

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 889 556 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.01.1999 Bulletin 1999/01

(51) Int Cl.⁶: **H01R 13/74, H01R 9/24**

(21) Application number: **98305026.1**

(22) Date of filing: **25.06.1998**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **30.06.1997 US 51351 P**

(71) Applicant: **THE WHITAKER CORPORATION**
Wilmington, Delaware 19808 (US)

(72) Inventors:
• **Douty, George H.**
Mifflintown, Pennsylvania 17059 (US)
• **Landis, John M.**
Camp Hill, Pennsylvania 17011 (US)
• **Snyder Jr., Clair W.**
York, Pennsylvania 17406 (US)

(74) Representative: **Johnstone, Douglas Ian et al**
Baron & Warren,
18 South End
Kensington, London W8 5BU (GB)

(54) Panel mountable terminal block

(57) Terminal block (10) mountable without fasteners in a panel cutout (152) such as a power port of an appliance, with a cable strain relief clamp (58) and an array of termination sites (20) for interconnection of terminals (188) of cable conductors (190) with terminals (86) of internal wire conductors (186). The terminal block includes a body (12) of insulating material with tabs (34) adapted to engage notches (162) in edges of the cutout (152). As the body (12) is slid sideways, ears (50) on the body (12) engage one side of the cutout (152) and embossments (48) snap into engagement with cutouts (152) on an opposite side thereof. Terminals (86) of conductors (186) are removably fixable to the housing at said termination sites (20). Bosses hold each terminal (86) of a conductor (186) against a support surface with a nut captured in a wall portion below the terminal (86).

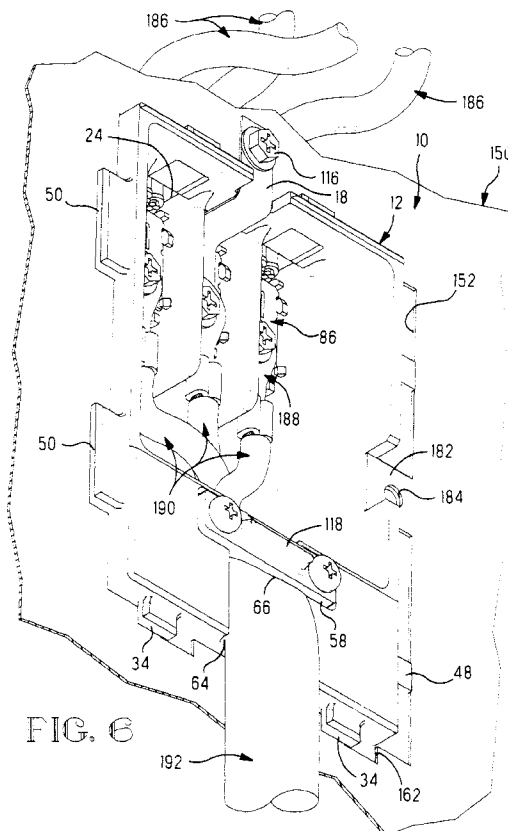


FIG. 6

EP 0 889 556 A2

Description

The present invention relates to the field of electrical connectors and more particularly to terminal blocks.

Terminal blocks are known that provide for the electrical interconnection of conductors for power transmission, where each conductor has been terminated by a discrete terminal. The insulative block provides discrete interconnection positions with insulative barrier walls therebetween for assured isolation. Conductive fasteners are used to thread into the block at each side to compressively secure the conductor-terminating terminals to each other. Other fasteners are utilized to mount the block to a surface such as in an appliance onto a frame or a frame-mounted bracket.

In one terminal block product sold by AMP Incorporated, Harrisburg, PA as an Appliance Connector having Part No. 520942-2, one of the conductor-terminating terminals is adapted to be seated in the insulative block such that only one conductive fastener is necessary, used with a nut captured beneath the interconnection terminal. The seated terminal is held immobilized in position during attachment and removal of the fastener, simplifying assembly.

In an appliance such as a clothes dryer, it is known to interconnect external power cable conductors to internal power conductor wires using a terminal block mounted to a bracket that in turn is mounted to the appliance housing at an opening or cutout therethrough, using the housing as a chassis ground. The opening or cutout is relatively large to permit manual access to the block to permit tool-assisted connection, removal and reconnection of cables for installation or for service and repair, and the block is set inwardly from the opening so that all portions thereof are inset to permit securing a first safety cover over a first portion of the cutout. A second cover for the remaining portion includes a clamp for cable strain relief and is offset from the first portion of the cutout, with the cable clamp holding the cable while the terminals on the conductors thereof are being interconnected at the terminal block. The relatively large opening is known to undesirably permit fasteners and even tools to fall within the appliance housing, with great difficulty needed to retrieve them.

It is desired to provide a terminal block that minimizes the number of components necessary to provide the interconnection and mount the block and a cutout covering to the appliance housing, and to simplify assembly, installation and servicing, and enhance safety.

The terminal block of the present invention provides for interconnection of the conductors of a power cable with respective wires within the appliance at respective termination sites, by interconnecting first terminals on the internal wires with second terminals of the cable conductors. An insulative body is securable within the panel cutout, securing itself directly to the panel and eliminating the need for any mounting accessories and greatly simplifying installation. A cable clamp is securable to the

insulative body about the cable jacket, and a cutout safety cover is mountable to the appliance housing over the terminal block and in assured ground engagement with the housing. The terminal block can be installed onto lengths of the internal wiring forming a cable harness unit that is easily installed into the housing with minimal effort.

Preferably, the insulative body includes a skirt that closes off the interior of the appliance at the cutout. Each termination site providing for seating of a first terminal and thereafter enabling the associated second terminal to be electrically interconnected thereto by a fastener extending through aligned apertures of both, and threaded into a nut seated beneath the first terminal. A ground terminal connected to a ground cable conductor, is mounted on the terminal block and is adapted to be grounded to the appliance housing for chassis ground.

