Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2334152 C 2008/04/08

(11)(21) 2 334 152

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 1999/05/20
(87) Date publication PCT/PCT Publication Date: 1999/12/09
(45) Date de délivrance/Issue Date: 2008/04/08
(85) Entrée phase nationale/National Entry: 2000/12/04
(86) N° demande PCT/PCT Application No.: US 1999/011120
(87) N° publication PCT/PCT Publication No.: 1999/063628
(30) Priorité/Priority: 1998/06/05 (US09/092,545)

(51) Cl.Int./Int.Cl. *H01R 13/518* (2006.01),
H04Q 1/14 (2006.01)

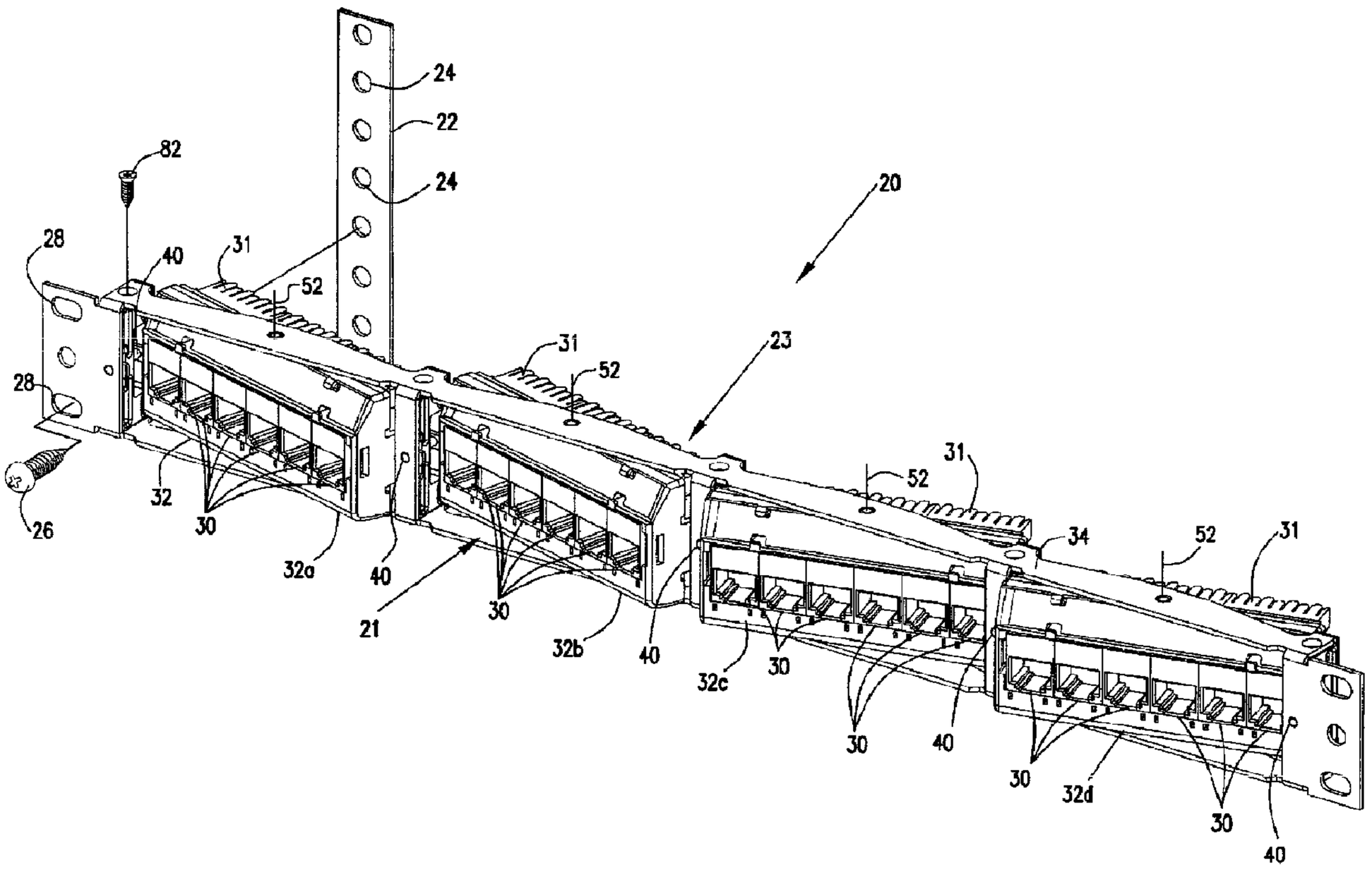
(72) Inventeur/Inventor:
FOLLINGSTAD, MICHAEL JAY, US

(73) Propriétaire/Owner:
ADC TELECOMMUNICATIONS, INC., US

(74) Agent: ROBIC

(54) Titre : PANNEAU DE RACCORDEMENT DE TELECOMMUNICATION A MODULES DE CONNECTEUR ANGULAIRES ET PROCEDE DE MONTAGE DE CE PANNEAU

(54) Title: TELECOMMUNICATIONS PATCH PANEL WITH ANGLED CONNECTOR MODULES AND METHOD OF ASSEMBLING SUCH A PANEL



(57) Abrégé/Abstract:
A telecommunications patch panel is provided having a plurality of connector modules rotatably mounted to a frame member. Each connector module has a front face and an opposite facing rear face, and each front face includes a plurality of connector jacks. Eachrear face includes a plurality of wire termination blocks. The wire termination blocks are electrically connected to the connector jacks. Each connector module is rotatable about a rotation axis relative to the frame member. A lock selectively locks each connector module to the frame member as desired. The connector jacks and the connector modules are arranged in linear arrays perpendicular to the axis of rotation.

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : **H01R 13/518** — **A1**

(11) International Publication Number: **WO 99/63628**

(43) International Publication Date: 9 December 1999 (09.12.99)

(21) International Application Number: PCT/US99/11120

(22) International Filing Date: 20 May 1999 (20.05.99)

(30) Priority Data:
09/092,545 5 June 1998 (05.06.98) US

(71) Applicant: ADC TELECOMMUNICATIONS, INC. [US/US]; 12501 Whitewater Drive, Minnetonka, MN 55343 (US).

(72) Inventor: FOLLINGSTAD, Michael, Jay; 5825 York Avenue South, Edina, MN 55410 (US).

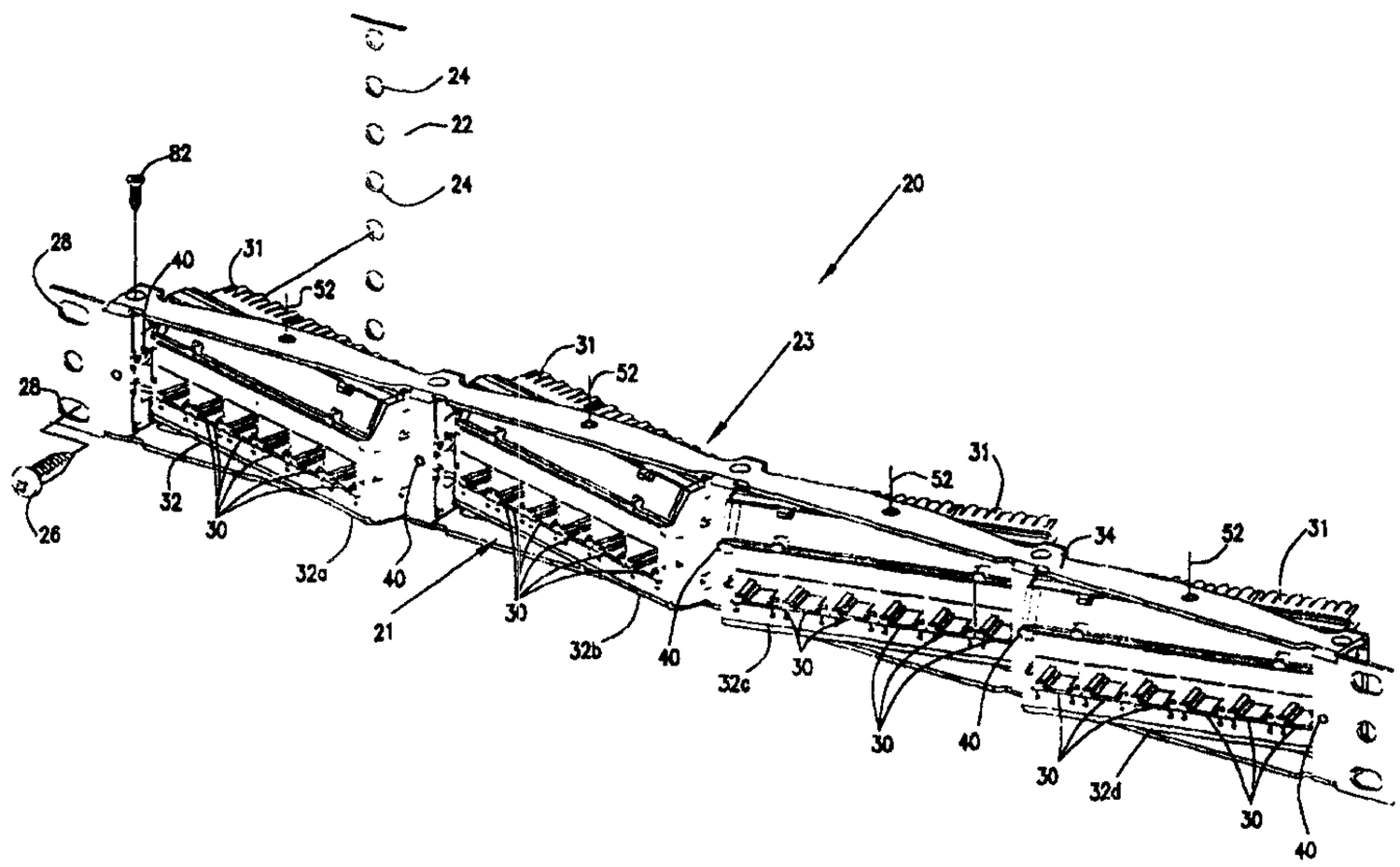
(74) Agent: BRUESS, Steven, C.; Merchant & Gould P.C., 3100 Norwest Center, 90 South Seventh Street, Minneapolis, MN 55402–4131 (US).

(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: TELECOMMUNICATIONS PATCH PANEL WITH ANGLED CONNECTOR MODULES AND METHOD OF ASSEMBLING SUCH A PANEL



(57) Abstract

A telecommunications patch panel is provided having a plurality of connector modules rotatably mounted to a frame member. Each connector module has a front face and an opposite facing rear face, and each front face includes a plurality of connector jacks. Eachrear face includes a plurality of wire termination blocks. The wire termination blocks are electrically connected to the connector jacks. Each connector module is rotatable about a rotation axis relative to the frame member. A lock selectively locks each connector module to the frame member as desired. The connector jacks and the connector modules are arranged in linear arrays perpendicular to the axis of rotation.

TELECOMMUNICATIONS PATCH PANEL WITH ANGLED CONNECTOR MODULES AND METHOD OF ASSEMBLING SUCH A PANEL

Field of the Invention

The present invention relates to a telecommunications connecting panel and, more particularly, to a cross–connect patch panel including a frame with jacks on one side and wire termination locations on an opposite side.

Background of the Invention

Local area networks and telecommunications connections often use patch panels, especially at the customer's premises to enable cross–connection between telecommunications equipment. Patch panels typically include front and rear connection locations. The rear connections are typically a more permanent type of connection, such as insulation displacement connectors to connect to copper based, twisted pair telecommunications cable. The front connections of the patch panel may include any of a variety of jacks for receipt of a plug of a patch cord or other transmission cable. The jack and plug allows fairly rapid connection and disconnection between two jacks in the same patch panel, or between one jack in the patch panel and another jack in a nearby patch panel, with the patch cord. One type of jack and plug arrangement for a patch panel is an RJ45 type connector. U.S. Patent No. 5,639,261 is an example of a cross–connect panel including rear insulation displacement connectors, and front connector jacks for receiving plugs of patch cords.

There is an increasing need for cable management in order to protect and organize the various cables. One area where damage and/or loss of performance may occur with copper based, twisted pair cables is when excessive bending of the cable occurs. This is especially a concern as higher frequencies are used, such as category 5 and greater. Falling below minimum bend radii of the cables can adversely affect performance with the transmission of signals through the copper wire patch cords. Therefore, there is a need for patch panels which address the cable management concerns noted above.

Summary of the Invention

A telecommunications patch panel according to one aspect of the invention includes a connector module, and a frame member for mounting the connector module. The connector module includes a connector jack along a front face. A rear face includes a connection location for connecting to a conductive wire or other transmission cable. Each connector module defines an axis of rotation

relative to the frame member generally parallel to the front face. The connector module is positionable in one of three position: a first position where the front face of the connector module is generally parallel to the front face of the frame member, a first angled position where the front face of the connector module is at a first angle relative to the front face of the frame member, and a second angled position in a left facing direction where the front face of the connector module is at a second angle in a right facing direction relative to the front face of the frame member in an opposite direction to the first angled position.

A plurality of connector modules in at least one linear array are preferably provided. Preferably, a plurality of connector jacks are provided on each connector module. The connector jacks are preferably arranged in linear arrays generally perpendicular to each axis of rotation of the connector module or modules. Locks are provided to lock the connector modules to the frame member in one of the selected positions.

According to another aspect of the present invention there is provided a telecommunications patch panel comprising:

a plurality of connector modules, each connector module having a front face and an opposite facing rear face, each front face including a plurality of connector jacks defining at least one linear array, each rear face including a plurality of cable connection locations, the cable connection locations connected to the connector jacks for transmission of telecommunications signals therebetween, each connector module defining an axis of rotation generally parallel to the front face, the linear arrays of connector jacks generally perpendicular to the respective rotation axes of the connector modules;

a frame member having a front face and a linear array of openings, each of the connector modules mounted to the frame member in one of the openings for rotatable movement about the respective rotation axes.

