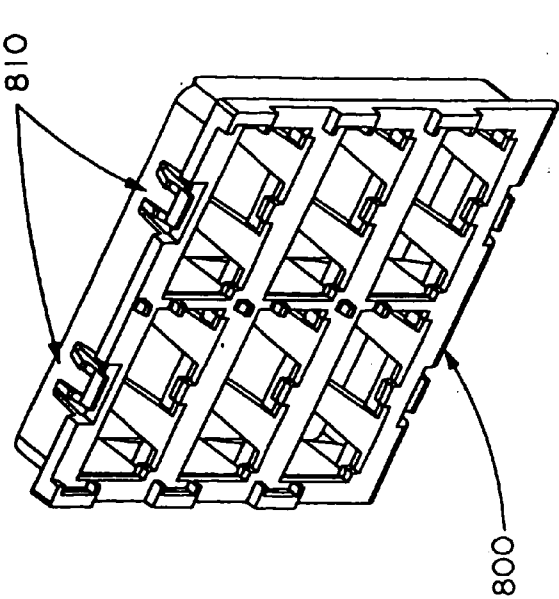


FIG. 8

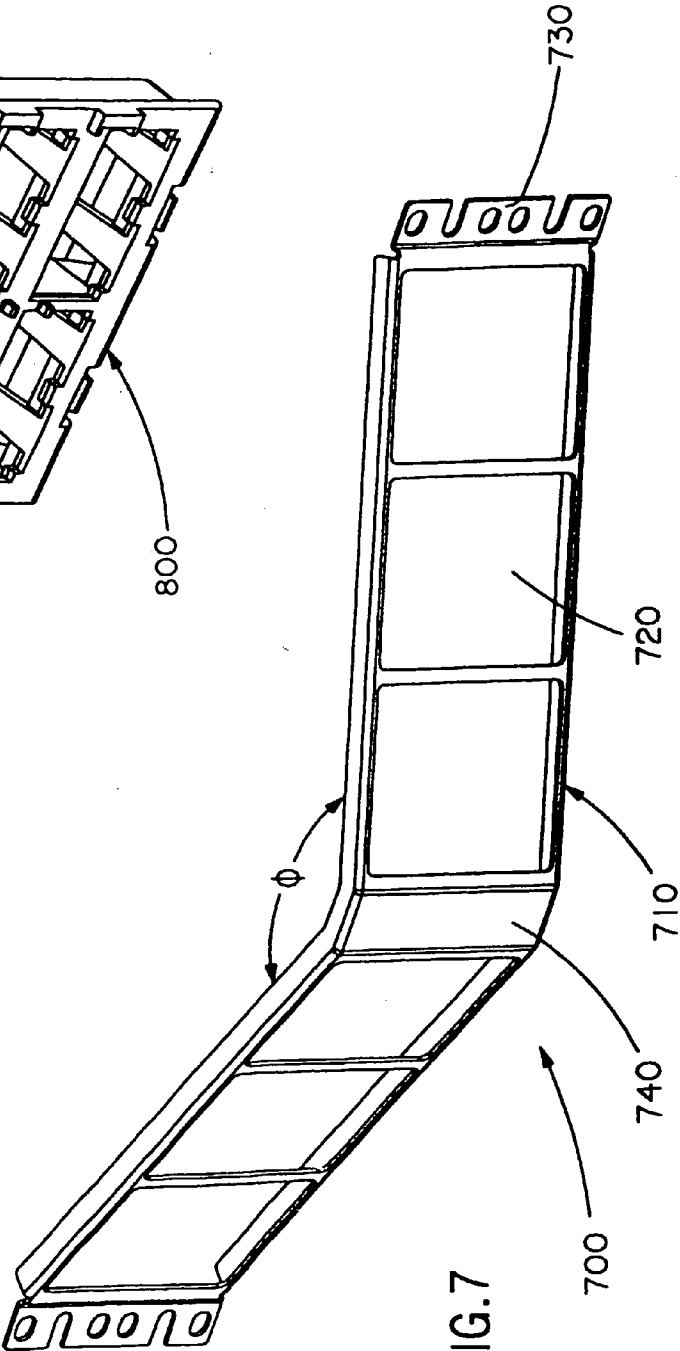
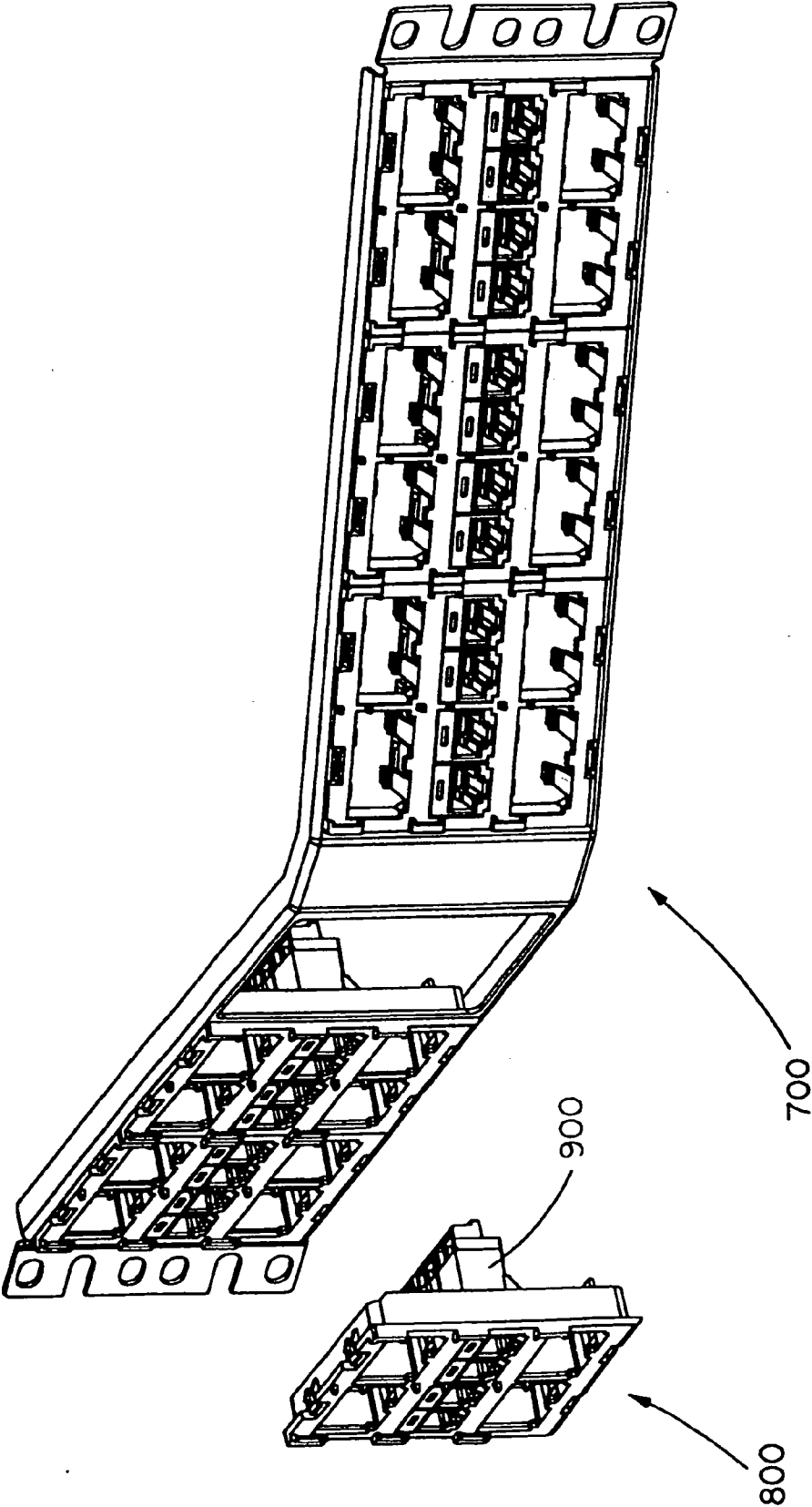


FIG. 7



ANGLED PATCH PANEL WITH CABLE SUPPORT BAR FOR NETWORK CABLE RACKS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of application Ser. No. 11/353,703, filed Feb. 14, 2006, which is a continuation of application Ser. No. 11/256,798, filed Oct. 24, 2005, which is a continuation of application Ser. No. 11/139,327, filed May 27, 2005, now U.S. Pat. No. 6,981,893, which is a continuation of application Ser. No. 10/941,472, filed Sep. 15, 2004, now U.S. Pat. No. 6,918,786, which is a continuation of application Ser. No. 09/916,923, filed Jul. 26, 2001, now U.S. Pat. No. 6,866,541.