Embodiments of the terminal block will now be described by way of example with reference to the accompanying drawings, in which:

FIGURE 1 is a front isometric view of the terminal block mounted in a panel cutout, in a vertical orientation;

FIGURE 2 is a rear isometric view of the terminal block of FIG. 1;

FIGURE 3 is an isometric view showing the terminal block and a cover exploded from the panel cutout, with a cable clamp, ground strap, and a first terminal and their fasteners exploded from the terminal block;

FIGURES 4 and 5 are enlarged isometric view of a termination site, with a first terminal exploded from the termination site in FIG. 4, and seated therein to be interconnected to a second terminal in FIG. 5;

FIGURE 6 is an isometric view of the terminal block with a cable clamped thereto, with the cable's conductors interconnected to respective internal wires at the termination sites of FIGS. 4 and 5; and

FIGURES 7 and 8 show another arrangement for defining a chassis ground connection, with FIG. 7 being an isometric view of a ground contact, and FIG. 8 being a plan view of the ground contact mounted in a terminal block that is mounted on a panel.

FIG. 1 illustrates terminal block 10 mounted in a cutout 152 of a panel 150 that may be, for example, the housing of an appliance, and that is conductive. Terminal block 10 includes an insulative body 12 that defines a cable clamping region 14, a panel-mounting periphery 16, a ground contact 18 positioned at periphery 16, a termination region having an array of termination sites 20, and a skirt 22 extending between termination sites 20 and cable clamping region 14. Grounding hole 154 (FIG. 3) permits a screw 116 to interconnect ground strap 18 to the panel for chassis ground. Termination sites 20 are located adjacent to end wall 26 and wire

exits 24 through insulative body 12 are located adjacent each termination site 20. Termination sites 20 are recessed rearwardly from the periphery 16 to define a clearance region 28 bounded by side walls 30 and skirt 22. Three termination sites are shown, to accommodate a power cable having three conductors. As best discerned in FIG. 2, insulative body 12 provides an essentially continuous insulative wall extending within panel-mounting periphery 16.

In FIG. 3 can be seen cutout 152 having opposed upper and lower peripheral edges 156,158 including pairs of notches 160,162 therealong, and opposed side peripheral edges 164,166. Opposed pairs of tabs 32,34 of upper and lower edge portions 36,38 of panel-mounting periphery 16 are associated with notches 160,162 and dimensioned to pass therethrough when terminal block 10 is being mounted in cutout 152. Ledges 40,42 of upper and lower housing sides 36,38 are offset rearwardly of tabs 32,24 and extend outwardly farther than the tabs, defining a transverse panel-receiving gap therebetween, and upper and lower peripheral edges 156,158 of the panel will be received against the ledges during the initial stage of mounting. Subsequently, terminal block 10 is translated laterally within the cutout so that tabs 32,34 are moved laterally of notches 160,162 and are now forwardly of notch-adjacent portions of upper and lower peripheral cutout edges 156,158. A locking section along said third side cooperates with side edge 164 to lock the housing in its translated or fully mounted position when the housing is moved toward said fourth side edge. As shown, the locking section comprises a pair of spaced apart integral springs 44 along a third housing side 46 of peripheral portion 16 snap forwardly within the cutout adjacent to side edge 164 of cutout 152 for embossments 48 to pass through the cutout to either side of mounting flange 182 and secure the terminal block in the translated or fully mounted position. Ears 50 along fourth housing side 52 of peripheral portion 16 are now disposed forwardly of side edge 166 of cutout 152 while ledge 54 offset from ears 50 and defining a panel-receiving gap therebetween, is disposed rearwardly of side edge 166.

The terminal block is now securely held in panel cutout 152 by ledges 40,42,54 rearwardly of the panel, tabs 32,34 and ears 50 forwardly thereof, and embossments 44 protruding through the cutout to maintain the translated terminal block position. Additionally, it is preferred that spring arms 56 be biased against inwardly facing surfaces of upper and lower cutout edges 156,158 to eliminate noise from vibration. It is also preferred that the cutout and terminal block be polarized to assure panel mounting in only a single desirable orientation, and this is easily accomplished by asymmetric positioning of notches 160,162 and tabs 32,34 as shown, with the exiting cable to extend vertically downwardly.

Strain relief clamp 58 is securable to cable exit region 14 of insulative body 12 by fasteners 60, and is received into pocket 62 astride cable exit 64. Cable clamp-

ing surface 66 will compress the outer jacket of the cable (see FIG. 6) upon mounting, as the jacketed end of the cable extends outwardly from cable exit 64. Cover 168 is mountable atop terminal block 10 to close off clearance region 28. Cover 168 is shown to include a pair of footed tabs 170 along edge 172 that extend past side edge 166 of panel 100 and are inserted through slots 68 through ledge 54 of insulative body 12 so that transverse feet 174 will hook under ledge 54 when cover 168 is secured by fastener 176 to the terminal block. Inwardly offset tab 178 contains mounting hole 180 for fastener 176 that aligns with hole 184 through mounting tab 182 extending from panel edge 164. Mounting tab 182 is seated within seat 70 along side 46 of insulative body 12, and cover tab 178 is also received into seat 70, and fastener 176 threads into hole 184 of the panel, with hole 72 of the terminal block providing clearance for the fastener end. It can be seen that after installation of the cover, its fastener 176 will serve as a secondary securing feature and prevent terminal block 10 from inadvertently shifting laterally and become dislodged from the panel, by abutting panel edge 164. The cover thus is mounted directly to the panel.

Optionally, the terminal block could provide for the cover to be mounted in a reversed orientation to that shown, and fastened directly to the panel spaced from edge 166 eliminating the need for a panel mounting flange, with tab receiving slots provided along side 46 of the terminal block, and also enabling a single spring similar to springs 44 to be utilized if desired.