Yet another aspect of the invention concerns a telecommunications patch panel comprising:

a plurality of connector modules, each connector module having a front face and an opposite facing rear face, each front face including a plurality of connector jacks defining at least one linear array, each rear face including a plurality of wire termination blocks, the wire termination blocks electrically connected to the connector jacks, each connector module defining an axis of rotation generally parallel to the front face, the linear arrays of connector jacks generally perpendicular to the respective rotation axes of the connector modules;

a frame member having a front face, each of the connector modules mounted to the frame member for rotatable movement about the respective rotation axes, each of the connector modules positionable in one of three selectable positions, a first position where the front face of the connector module is generally parallel to the front face of the frame member, a first angled position where the front face of the connector module is at a first angle in a left facing direction relative to the front face of the frame member, and a second angled position where the front face of the connector module is at a second angle in a right facing direction relative to the front face of the frame member in an opposite direction to the first angled position;

a stop for limiting rotation of each of the connector modules to a predetermined range of motion;

a plurality of locks for selectively locking each of the connector modules to the frame member in one of the three selectable positions.

Still another aspect of the invention concerns a telecommunications patch panel comprising:

a plurality of connector modules, each connector module including at least one linear array of connector jacks, each connector jack connected to a wire termination block;

a frame member having a front face defining a front plane, the connector modules mounted to the frame member, each of the linear arrays of connector jacks defining a line from a first connector jack of the linear array to a last connector jack of the linear array, each line positioned at an angle in a left

facing direction or a right facing direction relative to the front plane of the front face.

Yet another aspect of the present invention provide a method for assembling a telecommunications patch panel comprising:

providing a frame member including a plurality of connector modules, each connector module having a front face and an opposite facing rear face, each front including a plurality of connector jacks defining at least one linear array, each rear face including a plurality of connection locations, the connection locations electrically connected to the connector jacks, each connector module defining an axis of rotation generally parallel to the front face, the linear arrays of the connector jacks generally perpendicular to the respective rotation axes;

mounting a cable to one of the plurality of connection locations on a selected one of the connector modules;

mounting a patch cord to the connector jack on the selected connector module connected to the connection location mounted to the cable;

unlocking the selected connector module from a locked condition relative to the frame member;

rotating the selected connector module relative to the frame member to a rotated position; and

relocking the selected connector module in a rotated position relative to the frame member.

Yet another aspect of the present invention a telecommunications patch panel for mounting to a telecommunications rack comprising:

a frame member having first and second ends, the first and second ends having first and second brackets, the first and second brackets defining a vertical plane when the telecommunications patch panel is mounted to the telecommunications rack;

first and second connector module, the first connector module including a first horizontal row of front connector jacks aligned along a first horizontal line when the frame member is mounted to the rack, the second

connector module including a second horizontal row of front connector jacks aligned along a second horizontal line when the frame member is mounted to the rack, each front connector jack connected to a rear connection location;

the first and second connector modules being laterally adjacent to one another when the frame is mounted to the rack, each of the first and second horizontal lines being positioned at an angled relative to the vertical plane, and the first and second horizontal lines intersecting one another at a location in front of the frame member.

Yet another aspect of the present invention provide a telecommunications patch panel for mounting to a telecommunications rack, the patch panel comprising:

a frame adapted for connection to the telecommunications rack, the frame defining at least first and second mounting openings;

a first connector module that mounts at the first mounting opening, the first connector module including a first horizontal row of front connector jacks, the first horizontal row of front connector jacks defining a first front face plane that is generally vertical when the patch panel is mounted to the telecommunications rack;

a second connector module that mounts at the second mounting opening, the second connector module including a second horizontal row of front connector jacks, the second horizontal row of front connector jacks defining a second front face plane that is generally vertical when the patch panel is mounted to the telecommunications rack;

the first and second connector modules being aligned along generally the same horizontal plane when the patch panel is mounted to the telecommunications, rack; and

the first and second front face planes intersecting each other at an oblique angle.

Yet another aspect of the present invention provide a telecommunications patch panel for mounting to a telecommunications rack comprising:

a frame member mountable to the telecommunications rack, the frame member having first and second ends defining a vertical plane when the telecommunications patch panel is mounted to the telecommunications rack, the frame also including a spacer;

first and second horizontal rows of front connector jacks mounted to the frame member on opposite sides of the spacer, the first and second horizontal rows of front connector jacks being aligned generally along the same horizontal plane when the telecommunications patch panel is mounted to the telecommunications rack, the front connector jacks configured and arranged to receive plugs of copper telecommunications cables, each front connector jack connected to a rear connection location, the first horizontal row of front connector jacks positioned between the spacer and the first end of the frame member, the second horizontal row of front connector jacks positioned between the spacer and the second end of the frame member; and

the first horizontal rows of front connector jacks being aligned along a first horizontal line, the second horizontal row of front connector jacks being aligned along a second horizontal line, and the first and second horizontal lines being angled relative to one another when viewed from above the frame member.

Yet another aspect of the present invention provide a telecommunications patch panel for mounting to a telecommunications rack, the patch panel comprising:

a frame adapted for connection to the telecommunications rack, the frame defining at least first and second mounting openings;

a first row of front connectors that mount within the first mounting opening, the first row being generally horizontal when the patch panel is mounted to the telecommunications rack;

a second row of front connectors that mount within the second mounting opening, the second row being generally horizontal when the patch panel is mounted to the telecommunications rack;

the first and second rows of front connectors being aligned generally along the same horizontal plane when the patch panel is mounted to the telecommunications rack; and

the first and second rows of front connectors together defining a front connection interface that is generally v-shaped when viewed from above the frame.

Yet another aspect of the present invention provides a telecommunications patch panel for mounting to a telecommunications rack, the patch panel comprising:

a frame adapted for connection to the telecommunications rack, the frame including a first end positioned opposite from a second end, the frame including a first mounting bracket positioned at the first end of the frame and second mounting bracket positioned at the second end of the frame, the first and second mounting brackets defining a generally vertical plane when the patch panel is mounted to the telecommunications rack;

a first row of front jacks mounted to the frame, the first row being generally horizontal when the patch panel is mounted to the telecommunications rack;

a second row of front jacks mounted to the frame, the second row being generally horizontal when the patch panel is mounted to the telecommunications rack;

the first and second rows of front jacks being aligned generally along the same horizontal plane when the patch panel is mounted to the telecommunications rack; and

the first and second rows of front jacks oriented at oblique angles relative to one another and the first and second rows of front jacks together defining a front connection interface that is generally v-shaped when viewed from above the frame.

It is still another aspect of the present invention to provide a telecommunications component, comprising:

a) a frame piece having a front face, the front face defining an opening; and

b) a connector module including at least a first connector jack configured for coupling to a telecommunication cable, the connector module being rotatably mounted at the opening of the frame piece;

c) wherein the connector module locks in any selected one of a number of positions, the number of positions including:

i) a center position;

ii) a first angled position wherein the connector module is rotated within the opening of the frame piece at a first angle relative to the center position; and

iii) a second angled position wherein the connector module is rotated within the opening of the frame piece at a second angle relative to the center position.

Yet another aspect of the invention provides a telecommunications component, comprising:

a) a frame structure having a front face that defines an opening, the frame structure including a locking element; and

b) a connector module for coupling to a telecommunication cable, the connector module being rotatably mounted at the opening of the frame structure, the connector module including one or more detents;

c) wherein the locking element of the frame structure is arranged to engage the one or more of the detents of the connector module to lock the connector module in any selected one of a number of positions, the number of positions including:

i) a center facing position;

ii) a rightward facing position; and

iii) a leftward facing position.

Still another aspect of the invention provides a telecommunications panel comprising:

a frame having a length that extends from a left end to a right end of the frame, the frame including a left mounting bracket positioned at the left end of the frame and a right mounting bracket positioned at the right end of the frame, the frame also including upper and lower portions tat extend along the length of the frame; and

a plurality of connector modules mounted between the upper and lower portions of the frame and between the left and right ends of the frame, each of the connector modules including a front side at which a plurality of front connectors are located and a rear side at which a plurality of rear connectors are located, the connector modules being pivotally movable about generally upright pivot axes that extend between the upper and lower portions of the frame, each connector module having a height that extends between the upper and lower portions of the frame and a length that extends between the left and right ends of the frame, the lengths of the connector modules being longer than the heights, and the lengths of the connector modules being generally perpendicular relative to the pivot axes.

Another aspect of the invention provides a telecommunications panel comprising:

a frame having front face and a rear face; and

at least one connector module mounted to the frame, the connector module including a front side and at least first and second front jacks positioned at the front side, the first and second front jacks each defining a port adapted for receiving a plug, the connector module also including a rear side and rear connection locations positioned at the rear side, the connector module being pivotally movable relative to the frame between first and second positions, the front side of the connector module being generally parallel to the front face of the frame when the connector module is in the first position, the front side of the connector module being angled relative to the front face of the frame when the connector module is in the second position, wherein moving the connector module to the second position causes the second front jack to be positioned further from the front face of the frame than the first front jack.

Still another aspect of the invention provides a telecommunications panel comprising:

a frame; and

a plurality of connector modules mounted to the frame, the connector modules each including a front side and a row of front connectors positioned at the front side, the rows of front connector being aligned generally along lines, the connector modules also including rear sides and rear connection locations positioned at the rear sides, the connector modules being pivotally movable relative to the frame about pivot axes that are generally perpendicular relative to the lines along which the rows of connectors are aligned.

Brief Description of the Drawings

Figure 1 is an exploded perspective view of an embodiment of a patch panel and a portion of a rack for holding the patch panel in accordance with the present invention, with two connector modules angled to the left and two connector modules angled to the right when the panel is mounted to the rack horizontally;

Figure 2 is a top view of the patch panel of Figure 1, showing front and rear connections to cables;

Figure 3 is a perspective view of the patch panel of Figure 1, showing all of the connector modules extending parallel to the frame;

Figure 4 is a top view of the patch panel of Figure 3, showing front and rear connections to cables;

Figure 5 is a perspective view of the patch panel of Figure 1, showing all of the connector modules angled to the left side of the frame;

Figure 6 is a perspective view of the patch panel of Figure1, showing all of the connector modules angled to the right side of the frame;

Figure 7 is an exploded perspective view of the patch panel of Figure 1;

Figure 8 is an exploded top view of the patch panel of Figure 1;

Figure 9 is a rear perspective view of the locking pin of the patch panel of Figure 1;

Figure 10 is a perspective view of the bracket of the patch panel of Figure 1;

Figure 11 is a perspective view of the connector module of the patch panel of Figure 1;

Figure 12 is a top view of the connector module of Figure 11;

Figure 13 is a front view of the connector module of Figure 11;

Figure 14 is a side view of the connector module of Figure 11, an opposite side being a mirror image;

Figure 15 is a rear view of the connector module of Figure 11;

Figure 16 is a bottom view of the connector module of Figure 11; and

Figure 17 is a rear perspective view of the circuit module of the connector module of Figure 11.

Detailed Description of the Preferred Embodiment

Referring now to Figures 1 and 2, an embodiment of a patch panel 20 is shown for use in connecting telecommunications equipment. Patch panel 20 is especially useful to cross–connect equipment through one or more of patch panels 20 or other panels. Patch panel 20 mounts to a rack 22 of conventional construction, such as with fasteners 26 passing through holes 28 of patch panel 20 for receipt in holes 24 of rack 22. Patch panel 20 includes a plurality of connector jacks 30, such as RJ45 connector jacks, on a front side 21. Patch panel 20 further includes a plurality of connection locations 31, such as wire termination or connection blocks 31 mounted on an opposite rear side 23. Preferably, termination blocks 31 include 110 type insulation displacement connectors. Termination blocks 31 allow for connection of signal transmission cables 46, each containing a plurality of conductive wires 48. Connector jacks 30 allow for connection of signal transmission patch cables or cords 44 including conductive wires and further including connector end plugs 42. Circuitry electrically connects each termination block 31 to a connector jack 30.

Patch panel 20 includes a plurality of connector modules 32, where each connector module 32 includes a plurality of connector jacks 30. The connector modules 32 of patch panel 20 are arranged in a linear array. Each connector module 32 includes a linear array of connector jacks 30. One linear array of jacks 30 is shown per connector module 32. Two or more arrays could be provided. Alternative embodiments include patch panels 20 with a single connector module

32. Also, each connector module 32 may be constructed with a single connector jack 30.

As shown in Figures 1 and 2, each connector module 32 is mounted in an angled orientation relative to frame 34. Specifically, frame 34 includes a front plane or face 36, and each connector module 32 includes a front plane or face 37 where each front face 37 of the connector modules 32 is at an angle relative to front face 36 of frame 34. Connector modules 32a, 32b are angled to the left of frame 34, and connector modules 32c, 32d are angled to the right. Alternatively stated, connector modules 32a, 32b are angled clockwise, and connector modules 32c, 32d are angled counterclockwise, as viewed from a top of frame 34 as depicted in Figure 2. If patch panel 20 was oriented vertically, then connector module 32a, 32b would be angled upwardly (or downwardly), and connector modules 32c, 32d would be angled downwardly (or upwardly).

In the illustrated preferred embodiment, the angle of displacement of each connector module 32 relative to frame 34 is about 15 degrees. In the case of patch cords 44a, 44b angled to the left, and patch cords 44c, 44d angled to the right, such an angle provides strain relief so as to help prevent cable damage and/or loss of cable performance. The cable positioning provided by the angled connector modules 32 helps reduce the likelihood of falling below the minimum bend radius of the cable as each cable travels to other jacks or other equipment. Such strain relief is advantageous over a perpendicular mounting of the connector plug relative to the cable pathway, such as illustrated in Figure 4.

Figures 3 and 4 are provided to illustrate advantageous features of patch panel 20 in accordance with the invention. Preferably, connector modules 32 are rotatable relative to frame 34. In Figures 3 and 4, each connector module 32 has its front face 37 positioned generally parallel to front face 36 of frame 34. Such an arrangement is useful when using a termination tool (not shown) to mount wires 48 to each of termination blocks 31 in the case of insulation displacement connectors. A lock 40, shown generally in Figures 1 and 2, holds each connector module 32 to frame 34 during the termination operation. Lock 40 is releasable to allow rotation of each connector module 32 as desired. As shown in Figures 1 and 2, connector modules 32a, 32b are rotated to the left, and connector modules 32c, 32d are rotated to the right. One or more connector modules 32 can be left in the positions shown in Figures 3 and 4, if desired. Alternatively, all the connector modules 32 can be rotated to the left as shown in Figure 5, or to the right as shown in Figure 6. To maintain the connector modules in the rotated positions, lock 40 is reactivated. If desired, one or more of the connector modules 32 and frame 34 can be constructed in a permanently angled configuration relative to front face 36 frame 34.