BACKGROUND OF THE INVENTION

[0002] 1. Field of Invention

[0003] Generally, the present invention relates to cable management devices for network equipment racks. In particular, the invention relates to an angled patch panel and cable support bar therefor.

[0004] 2. Description of Related Art

[0005] Cables, such as UTP, ScTP, coaxial and fiber optic cables, transmit data, voice, video and/or audio information in the telecommunications industry. Patch panel and network equipment enclosure rack systems are well-known in the industry. They manage and organize such cables both to and from such equipment and/or to and from such patch panels. These systems usually include the standard EIA 19", 23" or other distribution frame rack on which one or more patch panels, network equipment, fiber optic enclosures and the like are mounted. Rack enclosures serve various functions, including their use as slack trays, splice trays, cable organizers and patch panels. These rack enclosures also serve as interconnect or cross-connect enclosures when they interface with equipment. Additionally, rack systems may serve as a telecommunications closet, allowing the cables to be terminated, spliced, patched and/or stored at various places along their length.

[0006] The rack is usually formed from a frame having mounting apertures located along the vertical legs or walls of the rack. Patching equipment, such as a patch panel, is mounted onto the rack so as to generally define a patching side, where patch cords from another active device or another patch panel can be cross-connected and interconnected, and a distribution side, where cables from network equipment and/or work station areas are terminated. Generally, some form of cable management is provided on both sides of the rack to support and route the cables. While preventing detrimental bending is always important even for copper cabling, with the increasing use of fiber optic connectors as applied to connector rack systems, proper cable management and bend radius control has become increasingly important. Many known systems are unable to provide complete bend radius control, are inefficient, are difficult to manufacture, are difficult to manage and access, and/or have other drawbacks. Thus, improvement in the cable management of network rack systems is desired. In particular, many patch panel systems require both horizontal and vertical cable management within the rack.

[0007] There is a need for a patch panel design that eliminates the necessity for one or more of these cable management devices.

[0008] There is also a need for a patch panel system that can accommodate more port capacity and provide additional space for containing cabling.

SUMMARY OF THE INVENTION

[0009] It is an object of the invention to provide an improved patch panel for a network rack that can provide better cable management without the need for a horizontal cable manager.

[0010] It is another object of the invention to provide an improved patch panel that can accommodate greater port capacity.

[0011] It is another object of the invention to provide cable support to a patch panel.

[0012] Various ones of the above and other objects are achieved by a patch panel mountable to a network rack comprising a frame and rack mounting plates. The frame forms a central section having a longitudinal width sized to fit within the network rack, a predefined height, a front side, and a rear side. The rack mounting plates are provided on opposite longitudinal ends of the central section and allow the panel to be mounted to a network rack. The central section is angled outwardly in an inverted V-shape. The central section has mountable thereon a plurality of cable connectors that receive cabling on the front side and the rear side of the patch panel frame. When mounted, the plurality of cable connectors are oriented to have rear surfaces thereof face a common axis of the central section.

[0013] Various ones of the above and other objects are also achieved by a network rack and patch panel assembly, comprising: a network rack having two rails spaced a predetermined distance from each other, each rail including spaced mounting openings; and a patch panel mounted to the network rack. The patch panel includes a frame forming a central section and having a longitudinal width sized to fit between the two rails, a predefined height, a front side, and a rear side. The patch panel also includes rack mounting plates provided on opposite longitudinal ends of the central section connected to ones of the spaced mounting openings of the rails. The central section is angled outwardly in an inverted V-shape. Mounted on the central section are a plurality of cable connectors that receive cabling on the front side and the rear side of the patch panel frame. The plurality of cable connectors are oriented to have rear surfaces thereof face a common axis of the central section.