Each termination site 20, best seen in FIGS. 4 and 5, is located between side walls 74 and includes a well portion 76 within which is received a nut 78 with a threaded hole 80, and a seat portion 82 within which is received the plate-like contact section 84 of a first or wire terminal 86 that has been terminated at a connecting section 88 to a respective internal wire 186. Contact section 84 includes an aperture 90 through which will extend a conductive fastener such as screw 92, and which is aligned with threaded hole 80 of nut 78 upon terminal seating in seat portion 82. Back wall 94 of well portion 76 and the side walls thereof define forwardly facing support surfaces 96.

Pairs of first and second bosses 98,100 on side walls 74 at seat portion 82 form rearwardly facing surfaces 104 offset forwardly from support surfaces 96. Stops 106 are located proximate wire exits 24. After assembly, side edge portions 108 of contact section 84 of first terminal 86 are disposed between support surfaces 96 and first and second bosses 98,100. The terminal is assembled into termination site 20 by first being inserted through wire exit 24 and pulled forwardly of the termination site. The terminal is then aligned with the space between the support surfaces 96 and bosses 98,100 and urged rearwardly into seat portion 82 until downwardly directed lance 112 passes over and latches behind back wall 94. Such initial assembly of the terminal into seat portion 82 can be accomplished even with screw 92 and

nut 78 assembled thereto. Removal of the terminal for service and repair is easily accomplished by deflecting of lance 112 with a tool, and pulling the terminal forwardly. During connecting of the second or cable conductor terminals 188 terminated to cable conductors 190 of cable 192, when screw 92 is removed, well portion 76 includes front stops 114 that serve to retain nut 78 in well portion 76.

In FIG. 5, cable conductor or second terminal 188 can be seen to include a ring tongue contact section 194 with a hole 196 therethrough, through which screw 92 is inserted when hole 196 is aligned with hole 90 of first terminal 86 crimped to internal wire 186, and also hole 80 of nut 78, after which screw 92 is threaded into nut 78 until the flange of screw 92 is pressed against terminal 188 to generate compression of the terminals against each other. Second terminals 188 may be Ring Tongue terminals such as Part No. 485015-1, or may also be spade terminals such as Part No. 63526-1, both sold by AMP Incorporated.

FIG. 6 shows conductors 190 of power cable 192 completely interconnected to internal wires 186, and terminal block 10 has been mounted onto panel 150. Cable 192 extends through cable exit 64 and has been clamped therein by cable clamp 58. Ground strap 18, at the middle termination site, has been grounded to panel 150 by screw 116 and preferably includes rugged sharp teeth (not shown) defined on its panel-adjacent surface to bite through paint or corrosion layers on the panel to establish an assured ground connection. Cable clamp 58 is seen to include an outwardly extending rib 118, and by inverting the cable clamp, the clamp may easily be used for clamping against a flat power cable.

Preferably, the insulative body is molded of a thermoplastic resin such as of polybutylene terephthalate (PBTP), for ruggedness and heat resistance, such as VALOX 420 SEO sold by General Electric. The terminals may be of tinned No. 2 brass, for carrying a current of 30 amperes at 250 VAC maximum, and may be Power Ring Terminals sold by AMP Incorporated as Part No. 520944-1, as shown. Optionally, the terminal block could be modified to permit a second cover fastenable to the panel, that includes a conventional cable clamp; a cable exit wall adjacent the second cover location could provide discrete cable exit openings for the individual conductors of the cable.

FIGS. 7 and 8 illustrate an alternative chassis grounding arrangement for the terminal block. Block 200 is seen to include an insulative body 202 and a ground contact 204 that is connectable with a screw 206 to a terminal 208 of a ground conductor of a four-wire cable (not shown), at a termination site 210 using a nut as with the interconnections of FIGS. 1 to 6. Ground contact 204 includes a plate contact section 212 with a screw-receiving hole 214, a vertical body section 216 to extend forwardly to peripheral portion 218 of insulative body 202, and a panel-engaging socket contact section 220. Vertical body section 216 is disposed adjacent side wall 222

of block 200, and includes a locking lance 224 to seat in a recess along side wall 222 and lock beneath a ledge (not shown) to secure the ground contact against movement after being inserted into the termination site.

Panel-engaging socket contact section 220 extends transversely through a recess 228 in side wall 222 of block 200 at a level below ears 230, defining a panel-receiving mouth 232 between spring arms 234 along inside surfaces of which are defined stiff, rugged sharp teeth or tines 236. Optionally, an aperture (not shown) through side wall 222 could be provided rearwardly from an ear 230 through which the socket contact section would extend to engage the panel edge, so that ear 230 would physically protect socket contact section 220 from damage during handling, mounting, and servicing. As block 200 is moved transversely during panel mounting, edge 238 of panel 240 is receiving into mouth 232, forcing spring arms 234 apart. The sharp teeth scrape the opposed surfaces of the panel to break through any paint or corrosion layers and thereby establish an assured ground connection between ground contact 202 and panel 240. Ground contact 202 is also seen to include a blade contact section 242 extending forwardly from termination site 210; blade contact section 242 is utilized to be connected to a jumper (not shown) that commons a neutral conductor (not shown) of the cable, and that it is disconnectable from the neutral line for testing.

Modifications and variations may be made to the specific examples disclosed herein, that are within the scope of the claims.

Claims

1. A terminal block (10) mountable at a panel cutout (152), of the type having an insulative housing (12) adapted to be securable to a panel (150) defining said panel cutout (152), said housing (12) including a termination region containing at least one termination site (20) containing a first terminal (86) of said terminal block, characterized in that:

said first terminal (86) is seatable in said at least one termination site (20), and said termination site thereafter enabling a second terminal (188) to be electrically interconnected to said first terminal (86), for interconnecting a first conductor (186) terminated to said first terminal (86) to a second conductor (190) terminated to said second terminal (188).

