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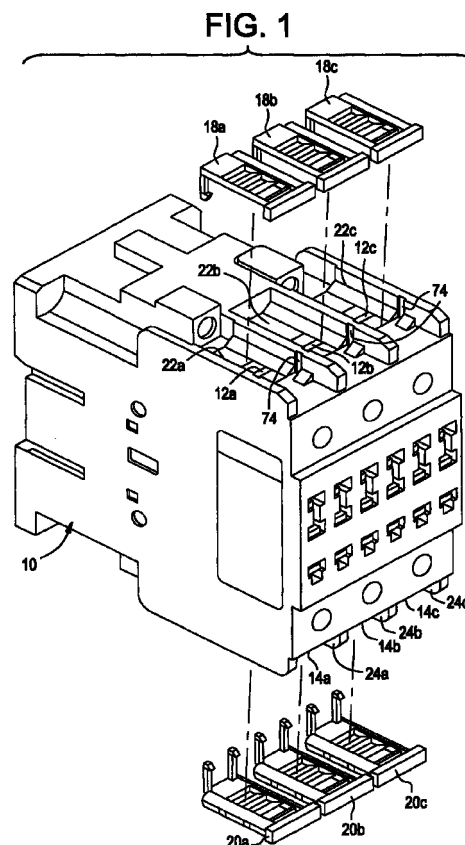
(71) Applicant:
**Power Controls Iberica S.A.
08225 Terrassa (Barcelona) (ES)**

(72) Inventors:
• **Van Causbroeck, Geert
9200 Dendermonde (BE)**
• **Roldan, Asencio Blas
08222 Terrassa, Barcelona (ES)**
• **Graciano, Antoni Enric Munoz
08226 Terrassa, Barcelona (ES)**

(74) Representative: **Goode, Ian Roy
GE LONDON PATENT OPERATION,
Essex House,
12/13 Essex Street
London WC2R 3AA (GB)**

(54) **Terminal protection device for low voltage apparatus**

(57) A low voltage apparatus having line and load terminals at opposing ends which are interconnected by fixed and moveable contacts under control of a coil. Terminal protectors (30) are provided at the line and load sides. The terminal protectors (30) protect (when installed on the low voltage apparatus) the contacts and box terminals. The terminal protectors are received in corresponding channels, in the low voltage apparatus. The terminal protector (30) has an end portion (32) which has two opposite side portions (34,36) extending rearwardly therefrom with a base or plate (46) extending therebetween. The base (46) has openings (48,49,50,51) therein defining portions including removable portions (52,54). These removable portions (52,54) are tapered along the sides thereof. Prior to inserting a wire into a terminal of the low voltage apparatus one or more removable portions (52,54) of the terminal protector (30) may require removal depending upon the diameter of the wire being inserted. A portion (52,54) is removed by inserting a blade of a screwdriver (or the like) into an adjacent opening (49,50) and applying an appropriate force on that portion to break it away at the taper sides.



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Description

[0001] The present invention relates generally to low voltage apparatus. More particularly, the present invention relates to terminal protection devices for low voltage apparatus such as contactors.

[0002] Low voltage a.c. (alternating current) and d.c. (direct current) contactors are used in industrial commercial applications to control power flow to electrical loads in circuits operating up to 690V RMS. Such electrical contactors typically have one or more contact pads disposed on a movable pad carrier (or bridge) structure that is selectively moved between an open and a closed position. The pad carrier is typically driven by a solenoid acting in opposition to a spring such that the bridge contacts can make and break contact, depending on the bridge position, with corresponding stationary contacts. The voltage supply and load supply leads are attached to respective contacts so that when the pad carrier is moved such that the bridge contact pads are disposed in contact with the respective stationary contact pads the circuit is closed; to open the circuit the pad carrier assembly is moved to separate the bridge contact pads from the respective stationary contact pads.

[0003] In an exemplary embodiment of the present invention a terminal protection device is provided for installation on a low voltage apparatus, such as a contactor, to protect the terminals thereof. The low voltage apparatus has line and load terminals at opposing ends which are interconnected by moveable contacts under control of a coil. The coil is receptive to connect and disconnect commands. Terminal protectors are provided at the line and load sides. The terminal protectors assure (when installed on the low voltage apparatus) an IP20 (Ingress Protection) protection level. The terminal protectors are received in corresponding channels, in the low voltage apparatus. In general, the overall size and shape of the terminal protectors are dictated by the channels in which they are to be received. Each of these channels has an opening defining a ledge which is used for retaining the terminal protectors. Each of the terminal protectors has openings therein receptive to a wire and includes removable portions. These removable portions are utilized depending upon the diameter of the wire to be inserted into the low voltage apparatus. Prior to inserting a wire into a terminal of the low voltage apparatus a removable portion is removed when the diameter of the wire to be inserted requires additional clearance. A portion is removed by inserting a blade of a screwdriver (or the like) into an adjacent opening and applying an appropriate force on that portion to break it away from the terminal protector.