[0014] The patch panel and rack may further include a cable support bar that supports the weight of cabling exiting the rear of the patch panel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The foregoing and further objects, features and advantages of the present invention will become apparent from the following description of preferred embodiments with references to the accompanying drawings, wherein:

[0016] **FIG. 1** shows an exploded isometric view of a first embodiment of an angled patch panel frame according to the present invention and a cable support bar therefor;

[0017] **FIG. 2** shows a top view of the patch panel frame of **FIG. 1**;

[0018] FIG. 3 shows an exploded view of an insert module loaded with four cable connector modules being inserted into the patch panel frame of FIG. 1;

[0019] FIG. 4 shows the patch panel of FIG. 3 and the cable support bar mounted onto a 19" standard rack;

[0020] FIG. 5 is a detailed partial view of the 19" standard rack and patch panel of FIG. 4;

[0021] FIG. 6 shows a top view of the patch panel and the 19" standard rack of FIG. 4;

[0022] FIG. 7 show an isometric view of a second embodiment of an angled patch panel frame according to the present invention;

[0023] FIG. 8 shows an insert module used in the second embodiment of the patch panel; and

[0024] FIG. 9 shows an exploded view of an insert module loaded with four cable connector modules being loaded into the second embodiment of the patch panel.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0025] A patch panel 100 according to an exemplary first embodiment of the invention is generally shown in FIGS. 1-6 and is useful in providing a support panel for mounting reconfigurable ports for patching components in a network rack.

[0026] The patch panel frame 100 includes an outwardly angled central frame 110, a plurality of faceplate openings 120 and a mounting plate 130 at each end with a plurality of mounting apertures 135, as shown in FIG. 1. A flat center-piece 140 located midway along frame 110 may be provided to space the openings 120 on opposite halves of the central frame 110 from each other. This centerpiece 140 also slightly reduces the depth D of the patch panel by eliminating the angle at a central portion where no openings 120 are located. Patch panel frame 100 is preferably formed of a suitable material, such as metal so as to be self grounding. However, frame 110 may be formed of any suitable rigid material, such as many plastics or composites. A separate or integral cable support bar 200 may be provided on a rear side of the patch panel. Cable support bar 200 includes a bar portion 210 and mounting plates 220.

[0027] Both the patch panel frame 100 and cable support bar 200 are designed to mount on a rack. Patch panel frame 100 can be any size, but preferably is sized with a width W to fit within a conventional 19" or 23" EIA network rack that has spaced vertical rails or legs 510 that allow the mounting of various rack elements thereon (see FIGS. 4-5). The patch panel can occupy a single rack unit height of 1.75" (4.45 cm) or multiple rack unit height, such as the two rack unit height illustrated (3.5" or 8.9 cm). The rack 500 should have various mounting openings 520 or comparable devices to facilitate equipment mounting. When mounted, patch panel frame 100 protrudes out from the front of the rack 500 by a distance D of several inches, as shown in FIGS. 2 and 6, due to the outwardly angled frame 110.

[0028] The invention is not limited to such EIA racks, but is equally applicable to other known or subsequently developed racks. Moreover, a network rack 500 need not be an open frame structure as in the above EIA racks, but may

include mounting cabinets or enclosures having mounting features and walls defining openings that can receive and affix rack elements, such as the patch panel 100, cable managers and the like.

[0029] Patch panel frame 100 is angled outwardly in a generally inverted V-shape. FIG. 2 shows a top view of the angled patch panel frame 100. Each half of the central frame 110 is preferably a mirror image and angled from the other by an angle ϕ , which is an obtuse angle of a suitable angle of between about 90° and 180°, preferably an angle of between about 100° to 140°, and more preferably between about 110° and 130°. The illustrative embodiment shown has an angle ϕ of about 120°. This allows cables attached to the front of the patch panel to flow directly to one or more vertical cable managers located adjacent the network rack.

[0030] The patch panel frame halves are also angled relative to mounting brackets 130 (which are oriented in line with each other and parallel to the front sides of rails 510 of the mounting rack 500) at an angle of θ , which is an acute angle of preferably not more than 45°, preferably between about 20° to 40° degrees, and more preferably between about 25° and 35°. In the illustrative example, the angle θ is about 30°. While the central section is shown and described as being symmetrical, it is to be understood that the patch panel sections 110 could be disposed at different angles relative to the brackets 130 and thus be of different lengths.

[0031] Patch panel frame 100 has a plurality of faceplate openings 120 that receive insert modules 300, as shown in FIG. 3. The insert modules 300 are sized to fit within openings 120, preferably by snap fit. However, rather than replaceable modules, modules 300 may be integrated into frame 110. The modules and openings may be multiple rack unit heights or may be sized as a single rack unit height, as shown. In the first illustrative exemplary embodiment, patch panel frame 100 has twelve faceplate openings 120. These twelve faceplate openings 120 allow twelve insert modules 300 to be inserted into the patch panel frame 100, as shown in FIG. 3.