2. The terminal block (10) as set forth in claim 1 further characterized in that said housing (12) includes a ground terminal (18,204) secured thereto adapted to be grounded to an external ground upon said housing being secured in said panel cutout (152).

3. The terminal block (10) as set forth in claim 1 or 2 further characterized in that said housing (12) includes a clearance region (28) adjacent said termination region, said housing (12) includes a skirt (22) adjacent said clearance region to close off said panel cutout, and said skirt includes a cable clamp (58) adjacent said clearance region and a cable exit channel (64) extending from said cable clamp at an angle from said clearance region to a lower housing side (38) at a level coplanar with said panel (150) after said housing is mounted thereto in said cutout. 5
4. The terminal block (10) as set forth in claim 1, 2 or 3 further characterized in that said termination site (20) includes a fastener (92) for affixing said second terminal (188) to said first terminal (86) at the or each said termination site in electrical interconnection with said first terminal. 10
5. The terminal block (10) as set forth in any preceding claim further characterized in that each said termination site (20) is located adjacent and aligned with an opening (24) through an end wall (36) of said housing (12) defining a wire exit through which extends said first conductor (186), said first terminal (86) is adapted to be inserted through said wire exit (24), and each said first terminal includes a plate-like contact section (84) to be disposed along a seat (82) of a respective said termination site (20) and against a planar surface thereof. 15
6. The terminal block (10) as set forth in claim 5 further characterized in that each said termination site (20) includes an inwardly facing stop (106) adjacent said wire exit (24), an outwardly facing stop (94) spaced inwardly from said inwardly facing stop (106), and at least one pair of bosses (98, 100) along opposed side walls (74) of said termination site and spaced above said seat (82), and said plate-like contact section (84) of said first terminal (86) includes side portions that are disposed between said pair of bosses (98, 100) and said seat (82) to secure said contact section adjacent said seat, and said first terminal further includes a lance (112) that latches behind said outwardly facing stop (94) upon said first terminal (86) being moved toward said end wall (36) from within said housing (12) after insertion through said wire exit (24), until said first terminal abuts against said inwardly facing stop (106). 20
7. The terminal block (10) as set forth in any preceding claim further characterized in that said housing (12) includes upper and lower sides (36, 38) and opposed third and fourth sides (46, 52), said third and fourth sides (46, 52) are less wide than a width of said panel cutout (152), said upper and lower housing sides (36, 38) each include ledges (40, 42) offset from opposed pairs of tabs (32, 34) to define a transverse panel-receiving gap therebetween, with said pairs of tabs (32, 34) being associated with notches (160, 162) along corresponding upper and lower edge portions (156, 158) of said panel cutout (152) to pass through said notches (156, 158) during assembly of said housing (12) to said panel (150) and with said ledges (40, 42) extending outwardly sufficiently to coextend along said panel adjacent said cutout (152), said fourth housing side (52) includes ears (50) extending outwardly and coplanar with said tabs (32, 34) to extend along a fourth side edge (166) of said cutout after insertion of said housing through said cutout during assembly, and said third housing side (52) including a locking section (44, 48) to lockingly cooperate with an adjacent third side edge (164) of said cutout after insertion of said housing through said cutout and translation of said housing (12) toward said fourth side edge (166) of said cutout, and said third housing side (46) further including a ledge (42) extending outwardly sufficiently to close off said cutout (152) after said housing is translated toward said fourth side edge (166), 25
- whereby said housing is mountable to said panel at said cutout without fasteners.
8. The terminal block (10) as set forth in claim 7 further characterized in that said locking section (44, 46) comprises at least one spring (44) integral with said housing along said third side (46) that snaps forwardly so that an embossment (48) thereon protrudes into said cutout adjacent said third side edge (164) thereof when said housing is translated toward said fourth side edge (166). 30
9. The terminal block (10) as set forth in claim 7 or 8 further characterized in that said ledges (40, 42) of said upper and lower housing sides (36, 38) include panel-engaging spring arms (56) integral with said housing and biased against said side edges (156, 158) of said panel upon full mounting of said housing to said panel for elimination of vibration noise. 35
10. The terminal block (10) as set forth in claim 7 or 8 further characterized in that said terminal block (10) includes a ground contact (204) including a panel-engaging clip (220) having a panel-receiving entrance, said ground contact (204) is interconnectable with a said first terminal (86) at a said termination site (20) adjacent said fourth housing side (52), and said fourth housing side includes a recess (228) therethrough through which said clip (220) extends straddling said panel-receiving gap to groundingly engage said panel (150) at said cutout when said housing is translated to said mounted position along said fourth side edge (166) of said cutout. 40