In Figures 2 and 4, cables 44 are shown as being directed away from patch panel 20. It is to be noted that the opposite ends of cables 44 can be connected to other connector jacks 30 of patch panel 20. Also, patch panel 20 is useable in both cross–connect systems, and in inter–connect systems, as desired. Providing strain relief so as to not fall below minimum bend radii is also an issue with fiberoptic transmission cables. The telecommunications patch panel 20 of the present invention is also useful in fiber applications with appropriately configured fiberoptic connectors.

Lock 40 is a preferred feature for patch panel 20. However, a patch panel 20 where the lock is not activated, or a patch panel 20 where no lock is present are both advantageous arrangements. In those instances, each connector module 32 is positionable to the left (fully or partially), to the right (fully or partially) or parallel as desired. For connector modules which are freely rotatable, the modules 32 may move to a new position from an original position to provide the strain relief, as the patch cords 44 are added or changed.

Referring now to Figures 7 through 17, additional details of patch panel 20 are shown. Each connector module 32 includes pins 50 extending in opposite directions and defining a rotation axis 52 (see Figure 11). Each rotation axis 52 is generally perpendicular to the linear array defined by connector jacks 30. Pins 52 are received in holes 54 of frame 34. The rotatable mounting of each connector module 32 to frame 34 could also be accomplished with a fastener passing through holes 54.

Frame 34 generally includes a top portion 34a and an opposing bottom portion 34b. End bracket portions 34c, 34d on opposite ends of frame 34 include rack mounting holes 28 noted above. End struts 34e are continuous with end bracket portions 34c, 34d. Middle struts 34f extend between top and bottom portions 34a, 34b. Struts 34e, 34f and top and bottom portions 34a, 34b define a linear array of openings for each receiving a connector module 32. Holes 54 of frame 34 are positioned in top and bottom portions 34a, 34b for holding the independently rotatable connector modules 32 about each respective rotation axis 52. The rotation axes 52 extend transversely relative to the linear arrays of connector jacks 30, and also a linear array defined by the plurality of connector modules 32.

A plurality of locking pins 60, and brackets 76 are mounted to frame 34. Each locking pin 60 includes a shaft 62, two spaced apart tabs 64, 66, a first tool engageable end 68, and an opposite end 70. Each tab 64, 66 has two ends extending in opposite directions. End 70 is received in hole 56 in a respective end or middle strut 34e, 34f. Tool engageable end 68 is received in an aperture 80 of bracket 76. Bracket 76 is mounted to top and bottom portions 34a, 34b of frame 34 with two

fasteners 82 positioned through apertures 58. Each fastener 82 is received in a hole 78 of bracket 76. Once brackets 76 are mounted to frame 34, locking pin 60 is rotatable between an unlocked position, and a locked position. The locked position is shown in the Figures. The unlocked position is where shaft 62 is rotated 90 degrees about its longitudinal axis, such as with a flathead screwdriver received in tool engageable end 68.

Each connector module 32 includes detents 84, 86 on each end. Lock 40 is constructed wherein tabs 64, 66 are received in detents 84, 86 when connector module 32 is locked in the position shown in Figure 3. When connector modules 32 are rotated out of plane 36 of frame 34, only one tab 64, 66 is received in one of detents 84, 86. When lock 40 is rotated 90 degrees from the position shown in the Figures, none of tabs 64, 66 are received in any of detents 84, 86 so as to allow free rotation of connector modules 32. Locks 40 associated with middle struts 34f of frame 34 each lock two adjacent connector modules 32.

Each connector module 32 includes a circuit module 90 and a face plate 92. Circuit module 90 includes a printed circuit board 94 having a generally planar construction. As shown in Figure 17, pins 96 of each termination block 31 project through printed circuit board 94 and are soldered to the board. As shown in Figure 15, connector jacks 30 include pins 98 projecting through printed circuit board 94, and the pins are soldered to the board. Connector jacks 30 also include two tabs 102 which snap mount to printed circuit board 94 through apertures 100 as shown in Figure 15. Printed circuit board 94 includes circuit pathways to electrically link each connector jack 30 with one of the termination blocks 31. Connector jacks 30 are shown in the Figures with the clip receiving portion of the jack facing vertically downwardly.

Face plate 92 preferably snap mounts to circuit module 90. Opposite ends 110 of face plate 90 include inner snaps 112 for snap fitting engagement of an edge of printed circuit board 94. (See, for example, Figure 12). Such a construction allows for repair or replacement of circuit module 90 or face plate 92, as desired.

Face plate 92 includes a central opening 108 for exposing connector jacks 30. Face plate 92 further includes outwardly facing stops 114 on each end 110 which limit the amount of rotation of connector module 32 during use. Each stop 114 engages one edge 116 of bracket 76 so as to limit the amount of rotation of connector module to approximately plus or minus 15 degrees in the preferred embodiment. Each face plate includes a front designation strip area 120 for labeling of connector jacks 30.

Examples of connector jacks 30 and termination blocks 31 are shown in U.S. Patent Nos. 5,700,167; 5,674,093; 5,639,261; 5,591,045; 5,310,363; 5,299,956; and 3,611,264.

The above specification and examples provide a complete description of the manufacture and use of the invention. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.

WHAT IS CLAIMED IS:

1. A telecommunications patch panel comprising:

a connector module having a front face and an opposite facing rear face, the front face of the connector module including a connector jack for receiving a plug of a first conductive wire, the rear face including a connection location for connecting to a second conductive wire, the connection location electrically connected to the connector jack, the connector module defining an axis of rotation generally parallel to the front face;

a frame member having a front face, the connector module rotatably mounted to the frame member for movement about the rotation axis, wherein the front face of the connector module is positionable in one of three selectable positions, a first position where the front face of the connector module is generally parallel to the front face of the frame member, a first angled position where the front face of the connector module is at a first angle in a left facing direction relative to the front face of the frame member, and a second angled position where the front face of the connector module is at a second angle in a right facing direction relative to the front face of the frame member in an opposite direction to the first angled position.

2. The telecommunications patch panel of claim 1, further comprising brackets extending from the frame member for mounting to a rack.

3. The telecommunications patch panel of claim 1, further comprising a lock for selective locking the connector module to the frame member in one of the three selectable positions.

4. The telecommunications patch panel of claim 1, further comprising a plurality of the connector jacks, wherein the plurality of connectors jacks are arranged in a linear array generally perpendicular to the axis of rotation.

5. The telecommunications patch panel of claim 4, further comprising a plurality of connector modules, each of the plurality of connector modules including a plurality of the connector jacks, the connector modules arranged in at least one linear array.

6. The telecommunications patch panel of claim 1, further comprising a plurality of connector modules.

7. The telecommunications patch panel of claim 1, wherein the connector jack is an RJ45 jack.

8. The telecommunications patch panel of claim 1, wherein the connection location is a wire termination block.

9. The telecommunications patch panel of claim 1, wherein the connector module includes a printed circuit board, a face plate, and a snap arrangement for snap fitting the face plate to the printed circuit board, the connector jack mounted to the printed circuit board on one side of the printed circuit board, the connection location including an insulation displacement connector mounted to the printed circuit board on an opposite side to the connector jack, the face plate including an opening for exposing the connector jack.

10. A telecommunications patch panel comprising:

a plurality of connector modules, each connector module having a front face and an opposite facing rear face, each front face including a plurality of connector jacks defining at least one linear array, each rear face including a plurality of cable connection locations, the cable connection locations connected to the connector jacks for transmission of telecommunications signals therebetween, each connector module defining an axis of rotation generally parallel to the front face, the linear arrays of connector jacks generally perpendicular to the respective rotation axes of the connector modules;

a frame member having a front face and a linear array of openings, each of the connector modules mounted to the frame member in one of the openings for rotatable movement about the respective rotation axes.

11. The telecommunications patch panel of claim 10, wherein each of the connector modules is positionable in one of three selectable positions, a first position where the front face of the connector module is generally parallel to the front face of the frame member, a first angled position where the front face of the connector module is at a first angle in a left facing direction relative to the front face of the frame member, and a second angled position where the front face of the connector module is at a second angle in a right facing direction relative to the front face of the frame member in an opposite direction to the first angled position.

12. The telecommunications patch panel of claim 10, further comprising brackets extending from the frame member for mounting to a rack.

13. The telecommunications patch panel of claim 10, further comprising a lock for selective locking the connector module to the frame member.

14. The telecommunications patch panel of claim 10, wherein the connector jacks are sized to receive plugs of copper telecommunications cables, and the cable connection locations include wire termination blocks configured and arranged for receiving wires of copper telecommunications cables.

15. A telecommunications patch panel comprising:

a plurality of connector modules, each connector module having a front face and an opposite facing rear face, each front face including a plurality of connector jacks defining at least one linear array, each rear face including a plurality of wire termination blocks, the wire termination blocks electrically

connected to the connector jacks, each connector module defining an axis of rotation generally parallel to the front face, the linear arrays of connector jacks generally perpendicular to the respective rotation axes of the connector modules;

a frame member having a front face, each of the connector modules mounted to the frame member for rotatable movement about the respective rotation axes, each of the connector modules positionable in one of three selectable positions, a first position where the front face of the connector module is generally parallel to the front face of the frame member, a first angled position where the front face of the connector module is at a first angle in a left facing direction relative to the front face of the frame member, and a second angled position where the front face of the connector module is at a second angle in a right facing direction relative to the front face of the frame member in an opposite direction to the first angled position;

a stop for limiting rotation of each of the connector modules to a predetermined range of motion;

a plurality of locks for selectively locking each of the connector modules to the frame member in one of the three selectable positions.

16. The telecommunications patch panel of claim 15, wherein at least one lock locks two adjacent connector modules to the frame member.

17. A telecommunications patch panel comprising:

a plurality of connector modules, each connector module including at least one linear array of connector jacks, each connector jack connected to a wire termination block;

a frame member having a front face defining a front plane, the connector modules mounted to the frame member, each of the linear arrays of connector jacks defining a line from a first connector jack of the linear array to a last connector jack of the linear array, each line positioned at an angle in a left

facing direction or a right facing direction relative to the front plane of the front face.

18. The telecommunications patch panel of claim 17, wherein the connector modules are rotatably mounted to the frame member.

19. A method for assembling a telecommunications patch panel comprising:

providing a frame member including a plurality of connector modules, each connector module having a front face and an opposite facing rear face, each front including a plurality of connector jacks defining at least one linear array, each rear face including a plurality of connection locations, the connection locations electrically connected to the connector jacks, each connector module defining an axis of rotation generally parallel to the front face, the linear arrays of the connector jacks generally perpendicular to the respective rotation axes;

mounting a cable to one of the plurality of connection locations on a selected one of the connector modules;

mounting a patch cord to the connector jack on the selected connector module connected to the connection location mounted to the cable;

unlocking the selected connector module from a locked condition relative to the frame member;

rotating the selected connector module relative to the frame member to a rotated position; and

relocking the selected connector module in a rotated position relative to the frame member.

20. A telecommunications patch panel for mounting to a telecommunications rack comprising:

a frame member having first and second ends, the first and second ends having first and second brackets, the first and second brackets defining a

vertical plane when the telecommunications patch panel is mounted to the telecommunications rack;

first and second connector module, the first connector module including a first horizontal row of front connector jacks aligned along a first horizontal line when the frame member is mounted to the rack, the second connector module including a second horizontal row of front connector jacks aligned along a second horizontal line when the frame member is mounted to the rack, each front connector jack connected to a rear connection location;

the first and second connector modules being laterally adjacent to one another when the frame is mounted to the rack, each of the first and second horizontal lines being positioned at an angled relative to the vertical plane, and the first and second horizontal lines intersecting one another at a location in front of the frame member.

21. The telecommunications patch panel of claim 20, wherein the brackets are integrally formed with the frame member.

22. The telecommunications patch panel of claim 20, wherein the connector modules are rotatably mounted to the frame member, and further comprising a lock for selectively locking each connector module to the frame member.

23. The telecommunications patch panel of claim 20, wherein at least some of the front connector jacks are configured and arranged to receive plugs of copper telecommunications cables.

24. The telecommunications patch panel of claim 20, wherein the connector modules are positioned in openings through the frame member.

25. The telecommunications patch panel of claim 20, wherein the rear connector locations are included as part of the modules.

26. The telecommunications patch panel of claim 20, wherein the frame member includes a spacer positioned between the first and second connector modules.

27. A telecommunications patch panel for mounting to a telecommunications rack, the patch panel comprising:

a frame adapted for connection to the telecommunications rack, the frame defining at least first and second mounting openings;

a first connector module that mounts at the first mounting opening, the first connector module including a first horizontal row of front connector jacks, the first horizontal row of front connector jacks defining a first front face plane that is generally vertical when the patch panel is mounted to the telecommunications rack;

a second connector module that mounts at the second mounting opening, the second connector module including a second horizontal row of front connector jacks, the second horizontal row of front connector jacks defining a second front face plane that is generally vertical when the patch panel is mounted to the telecommunications rack;

the first and second connector modules being aligned along generally the same horizontal plane when the patch panel is mounted to the telecommunications, rack; and

the first and second front face planes intersecting each other at an oblique angle.

28. The patch panel of claim 27, wherein the first and second front face planes intersect at a location in front of the frame.

29. The patch panel of claim 20, wherein the frame includes a spacer positioned between the first and second mounting openings.

30. A telecommunications patch panel for mounting to a telecommunications rack comprising:

a frame member mountable to the telecommunications rack, the frame member having first and second ends defining a vertical plane when the telecommunications patch panel is mounted to the telecommunications rack, the frame also including a spacer;

first and second horizontal rows of front connector jacks mounted to the frame member on opposite sides of the spacer, the first and second horizontal rows of front connector jacks being aligned generally along the same horizontal plane when the telecommunications patch panel is mounted to the telecommunications rack, the front connector jacks configured and arranged to receive plugs of copper telecommunications cables, each front connector jack connected to a rear connection location, the first horizontal row of front connector jacks positioned between the spacer and the first end of the frame member, the second horizontal row of front connector jacks positioned between the spacer and the second end of the frame member; and

the first horizontal rows of front connector jacks being aligned along a first horizontal line, the second horizontal row of front connector jacks being aligned along a second horizontal line, and the first and second horizontal lines being angled relative to one another when viewed from above the frame member.

31. The telecommunications patch panel of claim 30, further including first and second brackets adjacent said first and second ends of said frame member.

32. The telecommunications patch panel of claim 30, wherein the horizontal rows of front connector jacks are rotatably mounted to the frame member, and further comprising a lock for selectively locking each horizontal row of front connector jacks to the frame member.