[0032] Insert modules 300 are fitted to hold one or more removable cable connector modules 400. Cable connector modules 400 may take many forms, such as electrical, optical, telecommunications-related or other known or subsequently developed connector for connecting cabling. Preferred modules are capable of connecting UTP, ScTP, coaxial and/or fiber optic cables used in the telecommunications industry to transmit data, voice, video and/or audio information.

[0033] Insert modules 300 are secured within patch panel openings 120 by way of snap fit, as is known in the art. FIG. 3 shows an exploded view of an insert module 300 loaded with four cable connector modules 400 that is then inserted into patch panel 100. Three other insert modules 300 with cable connector modules 400 are already loaded into patch panel 100. In this first illustrative example of FIGS. 1-6, patch panel 100 can have a total of twelve insert modules 300, each with a capacity of four connector modules 400 for a total capacity of 48 ports in a two rack unit space.

[0034] There are several advantages to the inventive patch panel. By making the frame angled outwardly in an inverted V-shape, the axis of each cable connector is at the acute angle θ relative to a common central axis (parallel to the

depth direction D). This provides front connector surfaces that are better oriented relative to front corners of the rack rails 510, where vertical cable managers or ducts 530 are provided that contain cables 540 that mate with front sides of various ones of the cable connector modules 400 as shown in FIG. 6. In particular, the angled frame 110 provides a connector surface that is at a reduced angle relative to an exit direction of the cables exiting the vertical cable manager as compared to conventional patch panels. That is, prior art, flat-faced patch panels which were oriented substantially parallel to the exit direction and required one or more 90° cable bends for connection. In general practice, this required an external horizontal cable manager to control the bends and provide a minimum bend radius. However, as the inventive patch panel has surfaces that intersect this exit direction (direction X in FIG. 6) at an acute angle, the bend necessary to achieve connection is substantially less than 90° as shown. This reduces or eliminates the need for additional horizontal cable management adjacent to the patch panel to guide exiting cables from the vertical cable managers 530 to the individual connector modules 400 as each cable 540 is routed directly from each connector module 400 to the adjacent vertical duct 530.

[0035] Additionally, this structure results in slightly shorter patch cable lengths than before. Moreover, the outwardly angled frame 110 provides increased space behind patch panel frame 100 for housing the cabling. That is, as shown in FIG. 6, a conventional flat-faced patch panel would be flush to the rack rails 510 and would thus only provide an area of the inner rectangle between rails 510. However, with the angled patch panel, the receiving area is this inner rectangle plus the triangular area defined by the outwardly extending frame of patch panel 100.

[0036] Further, by making the front face of the patch panel angled (in an inverted V-shape), rather than flat, there is additional surface area on the front face of the patch panel. That is, for a rack of a given width, such as 19", a conventional flat patch panel would only have a surface area equal to $19" \times N \times 1.75"$, where N is the number of rack units in height. However, at any given angle θ , the total length of the two angled halves of frame 110 will be greater than the length of a corresponding flat piece. For example, with the inventive angled patch panel front face at an exemplary angle θ of 30°, the surface area is approximately $22" \times N \times 1.75"$. This and other surface areas for other angles θ can be simply solved using basic trigonometric principles.

[0037] The aforementioned features work together to increase the functionality of the inventive patch panel. That is, the increased space behind the patch panel helps accommodate the cabling needs, and the uniformly angled connector modules better manage the cabling on the front side of the patch panel by reducing the necessary bend angle for incoming cabling, eliminating the need for external horizontal cable managers as often required with conventional patch panels.

[0038] While horizontal cable management on the front side may not be necessary, it may be beneficial to provide cable support bar 200 to assist in supporting the weight of the various cabling attached to the rear side of patch panel 100, and to assist in the direction of the cables exiting patch panel 100. Cable support bar 200 is preferably formed of a suitable material, such as metal. Support bar portion 210

preferably extends the entire width of rack 500 and includes mounting plates 220 each with at least one mounting aperture 225 as shown to mount the support bar on rack 500 or comparable device.