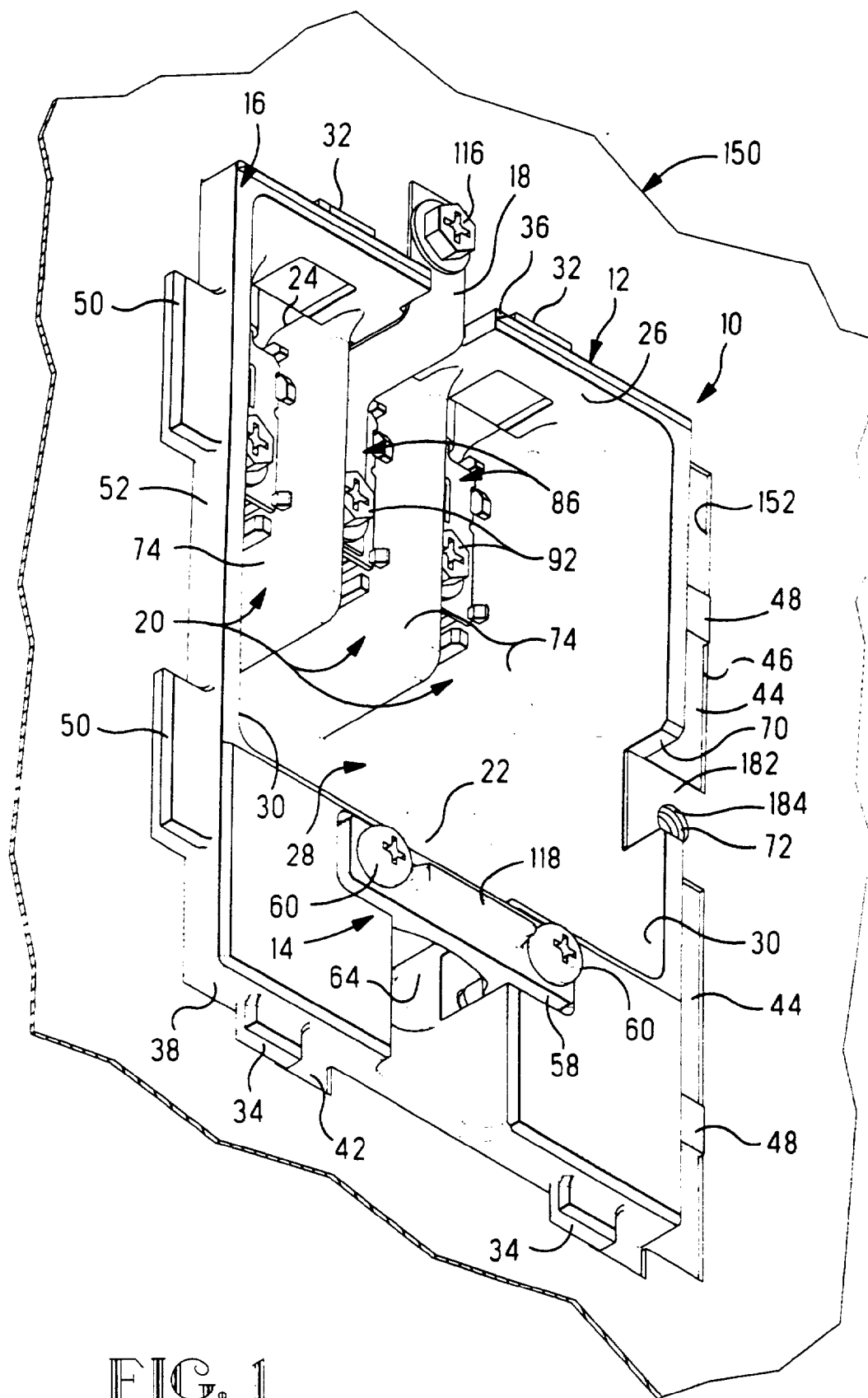


FIG. 1