33. The telecommunications patch panel of claim 30, wherein the connector jacks and the corresponding rear connector locations are mounted to the frame via connector modules.

34. A telecommunications patch panel for mounting to a telecommunications rack, the patch panel comprising:

a frame adapted for connection to the telecommunications rack, the frame defining at least first and second mounting openings;

a first row of front connectors that mount within the first mounting opening, the first row being generally horizontal when the patch panel is mounted to the telecommunications rack;

a second row of front connectors that mount within the second mounting opening, the second row being generally horizontal when the patch panel is mounted to the telecommunications rack;

the first and second rows of front connectors being aligned generally along the same horizontal plane when the patch panel is mounted to the telecommunications rack; and

the first and second rows of front connectors together defining a front connection interface that is generally v-shaped when viewed from above the frame.

35. The patch panel of claim 34, further comprising a first module that carries the first row of front connectors, and a second module that carries the second row of front connectors.

36. The patch panel of claim 34, further comprising rear connection locations connected to the first and second rows of front connectors, the rear connection locations defining a rear connection interface that is generally v-shaped when viewed from above the frame.

37. The patch panel of claim 34, wherein a first module carries the first row of front connectors and also carries the first rear connection locations connected to the first row of front connectors, and a second module carries the second row of front connectors and also carries second rear connection locations connected to the second row of front connectors.

38. The patch panel of claim 34, wherein the front connectors comprise jacks.

39. The patch panel of claim 30, wherein the first and second horizontal lines define an oblique angle.

40. The patch panel of claim 34, wherein the spacer is generally flat.

41. A telecommunications patch panel for mounting to a telecommunications rack, the patch panel comprising:

a frame adapted for connection to the telecommunications rack, the frame including a first end positioned opposite from a second end, the frame including a first mounting bracket positioned at the first end of the frame and second mounting bracket positioned at the second end of the frame, the first and second mounting brackets defining a generally vertical plane when the patch panel is mounted to the telecommunications rack;

a first row of front jacks mounted to the frame, the first row being generally horizontal when the patch panel is mounted to the telecommunications rack;

a second row of front jacks mounted to the frame, the second row being generally horizontal when the patch panel is mounted to the telecommunications rack;

the first and second rows of front jacks being aligned generally along the same horizontal plane when the patch panel is mounted to the telecommunications rack; and

the first and second rows of front jacks oriented at oblique angles relative to one another and the first and second rows of front jacks together defining a front connection interface that is generally v-shaped when viewed from above the frame.

42. A telecommunications component, comprising:

a) a frame piece having a front face, the front face defining an opening; and

b) a connector module including at least a first connector jack configured for coupling to a telecommunication cable, the connector module being rotatably mounted at the opening of the frame piece;

c) wherein the connector module locks in any selected one of a number of positions, the number of positions including:

i) a center position;

ii) a first angled position wherein the connector module is rotated within the opening of the frame piece at a first angle relative to the center position; and

iii) a second angled position wherein the connector module is rotated within the opening of the frame piece at a second angle relative to the center position.

43. The telecommunications component of claim 42, wherein the connector module rotates in a clockwise direction from the center position to the first angled position.

44. The telecommunications component of claim 42, wherein the connector module rotates in a counterclockwise direction from the center position to the second angled position.

45. The telecommunications component of claim 42, further including a locking arrangement configured to lock the connector module in any selected one of the number of positions.

46. The telecommunications component of claim 45, wherein the locking arrangement includes detents formed in the connector module.

47. The telecommunications component of claim 46, wherein the locking arrangement includes a locking structure interconnected to the frame piece, the locking structure being arranged to engage at least one of the detents formed in the connector module to lock the connector module in the selected one of the number of positions.

48. The telecommunications component of claim 47, wherein the locking structure includes a tab that engages the at least one detent of the connector module.

49. The telecommunications component of claim 42, wherein the first connector jack is configured for coupling to a copper-based telecommunication cable.

50. The telecommunications component of claim 42, wherein the connector module includes first and second connector jacks configured for coupling to telecommunication cables.

51. The telecommunications component of claim 42, wherein the connector module rotates about a vertical axis.

52. The telecommunications component of claim 42, wherein the front face of the frame piece defines a plurality of openings configured to receive a plurality of connector modules.

53. A telecommunications component, comprising:

a) a frame structure having a front face that defines an opening, the frame structure including a locking element; and

b) a connector module for coupling to a telecommunication cable, the connector module being rotatably mounted at the opening of the frame structure, the connector module including one or more detents;

c) wherein the locking element of the frame structure is arranged to engage the one or more of the detents of the connector module to lock the connector module in any selected one of a number of positions, the number of positions including:

i) a center facing position;

ii) a rightward facing position; and

iii) a leftward facing position.

54. The telecommunications component of claim 53, wherein the locking element includes a tab that engages the one or more of the detents of the connector module.

55. The telecommunications component of claim 53, wherein the connector module includes at least a first connector jack.

56. The telecommunications component of claim 55, wherein the first connector jack is configured for coupling to a copper-based telecommunication cable.

57. The telecommunications component of claim 53, wherein the connector module includes a first connector jack and a second connector jack, the first and second connector jacks being configured for coupling to telecommunication cables.

58. The telecommunications component of claim 53, wherein the connector module rotates about a vertical axis.

59. The telecommunications component of claim 53, wherein the front face of the frame structure defines a plurality of openings configured to receive a plurality of connector modules.

60. A telecommunications panel comprising:

a frame having a length that extends from a left end to a right end of the frame, the frame including a left mounting bracket positioned at the left end of the frame and a right mounting bracket positioned at the right end of the frame, the frame also including upper and lower portions tat extend along the length of the frame; and

a plurality of connector modules mounted between the upper and lower portions of the frame and between the left and right ends of the frame, each of the connector modules including a front side at which a plurality of front connectors are located and a rear side at which a plurality of rear connectors are located, the connector modules being pivotally movable about generally upright pivot axes that extend between the upper and lower portions of the frame, each connector module having a height that extends between the upper and lower portions of the frame and a length that extends between the left and right ends of the frame, the lengths of the connector modules being longer than the heights, and the lengths of the connector modules being generally perpendicular relative to the pivot axes.

61. The telecommunications panel of claim 60, wherein the front connectors include jacks having ports for receiving plugs.

62. The telecommunications panel of claim 61, wherein the jacks are RJ45 jacks.

63. The telecommunications panel of claim 60, wherein the rear connectors include insulation displacement connectors.

64. The telecommunications panel of claim 60, wherein the connector modules are aligned along a line that extends from the first end to the second end of the frame.

65. The telecommunications panel of claim 60, wherein the front connectors are arranged in rows that extend along the lengths of the connector modules.

66. The telecommunications panel of claim 60, wherein at least six of the front connectors are provided at each of the connector modules.

67. The telecommunications panel of claim 66, wherein four of the connector modules are mounted to the frame between the left and right ends of the frame.

68. The telecommunications panel of claim 60, wherein the connector modules are each pivotally movable about the pivot axes between at least first and second positions, and wherein the telecommunications panel has a latch arrangement for securing the connector modules in at least the first and second positions.

69. The telecommunications panel of claim 60, wherein the connector modules are each pivotally movable about the pivot axes between first, second and third positions, and wherein the telecommunications panel has a latch arrangement for securing the connector modules in the first, second and third positions.

70. The telecommunications panel of claim 69, wherein the pivot axes extend through mid-regions of the connector modules.

71. A telecommunications panel comprising:

a frame having front face and a rear face; and

at least one connector module mounted to the frame, the connector module including a front side and at least first and second front jacks positioned at the front side, the first and second front jacks each defining a port adapted for receiving a plug, the connector module also including a rear side and rear connection locations positioned at the rear side, the connector module being pivotally movable relative to the frame between first and second positions, the front side of the connector module being generally parallel to the front face of the frame when the connector module is in the first position, the front side of the connector module being angled relative to the front face of the frame when the

connector module is in the second position, wherein moving the connector module to the second position causes the second front jack to be positioned further from the front face of the frame than the first front jack.

72. The telecommunications panel of claim 71, wherein the frame has a length that extends from a left end to a right end of the frame, the frame including a left mounting bracket positioned at the left end of the frame and a right mounting bracket positioned at the right end of the frame, and wherein a plurality of the connector modules are mounted between the upper and lower portions of the frame and between the left and right ends of the frame.

73. The telecommunications panel of claim 72, wherein the connector modules pivot relative to the frame about generally upright pivot axes that extend between the upper and lower portions of the frame.

74. The telecommunications panel of claim 71, wherein the first and second front jacks are RJ45 jacks.

75. The telecommunications panel of claim 71, wherein the rear connection locations include insulation displacement connectors.

76. The telecommunications panel of claim 72, wherein the connector modules are aligned along a line that extends from the first end to the second end of the frame.

77. The telecommunications panel of claim 71, wherein the connector module includes at least one row of front jacks located at the front side of the connector module, the row of front jacks including at least the first front jack, the second front jack, and a third front jack, the third front jacks being positioned further from the front face of the frame that the second front jack when the connector module is in the second position.

78. The telecommunications panel of claim 71, wherein the telecommunications panel has a latch arrangement for securing the connector module in at least the first and second positions.

79. The telecommunications panel of claim 71, wherein the connector module is pivotally movable between first, second and third positions, wherein the second front jack is positioned closer to the front face of the frame than the first front connector when the connector module is in the third position, and wherein the telecommunications panel has a latch arrangement for securing the connector module in the first, second and third positions.

80. A telecommunications panel comprising:

a frame; and

a plurality of connector modules mounted to the frame, the connector modules each including a front side and a row of front connectors positioned at the front side, the rows of front connector being aligned generally along lines, the connector modules also including rear sides and rear connection locations positioned at the rear sides, the connector modules being pivotally movable relative to the frame about pivot axes that are generally perpendicular relative to the lines along which the rows of connectors are aligned.

81. The telecommunications panel of claim 80, wherein the frame has a length that extends from a left end to a right end of the frame, the frame including a left mounting bracket positioned at the left end of the frame and a right mounting bracket positioned at the right end of the frame, and wherein the connector modules are mounted between the upper and lower portions of the frame and between the left and right ends of the frame.

82. The telecommunications panel of claim 81, wherein the connector modules pivot relative to the frame about generally upright pivot axes that extend between the upper and lower portions of the frame.

83. The telecommunications panel of claim 80, wherein the front connectors are jacks defining ports adapted for receiving plugs.

84. The telecommunications panel of claim 80, wherein the rear connection locations include insulation displacement connectors.

85. The telecommunications panel of claim 80, wherein the connector modules are each pivotally movable about the pivot axes between at least first and second positions, and wherein the telecommunications panel has a latch arrangement for securing the connector modules in at least the first and second positions.

86. The telecommunications panel of claim 80, wherein the connector modules are each pivotally movable about the pivot axes between first, second and third positions, and wherein the telecommunications panel has a latch arrangement for securing the connector modules in the first, second and third positions.

87. The telecommunications panel of claim 80, wherein the pivot axes extend through mid-regions of the connector modules.