[0039] Cable support bar 200 is preferably separate from patch panel frame 100, but may be integrally formed therewith if desired. Cable support bar 200 may be attached to rack 500 using mounting apertures 225 either from the front when the patch panel frame 100 is attached, or from the back after the patch panel frame 100 has been attached. Attaching the cable support bar 200 from the back allows the end user to install the cable support bar 200 after all of the connectors have been terminated, thus eliminating any interference from the cable support bar 200 when terminating the connectors.

[0040] In a second embodiment of the present invention shown in FIGS. 7-9, a variation in configuration is provided. Patch panel frame 700 is angled with angles ϕ and θ as in the first illustrative embodiment. However, for this embodiment, there are only six faceplate openings 720 in frame 710 that allow for twelve-pack insert modules 800 to be inserted therein. These modules occupy a double rack height. Like the previous embodiment, mounting plates 730 are provided for mounting the patch panel to a rack and a flat centerpiece 740 may be provided.

[0041] The twelve-pack insert modules 800 for the second embodiment of the present invention are shown in FIG. 8. While more or less connector modules could be provided, the illustrative insert modules 800 are capable of receiving up to twelve single-spaced cable connector modules 900. To allow a snap fit within openings 720, insert modules 800 have four 'upside down' snaps 810, as shown in FIG. 8, which hold insert module 800 to patch panel frame 700. However, other methods of affixing insert modules 800 to openings 720 are contemplated.

[0042] FIG. 9 shows an exploded view of an insert module 800 loaded with four exemplary cable connector modules 900 being positioned for mounting into patch panel frame 700. Five other insert modules 800 with cable connector modules 900 are shown already loaded into patch panel 700. While not necessary, the illustrative patch panel 700 covers two rack units as in the previous embodiment and fits into a standard 19" network rack. With this configuration, a capacity of 72 cable connector ports can be achieved in a two rack height patch panel.

[0043] As in the previous embodiment, frame 710 is angled outwardly in an inverted V-shape so that the rear of all of the ports are angled toward a common central axis. This provides better flow of the cabling entering the front of patch panel 700 as described with respect to the first embodiment to eliminate the need for a front external horizontal cable manager. However, as in the first embodiment, a cable support bar 200 may be provided to support the weight of exiting cables to the rear of patch panel 700.

[0044] While the invention has been shown and described in conjunction with specific exemplary embodiments, the invention is not limited to these. It will be obvious to those skilled in the art that changes and modifications may be made without departing from the teachings of this invention and that the matter set forth in the foregoing description and accompanying drawings is offered by way of illustration

only and not as a limitation. The actual scope of the invention is intended to be defined in the following appended claims.

1. A patch panel mountable to a network rack, comprising:
 - a frame having rack mounting members provided on opposite longitudinal ends of the frame, wherein the frame includes two patch panel frame halves, wherein at least a portion of each of the frame halves are angled relative to each other by an obtuse angle between 90° and 180°, each of the frame halves having mountable thereon a plurality of connectors having a front face such that when the plurality of connectors are mounted on each of the frame halves, the front face of each connector in the patch panel is located such that the distance from each connector front face to a second plane, which is parallel to a first plane that is in line with the longitudinal ends of the frame, and which is in front of the patch panel, is not greater than the distance to the second plane from the front face of any other connector of the patch panel which is farther from the center of the patch panel in a horizontal direction.
2. The patch panel of claim 1, such that when the plurality of connectors are mounted thereon, the axis of each connector is horizontal.
3. The patch panel of claim 1, such that when the plurality of connectors are mounted thereon, the front face of each connector is parallel to the front face of the portion of the frame on which each connector is mounted.
4. The patch panel of claim 1, such that when the plurality of connectors are mounted thereon, the front face of each connector is substantially flush with the front face of the portion of the frame on which each connector is mounted.
5. The patch panel of claim 1, such that when the plurality of connectors are mounted thereon, each connector is in fixed orientation relative to the patch panel.
6. The patch panel of claim 1, wherein each of the plurality of connectors are individual cable connector modules.
7. The patch panel of claim 6, wherein each of the individual cable connector modules are mountable in one of a multitude of insert modules which are mountable in the frame.
8. The patch panel of claim 7, such that when the multitude of insert modules are mounted therein, each of the insert modules has a front face which is parallel to the front face of the portion of the frame in which the insert module is mounted.
9. The patch panel of claim 7, such that when the multitude of insert modules are mounted therein, each of the insert modules has a front face which is substantially flush with the front face of the portion of the frame in which the insert module is mounted.
10. The patch panel of claim 1, wherein the patch panel comprises only a first patch panel frame half and a second patch panel frame half.
11. The patch panel of claim 10, wherein the first and second patch panel frame halves are symmetrical.
12. A patch panel mountable to a network rack, comprising:
 - a frame having rack mounting members provided on opposite longitudinal ends of the frame, wherein the frame includes two patch panel frame halves, wherein at least a portion of each of the frame halves are angled