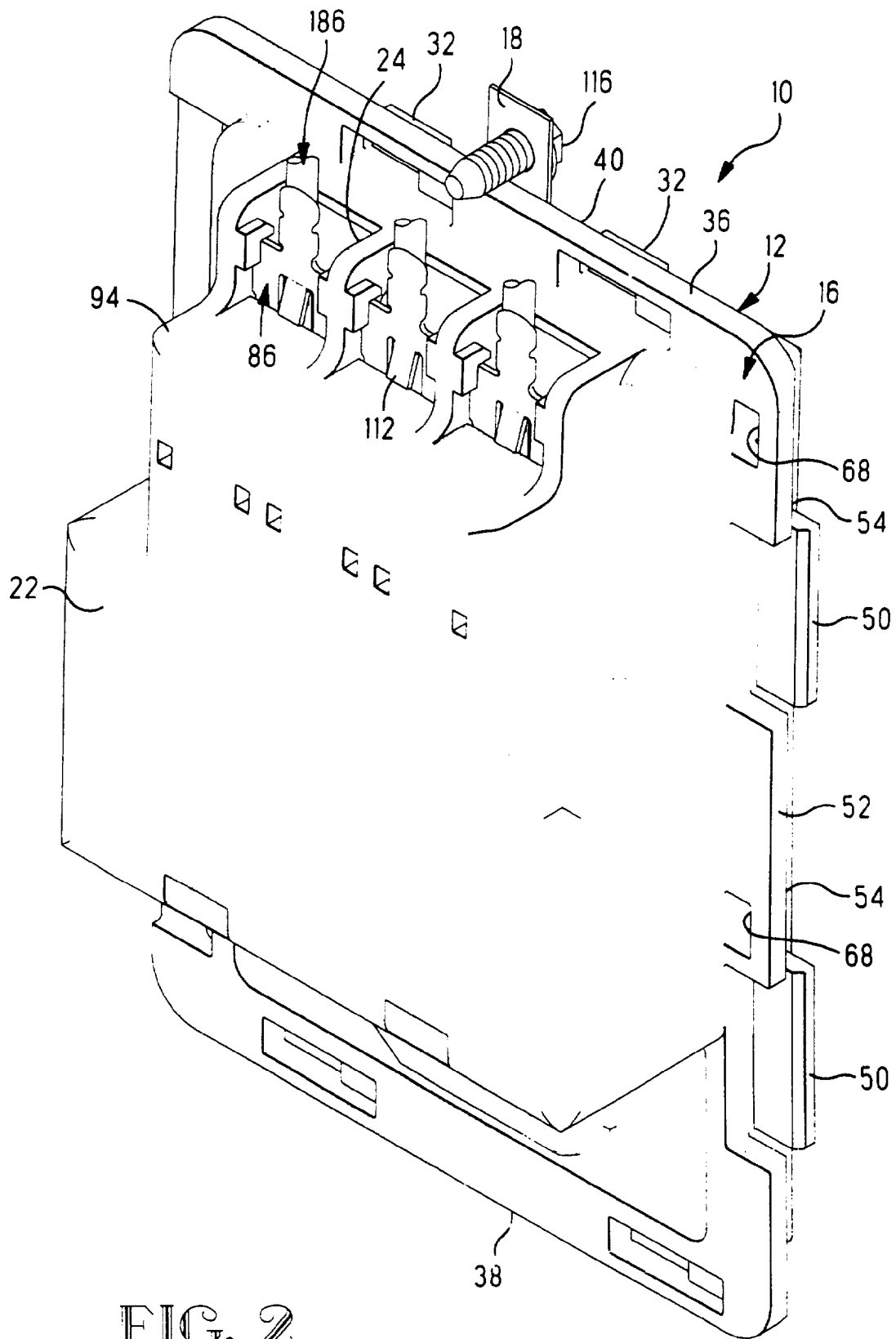
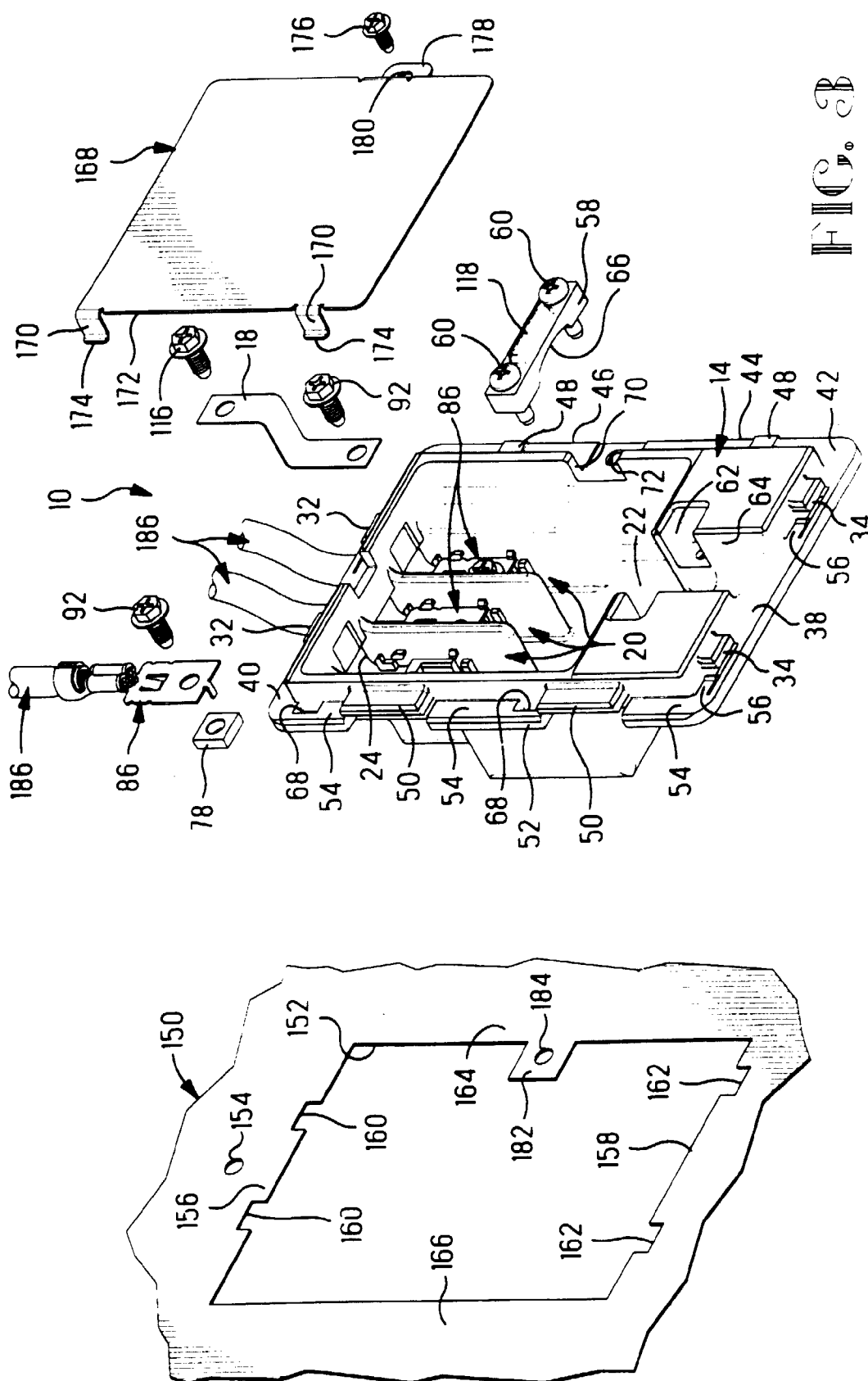