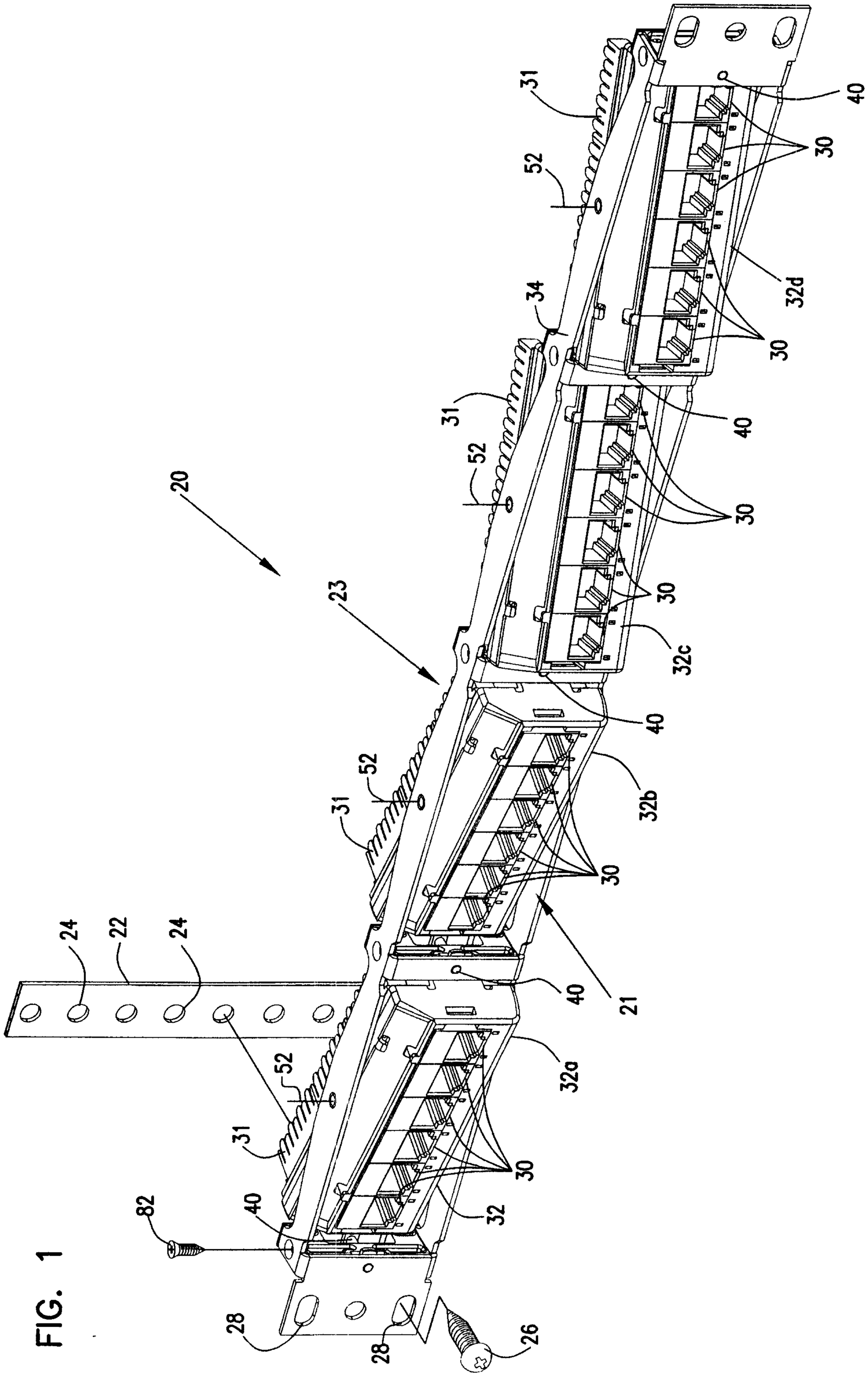


FIG. 1

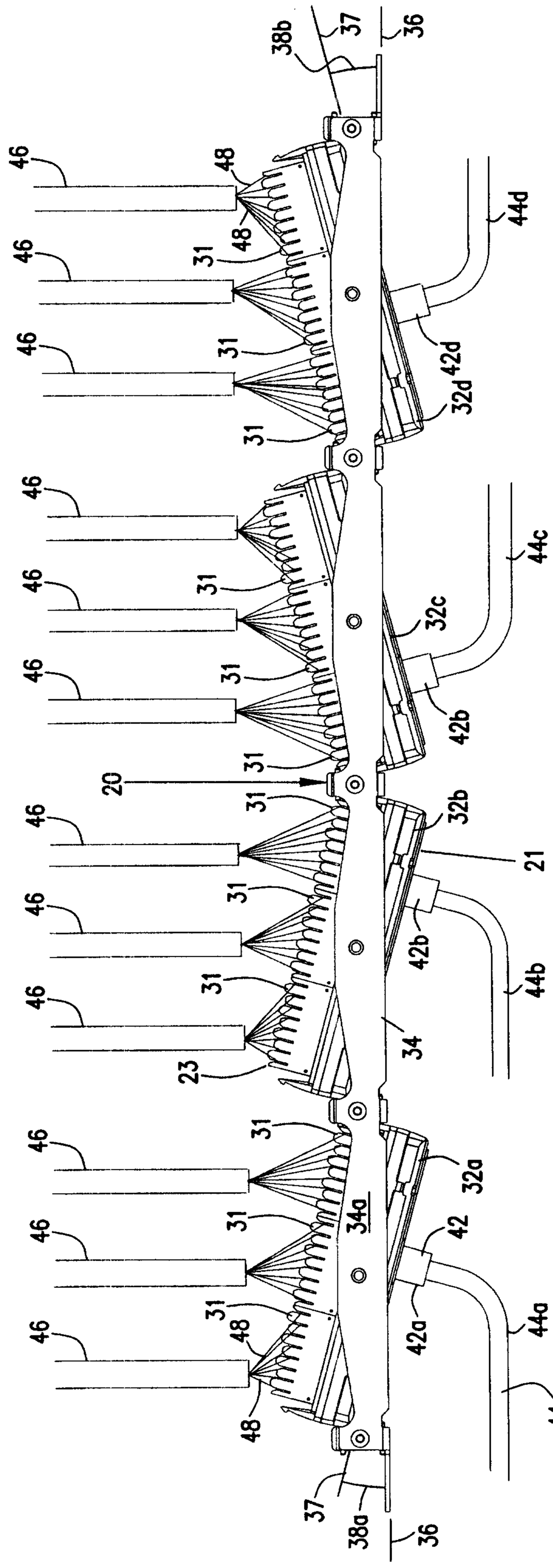

38b
37
36
46
48
48
46
31
44d
46
31
42d
32d
31
46
46
31
32c
46
31
44c
46
31
42b
20
31
46
32b
46
31
21
31
42b
46
44b
34
23
31
48
46
32a
31
34a
42
48
42a
44a
44
37
38a
36