relative to each other by an obtuse angle between 90° and 180°, each of the portions having mountable thereon a plurality of connectors having a front face such that when the plurality of connectors are mounted on each of these portions, the front face of each connector in the portions is located such that it is not behind the front face of that portion of the frame which is adjacent to the connector.

13. The patch panel of claim 12, such that when the plurality of connectors are mounted thereon, the axis of each connector is horizontal.
14. The patch panel of claim 12, such that when the plurality of connectors are mounted thereon, the front face of the connectors in each portion are in a common plane which is coincident with or parallel to the plane of the front face of the portion on which the connectors are mounted.
15. The patch panel of claim 12, such that when the plurality of connectors are mounted thereon, the front face of each connector in each portion is substantially flush with the front face of the portion on which the connectors are mounted.
16. The patch panel of claim 12, such that when the plurality of connectors are mounted thereon, each connector is in fixed orientation relative to the patch panel.
17. The patch panel of claim 12, wherein each of the plurality of connectors are individual cable connector modules.
18. The patch panel of claim 17, wherein each of the individual cable connector modules are mountable in one of a multitude of insert modules which are mountable in the frame.
19. The patch panel of claim 18, such that when the multitude of insert modules are mounted therein, each of the insert modules has a front face which is parallel to the front face of the portion of the frame in which the insert module is mounted.
20. The patch panel of claim 18, such that when the multitude of insert modules are mounted thereon, the front face of each insert module is substantially flush with the front face of the portion of the frame in which the insert module is mounted.
21. The patch panel of claim 12, wherein the patch panel comprises only a first patch panel frame half and a second patch panel frame half.
22. The patch panel of claim 21, wherein the first and second patch panel frame halves are symmetrical.
23. A patch panel mountable to a network rack, comprising:
 - a frame having rack mounting members provided on opposite longitudinal ends of the frame, wherein the frame includes two patch panel frame halves, each of the frame halves having mountable thereon a plurality of connectors having a front face such that when the plurality of connectors are mounted on each of the frame halves, the front face of each connector in the patch panel is located such that the distance from each connector front face to a second plane, which is parallel to a first plane that is in line with the longitudinal ends of the frame, and which is in front of the patch panel, is not greater than the distance to the second plane from the front face of any other connector of the patch panel which is farther from the center of the patch panel in a horizontal direction and the distance from the front face of a connector which is adjacent to the junction of the

frame halves to the second plane is less than the distance from the front face of a connector in the same half which is adjacent to a rack mounting member to the second plane.

24. The patch panel of claim 23, such that when the plurality of connectors are mounted thereon, the axis of each connector is horizontal.

25. The patch panel of claim 23, such that when the plurality of connectors are mounted thereon, the front face of each connector is parallel to the front face of the portion of the frame on which each connector is mounted.

26. The patch panel of claim 23, such that when the plurality of connectors are mounted thereon, the front face of each connector is substantially flush with the front face of the portion of the frame on which each connector is mounted.

27. The patch panel of claim 23, such that when the plurality of connectors are mounted thereon, each connector is in fixed orientation relative to the patch panel.

28. The patch panel of claim 23, wherein each of the plurality of connectors are individual cable connector modules.

29. The patch panel of claim 28, wherein each of the individual cable connector modules are mountable in one of a multitude of insert modules which are mountable in the frame.

30. The patch panel of claim 29, such that when the multitude of insert modules are mounted therein, each of the insert modules has a front face which is parallel to the front face of the portion of the frame in which the insert module is mounted.

31. The patch panel of claim 29, such that when the multitude of insert modules are mounted therein, each of the insert modules has a front face which is substantially flush with the front face of the portion of the frame in which the insert module is mounted.

32. The patch panel of claim 23, wherein the patch panel comprises only a first patch panel frame half and a second patch panel frame half.

33. The patch panel of claim 32, wherein the first and second patch panel frame halves are symmetrical.

* * * * *