FIG. 2



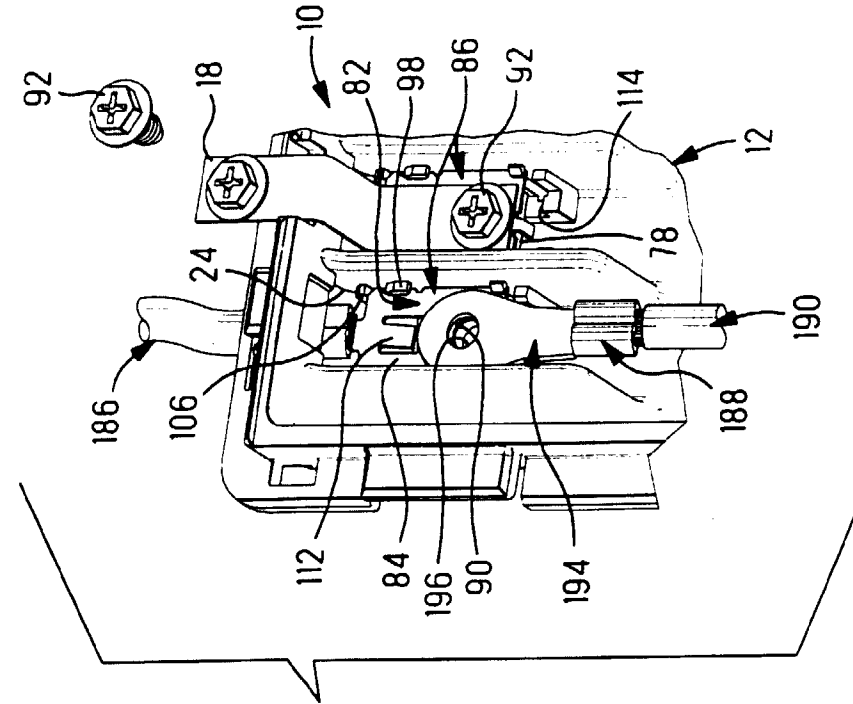


FIG. 5

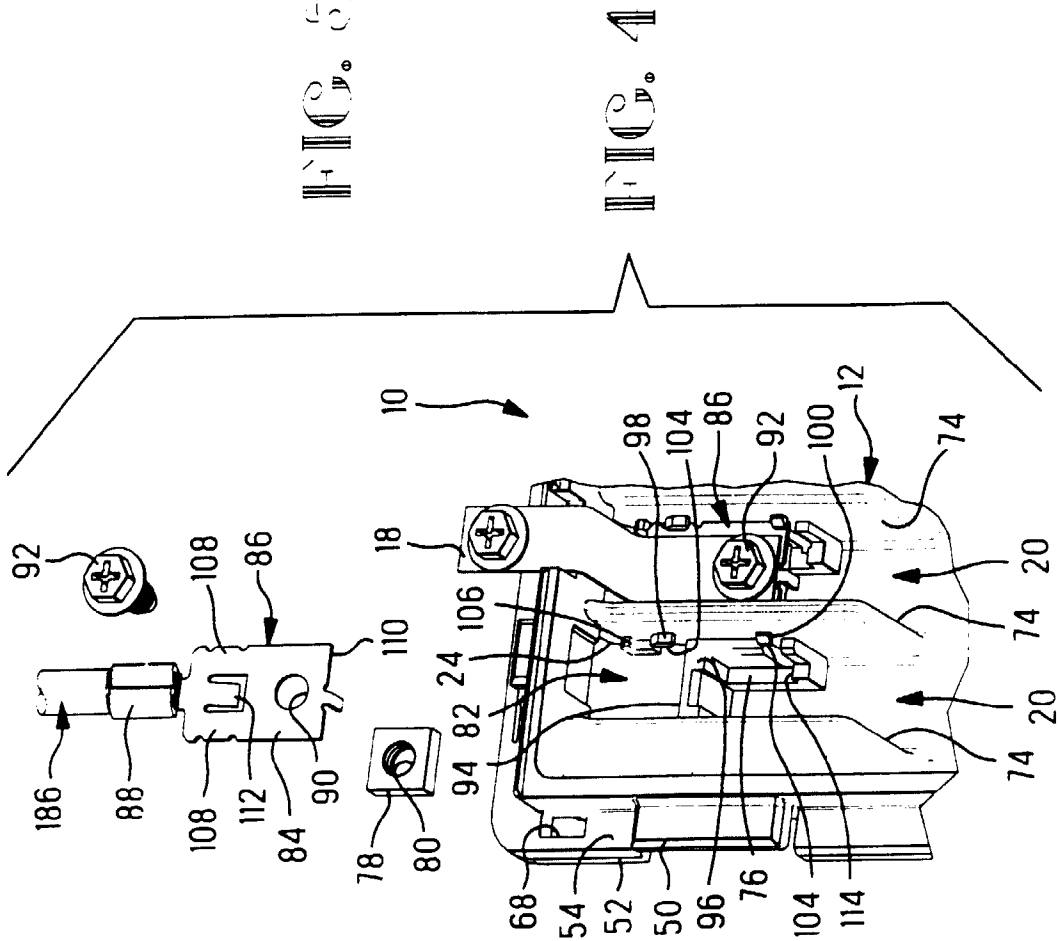
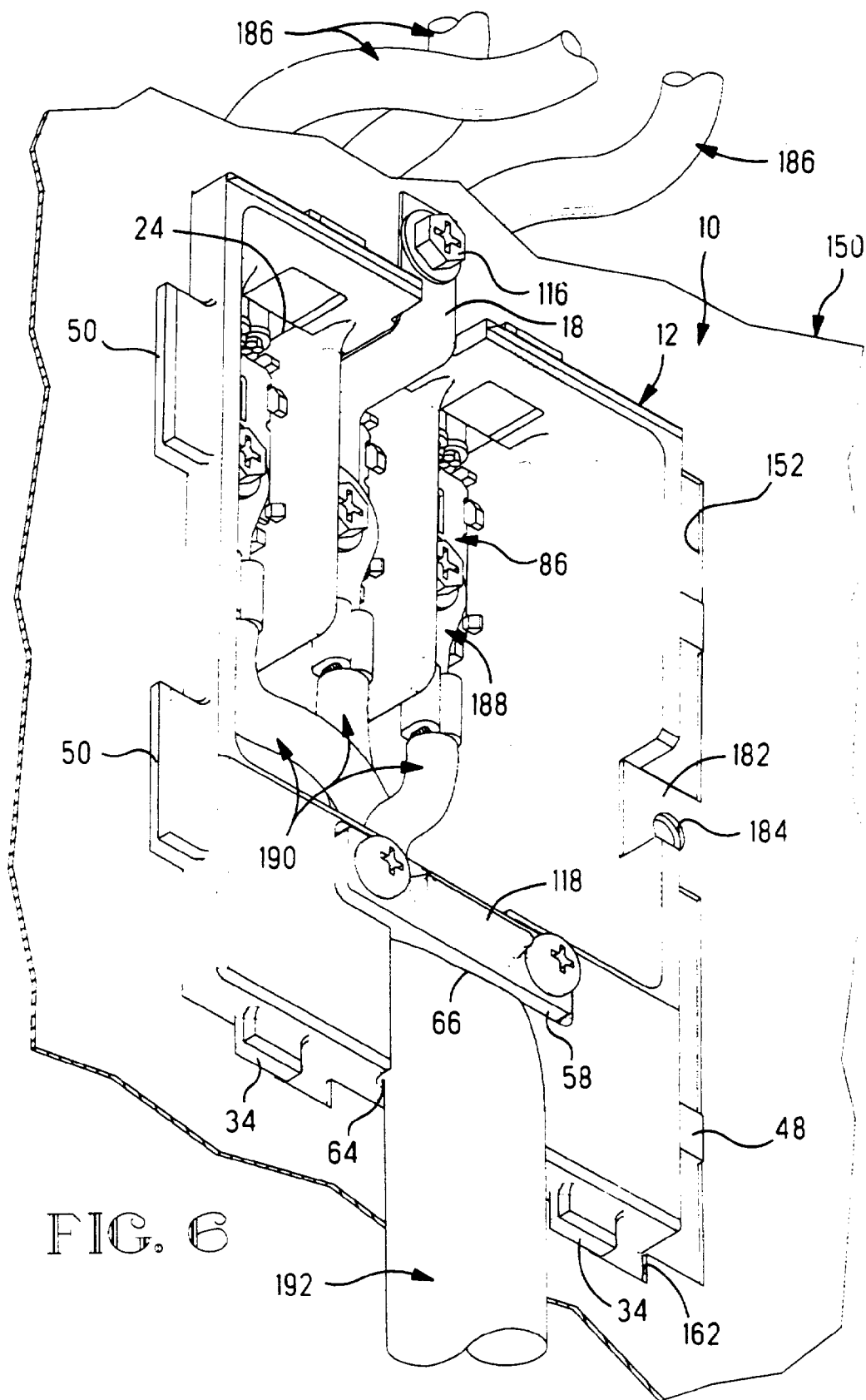