FIG. 2

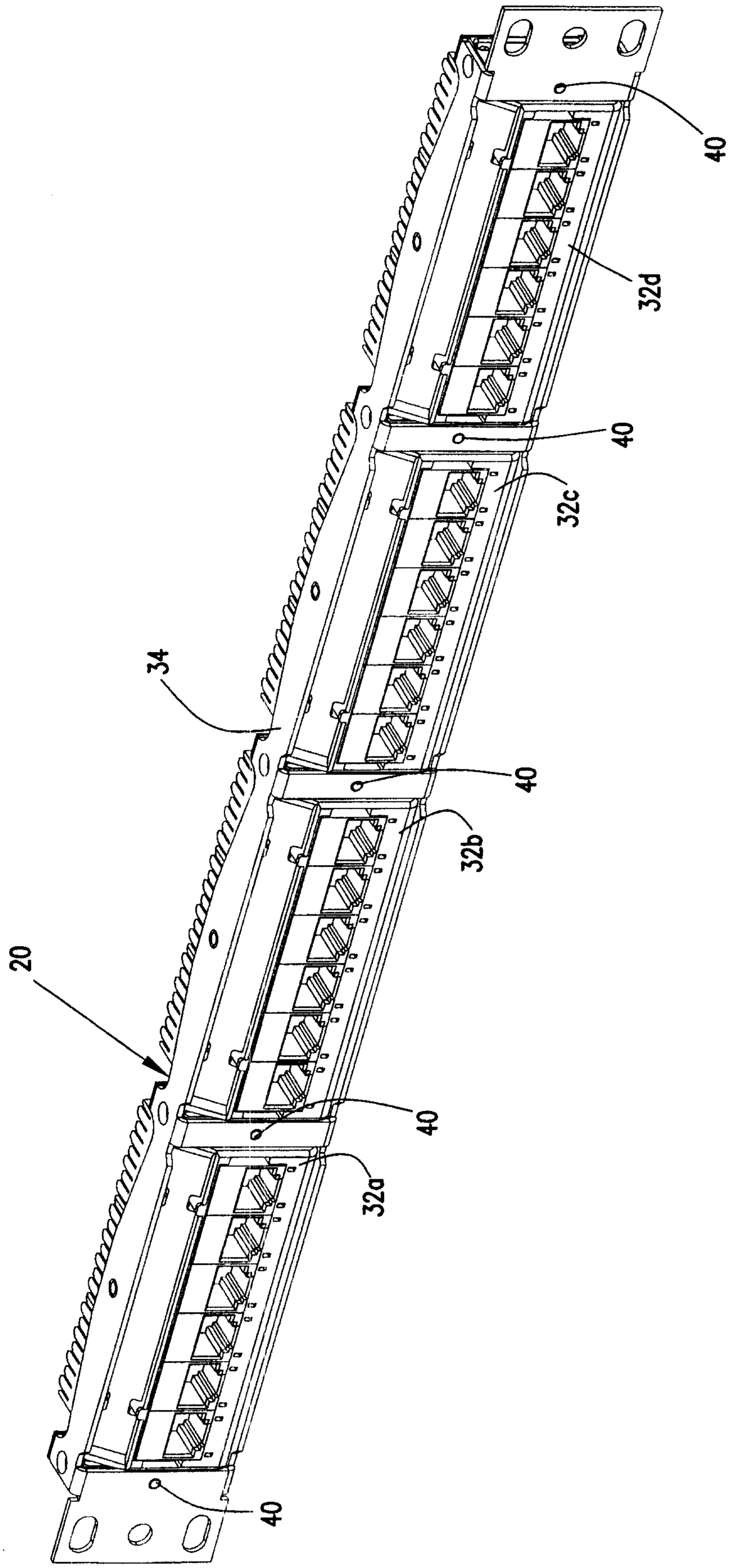


FIG. 3

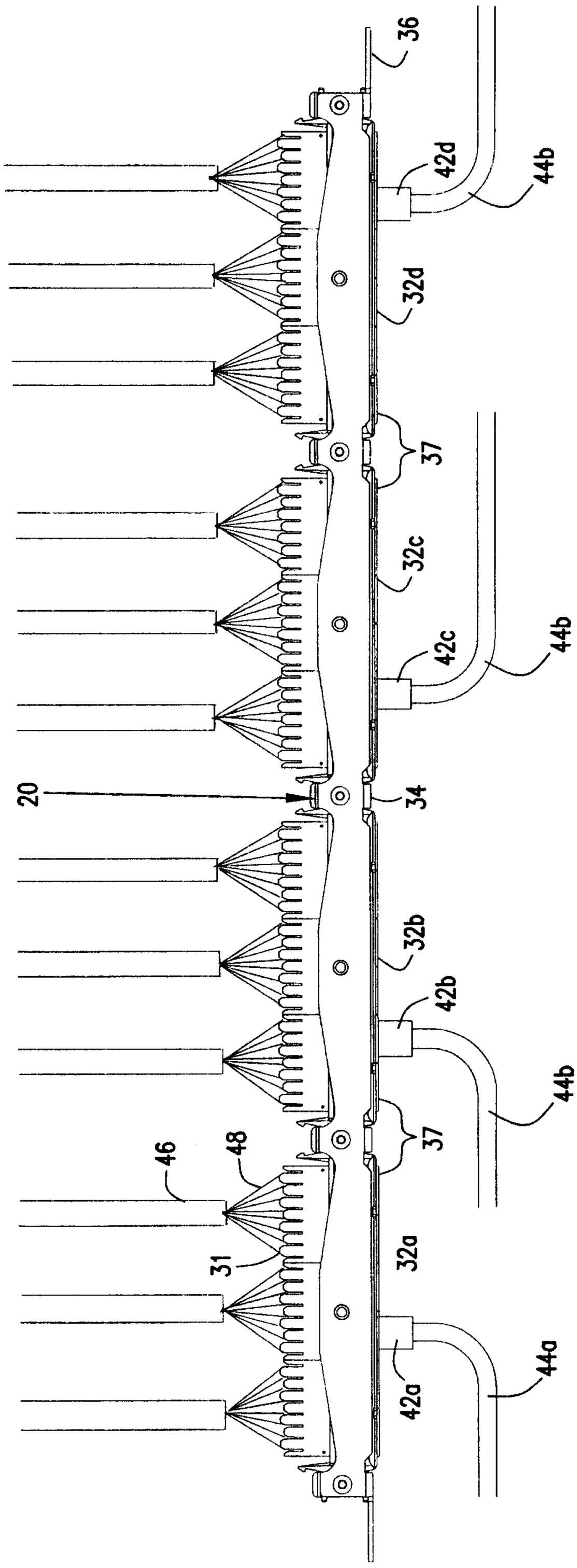

36
42d
44b
32d
37
32c
42c
44b
20
34
32b
42b
44b
46
48
37
31
32a
42a
44a

FIG. 4

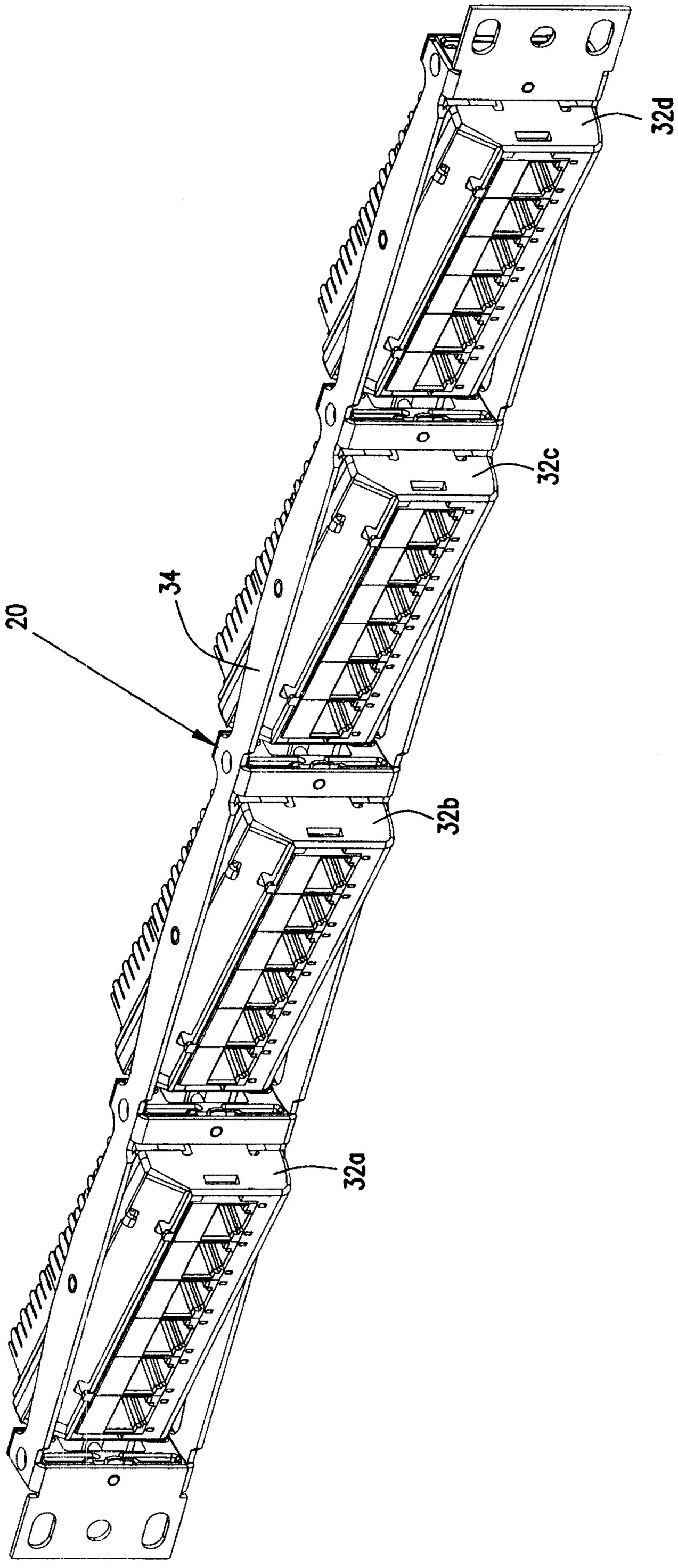


FIG. 5

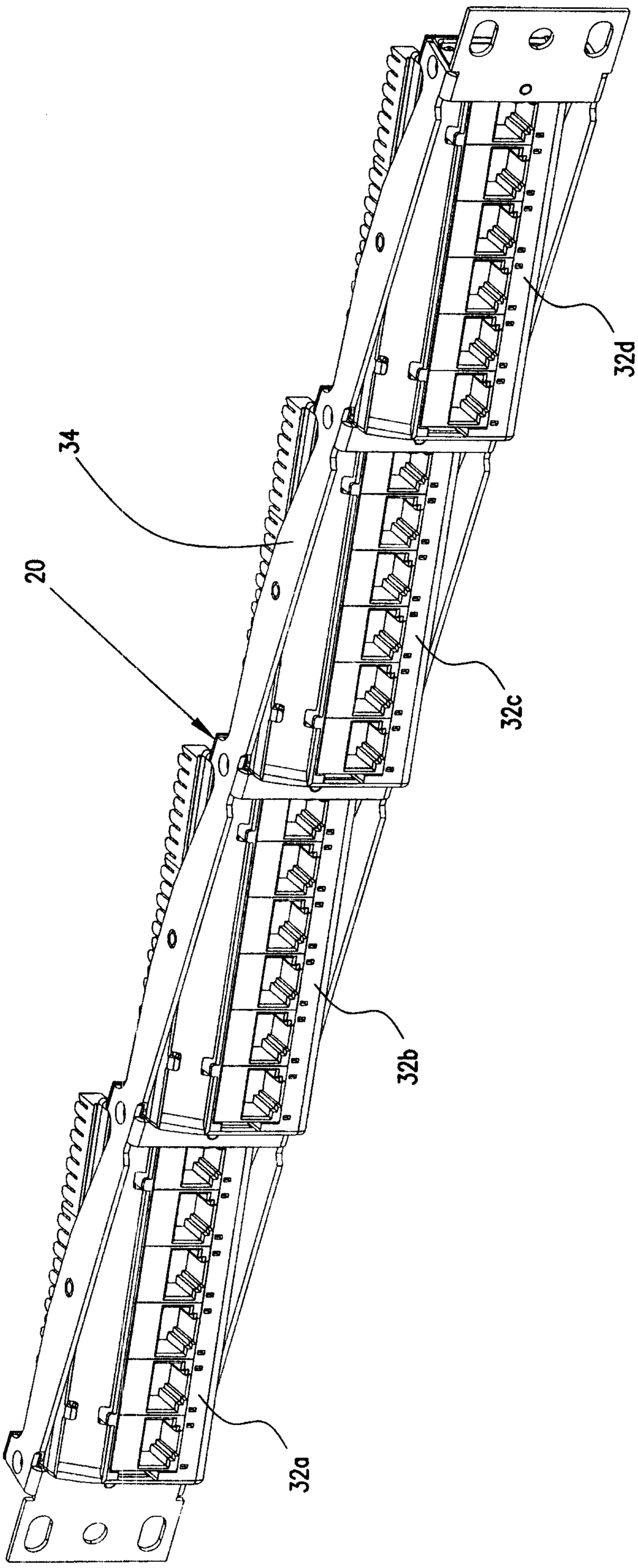


FIG. 6

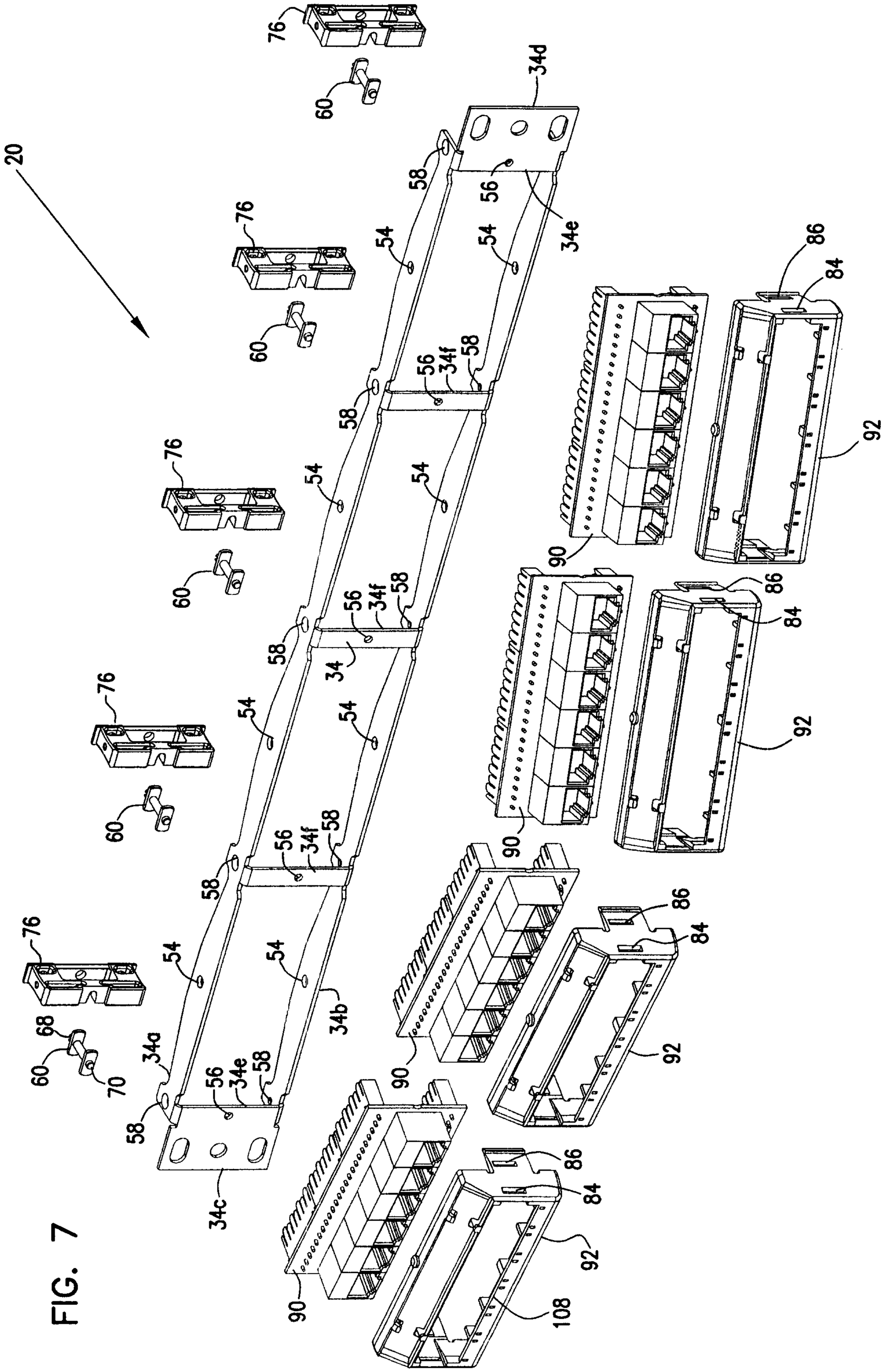


FIG. 7