FIG. 4



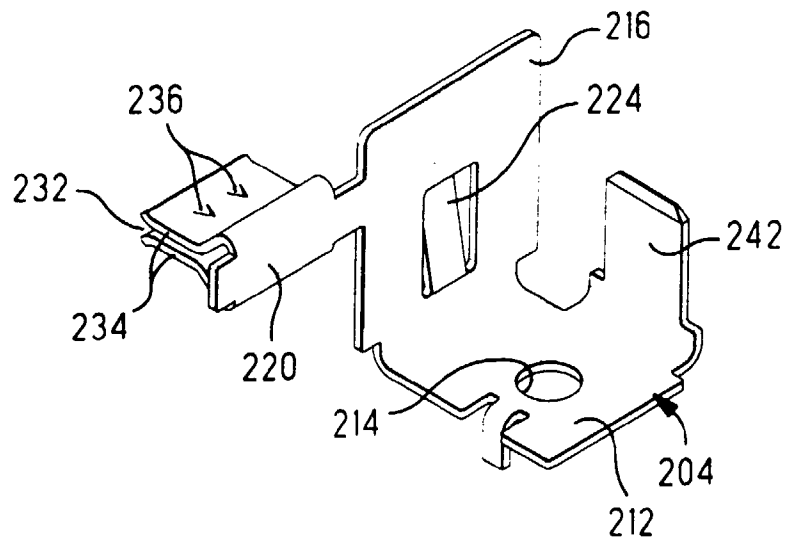


FIG. 7

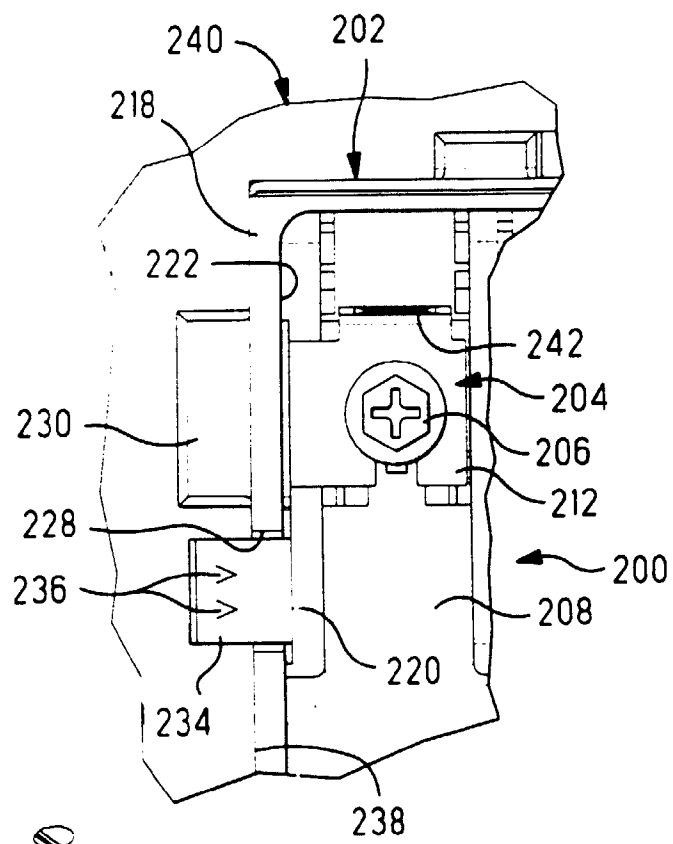


FIG. 8