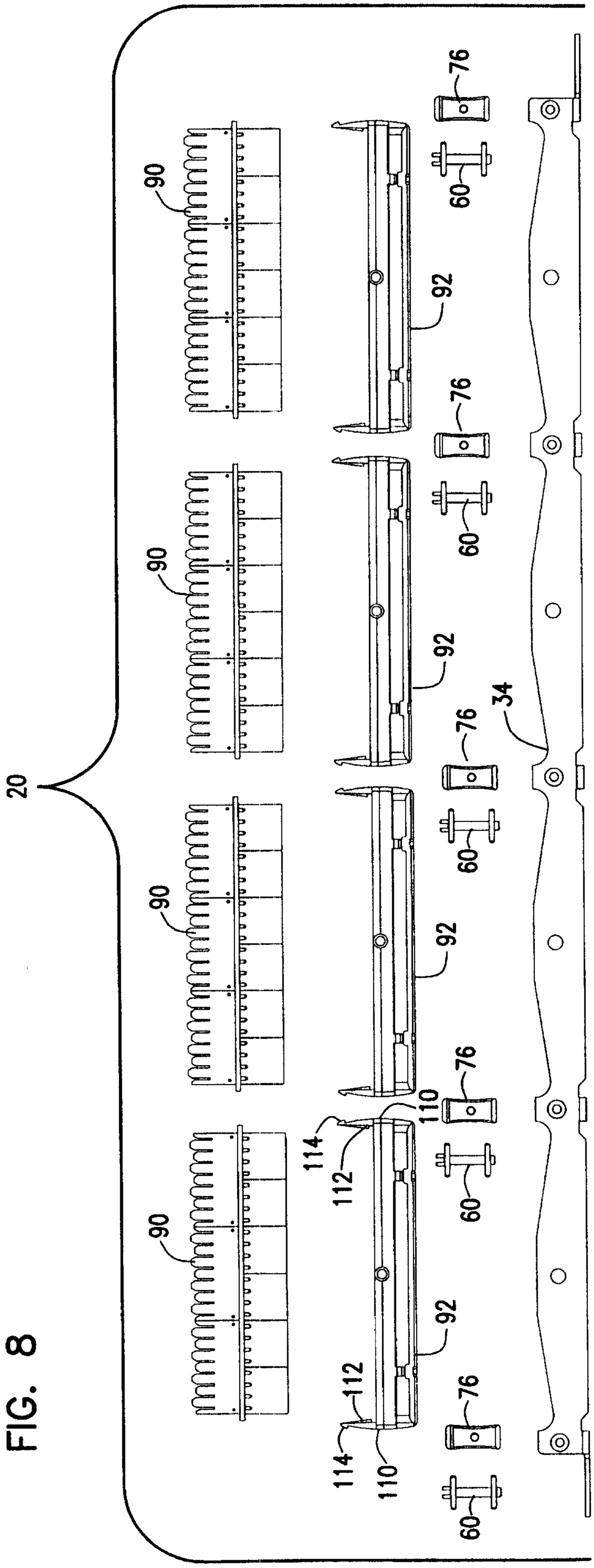


FIG. 8

FIG. 9

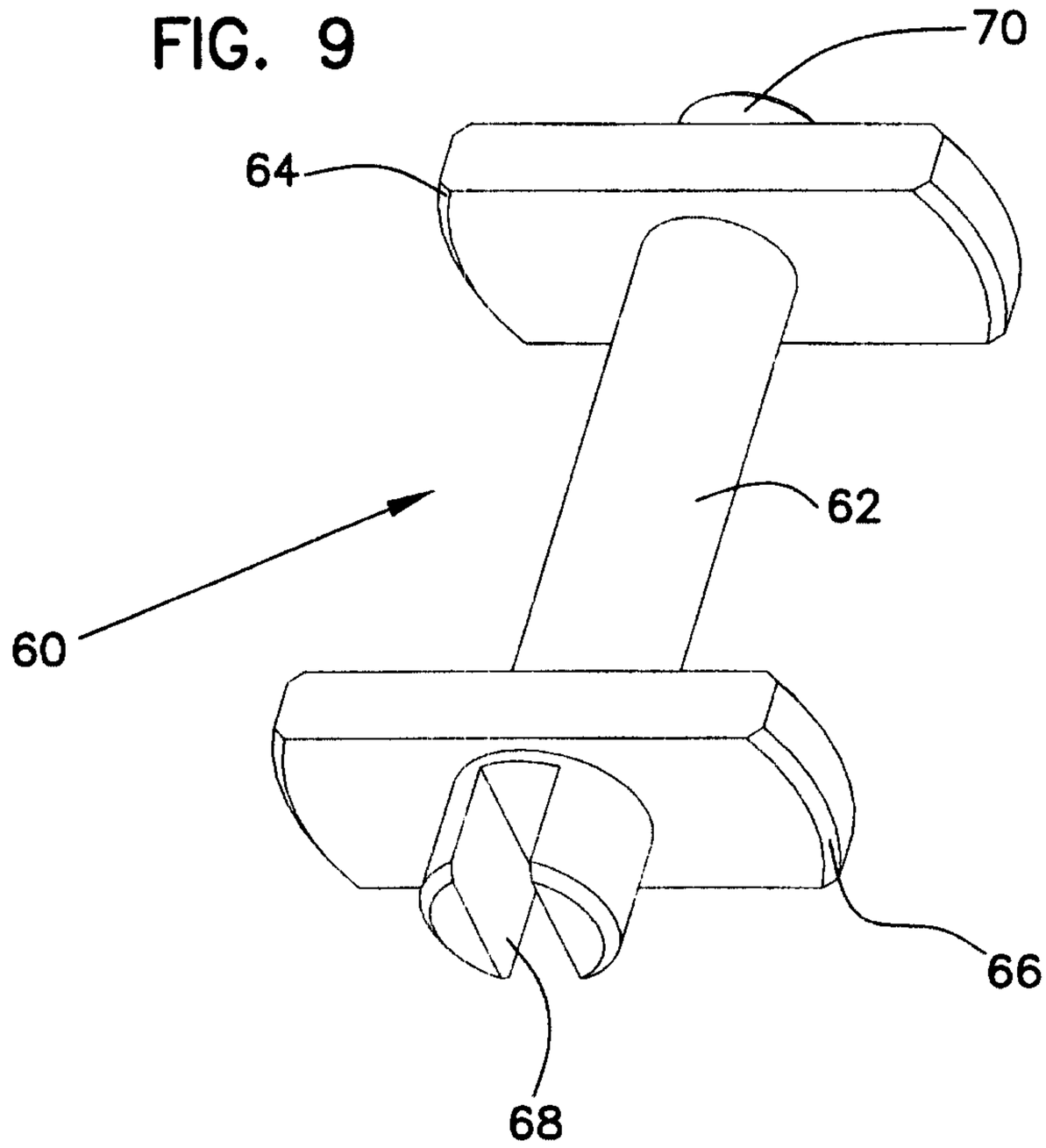


FIG. 10

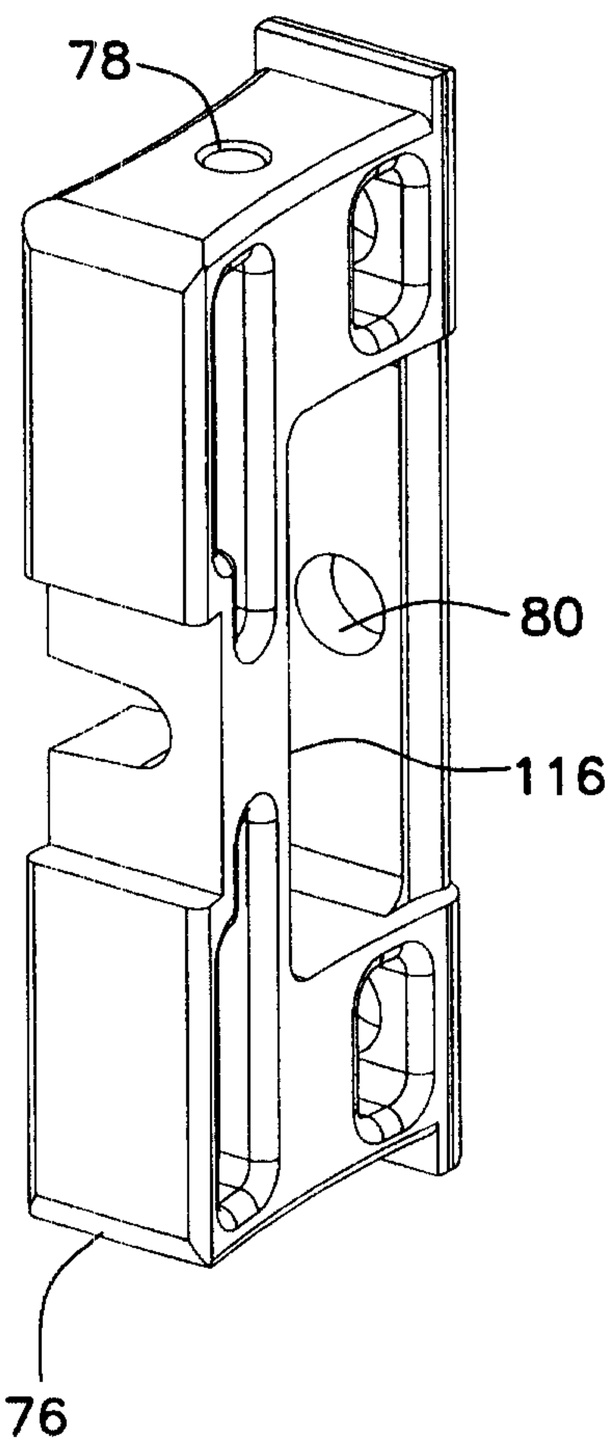


FIG. 11

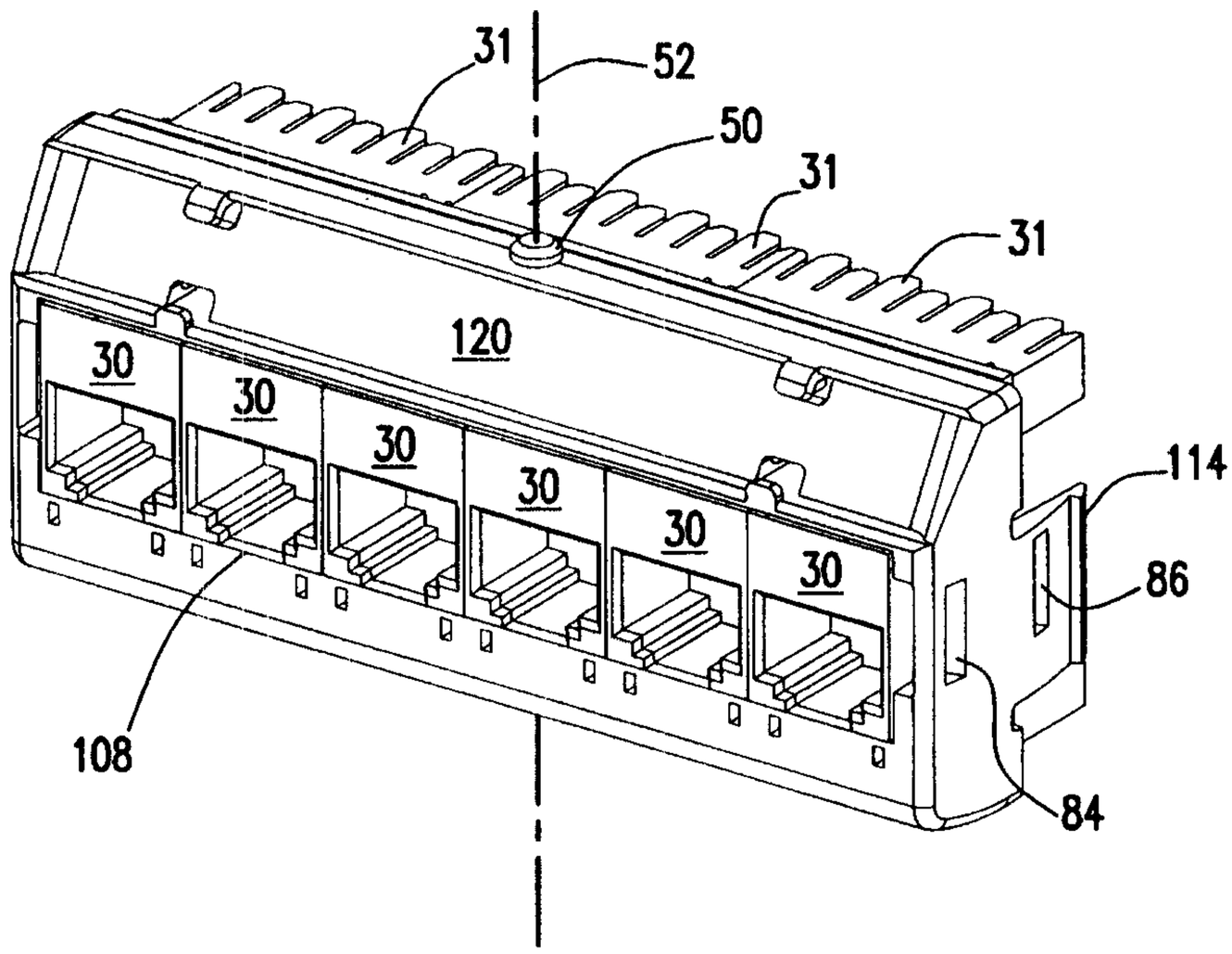


FIG. 12

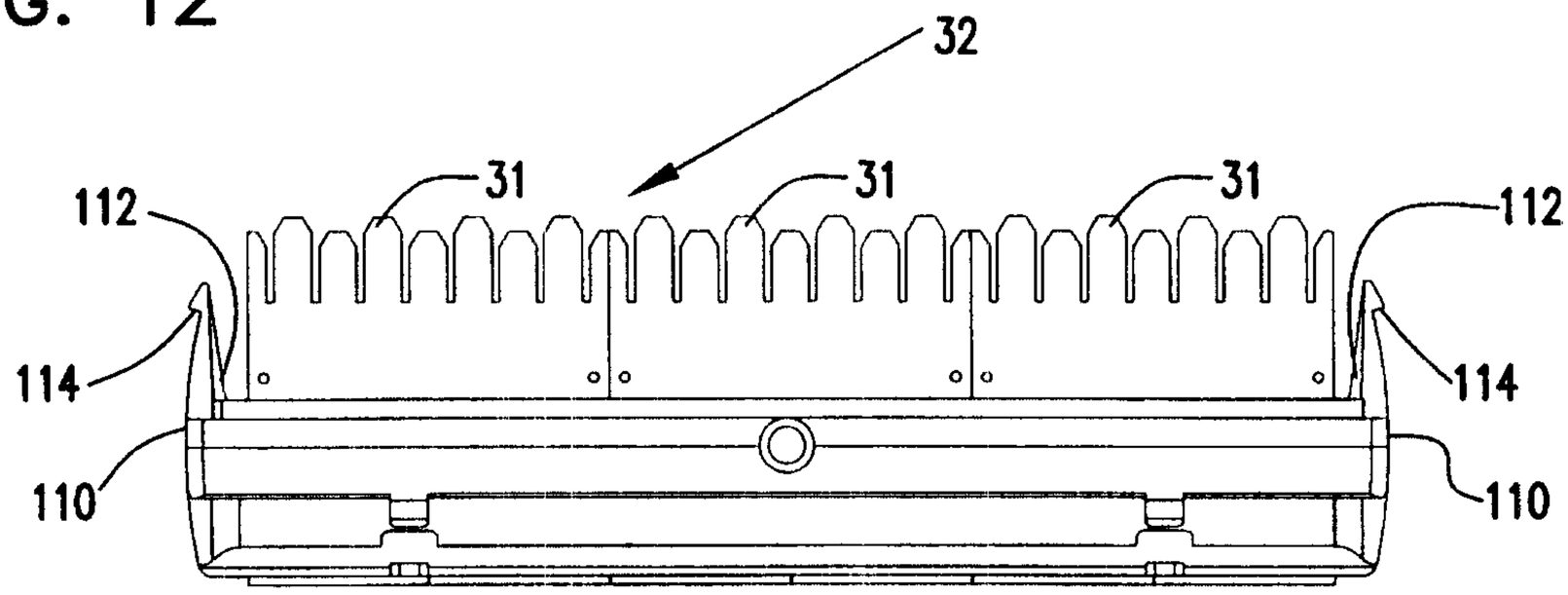


FIG. 13

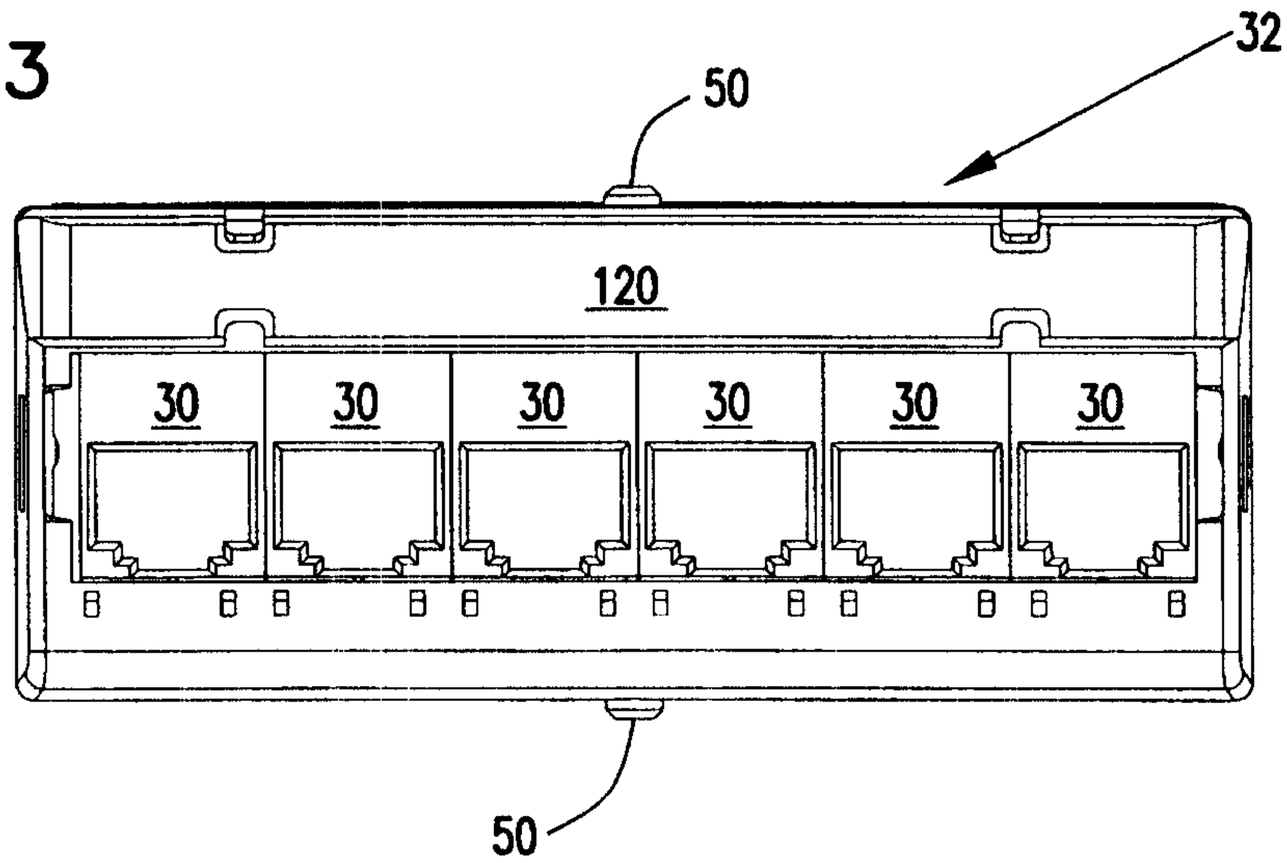


FIG. 14

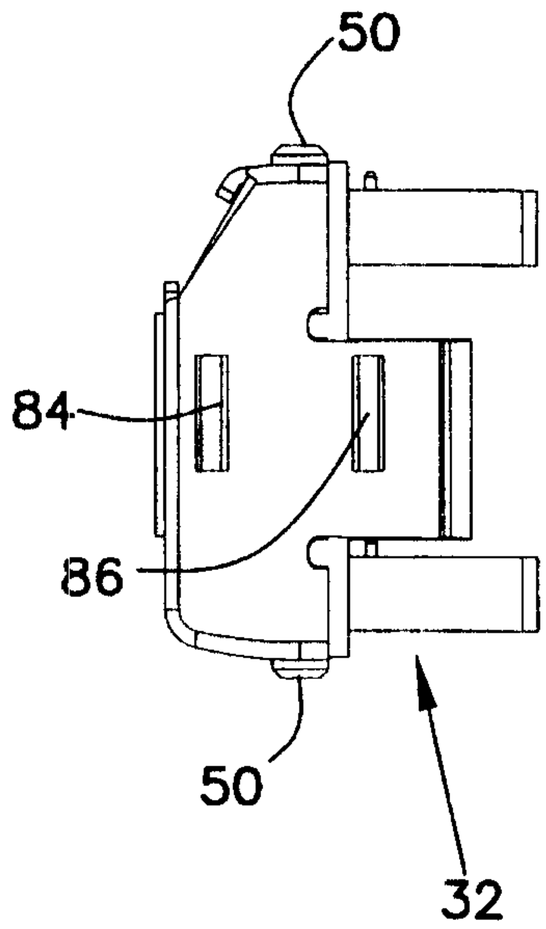


FIG. 15

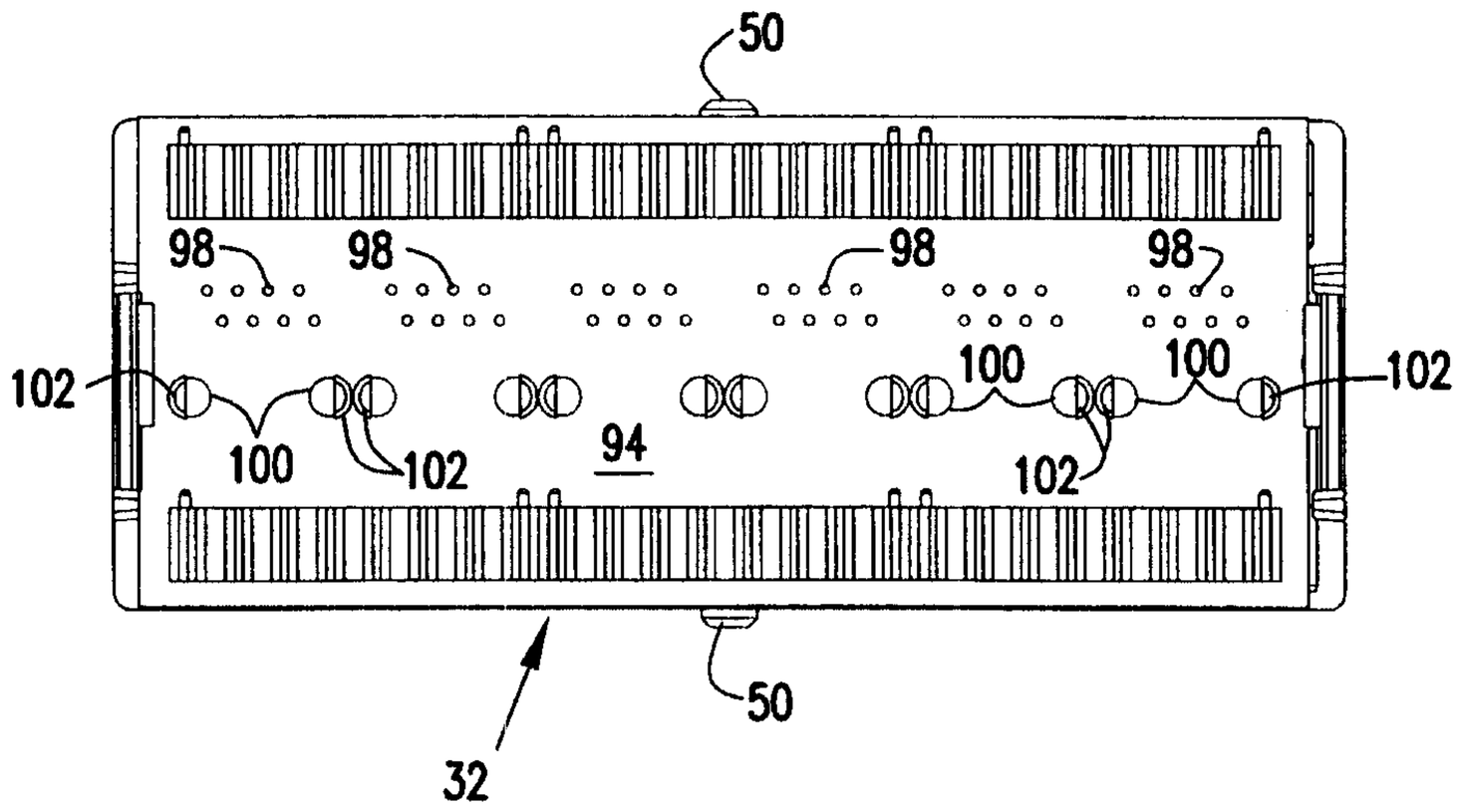


FIG. 16

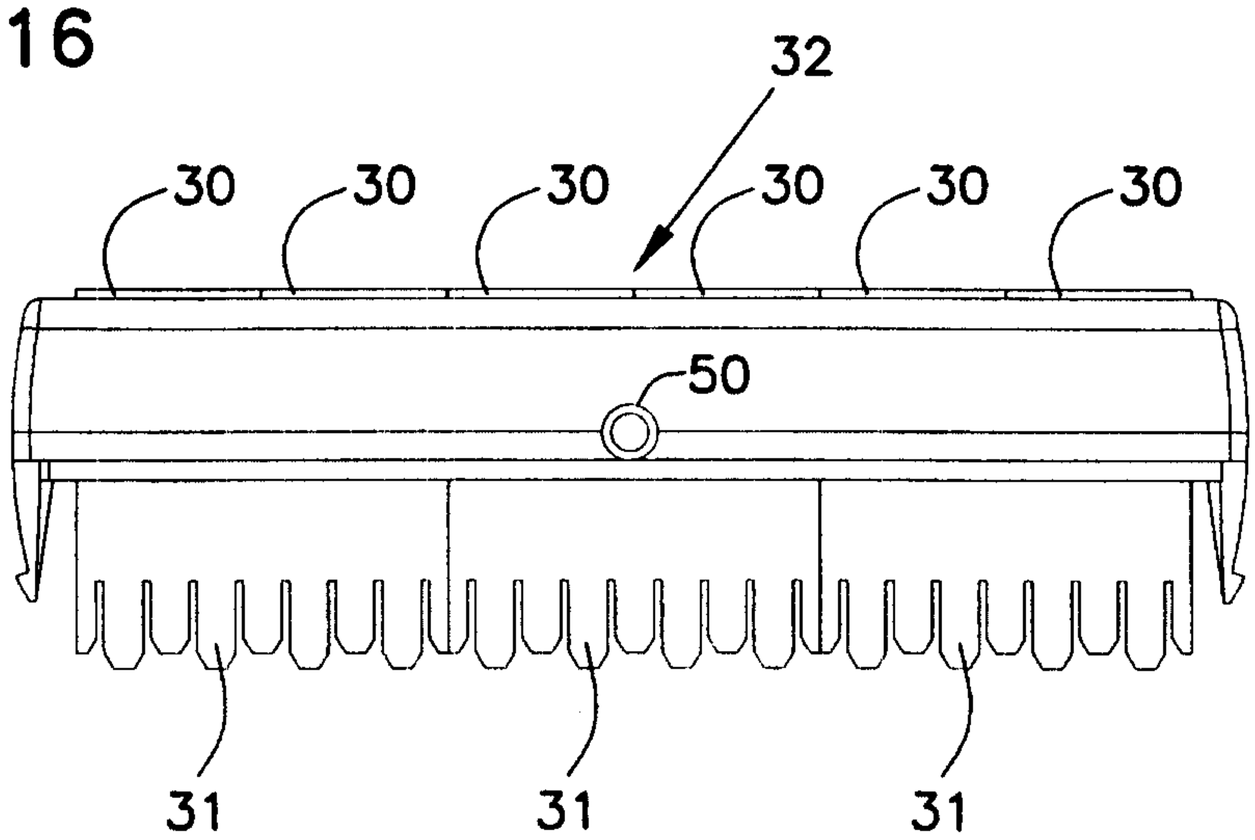
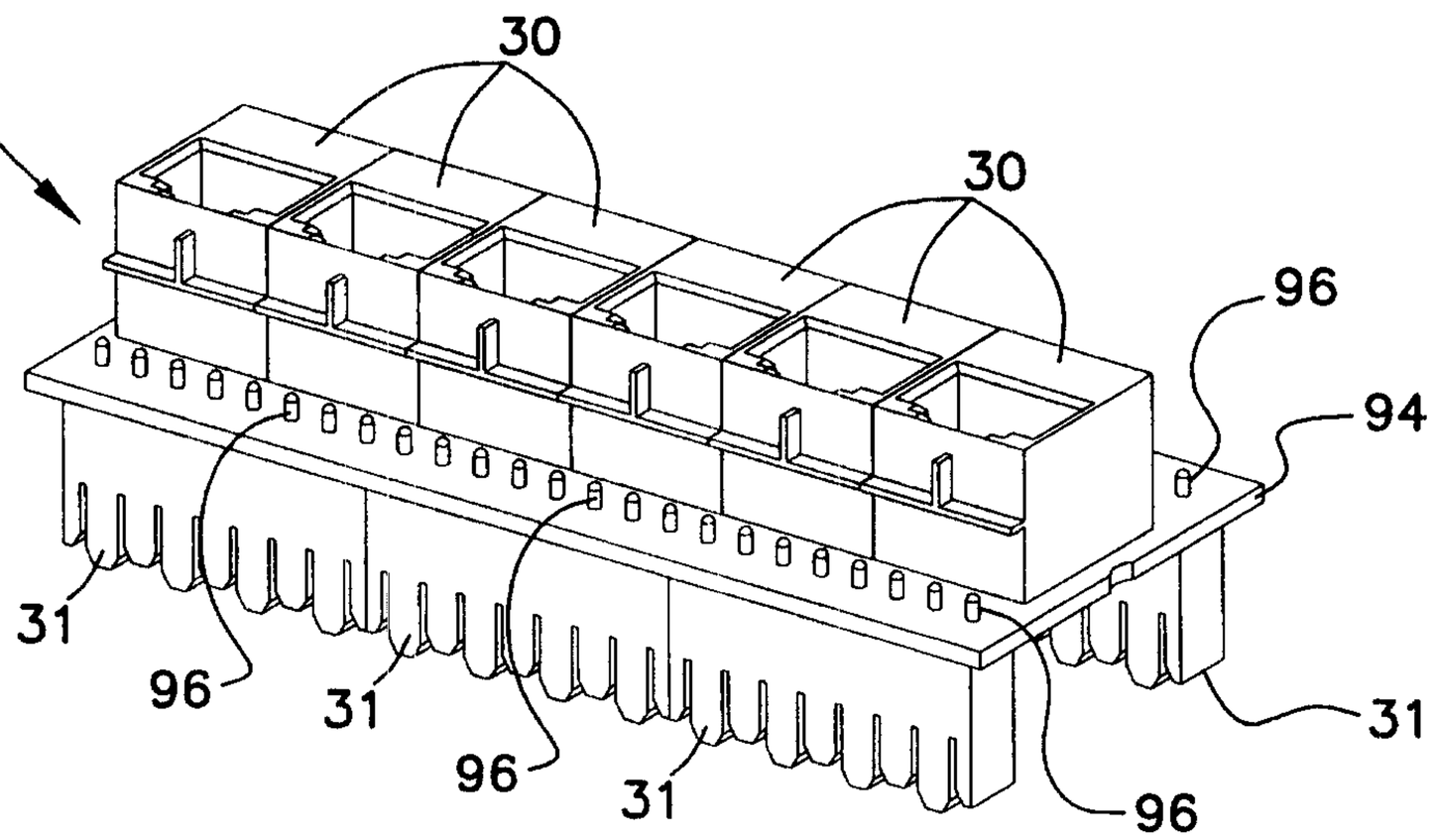
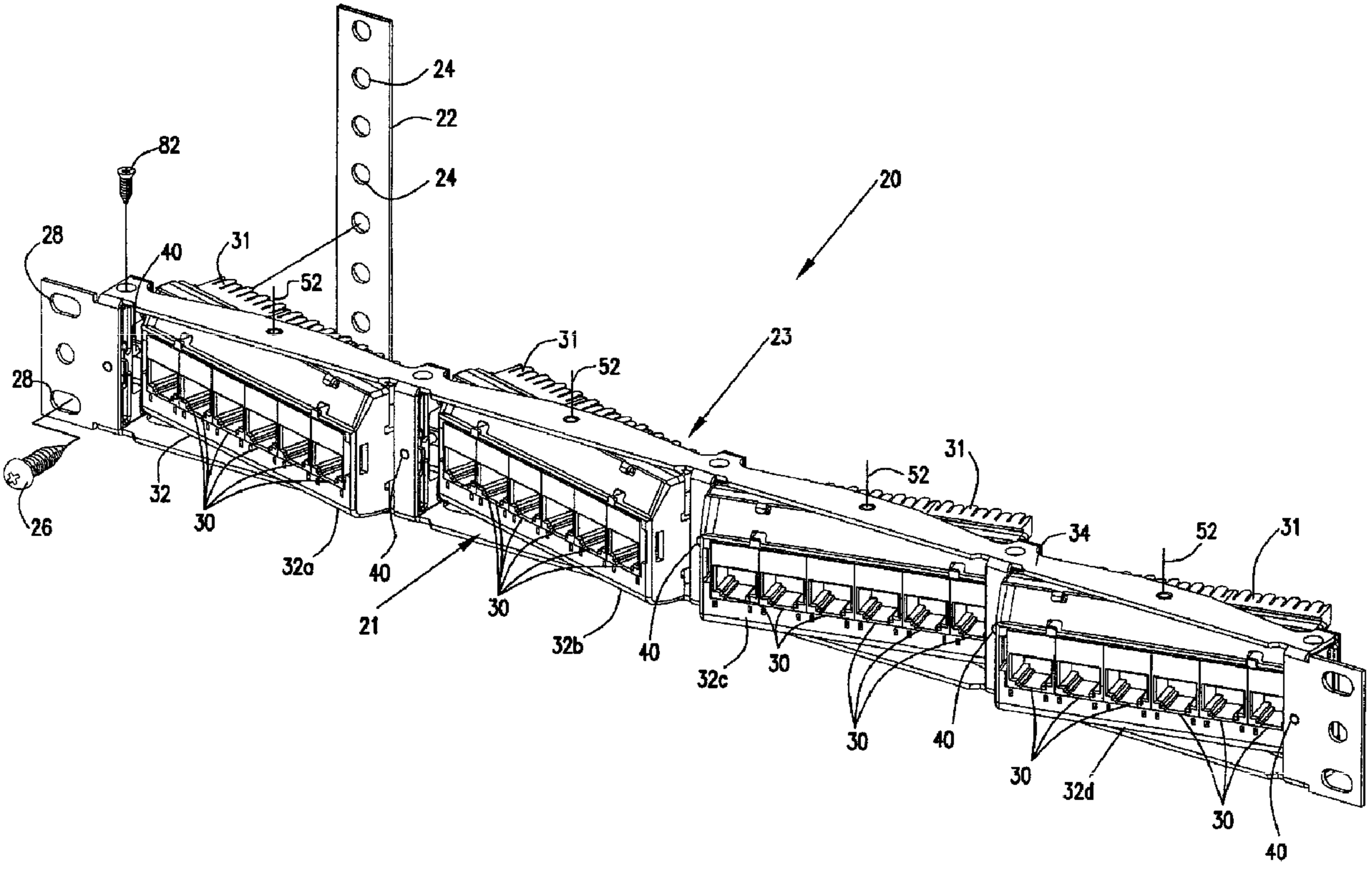


FIG. 17




24
22
24
82
28
40
31
52
20
23
31
52
28
31
52
34
52
31
32
30
32a
40
21
30
32b
40
32c
30
30
40
30
32d
30
40
26