[0004] Referring now to the drawings wherein like elements are numbered alike in the several FIGURES:

FIGURE 1 is a perspective partly exploded view of a low voltage apparatus (contactor) having terminal protection devices in accordance with the present

invention;

FIGURES 2A - E are views of a terminal protection device in accordance with a first embodiment of the present invention where FIGURE 2A is a perspective view thereof, FIGURE 2B is a bottom view thereof, FIGURE 2C is a cross sectional view thereof taken through line 2C - 2C of FIGURE 2B, FIGURE 2D is a top view thereof, and FIGURE 2E is an end view thereof;

FIGURES 3A - E are views of a terminal protection device in accordance with a second embodiment of the present invention where FIGURE 3A is a perspective view thereof, FIGURE 3B is a cross sectional view thereof taken through line 3B - 3B of FIGURE 3D, FIGURE 3C is a cross sectional view thereof taken through line 3C - 3C of FIGURE 3B, FIGURE 3D is a top view thereof, and FIGURE 3E is an end view thereof;

FIGURES 4A - F are views of a terminal protection device in accordance with a third embodiment of the present invention where FIGURE 4A is a perspective view thereof, FIGURE 4B is a cross sectional view thereof taken through line 4B - 4B of FIGURE 4C, FIGURE 4C is a top view thereof, FIGURE 4D is a bottom view thereof, FIGURE 4E is an end view thereof, and FIGURE 4F is an opposite end view thereof;

FIGURES 5A - F are views of a terminal protection device in accordance with a fourth embodiment of the present invention where FIGURE 5A is a perspective view thereof, FIGURE 5B is a cross sectional view thereof taken through line 5B - 5B of FIGURE 5E, FIGURE 5C is an end view thereof, FIGURE 5D is a bottom view thereof, FIGURE 5E is a top view thereof, and FIGURE 5F is an opposite end view thereof; and

FIGURE 6 is a perspective partial view of a contactor having a terminal protection device in accordance with a fifth embodiment of the present invention.

[0005] Referring to FIGURE 1, a low voltage apparatus 10 is, by way of example, a standard magnetic contactor such as is commercially available from the General Electric Company (the assignee hereof) under a CLxx series designation. Such contactors are typically three or four pole devices. Low voltage apparatus 10 has line and load stationary contacts (terminals) 12a-c, 14a-c at opposing ends which are interconnected by moveable contacts (not shown) under control of a contactor coil (not shown). The contactor coil is receptive to connect and disconnect commands, as is well known in the art. Low voltage apparatus 10 is for use in a three

phase system. Stationary contacts 12a-c and 14a-c are typically of identical construction, and comprise a conductive support material, for example, copper, nickel, metal oxides, or mixtures of such materials and having a contact tip (such as a silver alloy) to provide the combination of electrical conductivity and physical robustness required for a particular contactor application. The conductive material provides a contact material having characteristics of low contact welding, high electrical conductivity, low contact erosion, and controlled arc stability. The physical dimensions of contacts are typically determined based upon the current carrying capacity of the contact as required by the particular rating of low voltage apparatus 10.

[0006] Terminal protectors 18a-c are provided at the line side and terminal protectors 20a-c are provided at the load side. Terminal protectors 18a-c, 20a-c protect (when installed on low voltage apparatus 10) terminals 12a-c, 14a-c respectively. Terminal protectors 18a-c and 20a-c are received in corresponding channels 22a-c and 24a-c, respectively, in low voltage apparatus 10. In general, the overall size and shape of the terminal protectors is dictated by the channels in which they are to be received. Each channel 22a-c and 24a-c has an opening defining a ledge (not shown) which is used for retaining the terminal protectors.

[0007] Referring to FIGURES 2A-E, a terminal protector in accordance with a first embodiment of the present invention is generally shown at 30. Terminal protector 30 has a generally rectangularly shaped end portion (member) 32 which has two opposite side portions (members) 34, 36 extending rearwardly therefrom. Each side portion 34, 36 has opposing inner and outer angled side surfaces 38, 40, respectively, an outer vertical side surface 42, and inner vertical side surface 44. A base (or plate) 46 extends between surfaces 44 of each side portion.

[0008] Base 46 has openings 48-51 therein defining portions 52-54. Portions 52 and 54 are removable portions and are about one half the thickness (FIGURE 2C) of portion 53 (and the remainder of the base 46). Openings 48 and 51 extend at 56 along the sides of the terminal protector, as best shown in FIGURE 2D. Further, portions 52 and 54 are tapered (FIGURE 2D) along the sides of the terminal protector at a length 58 to a thickness of about one quarter of that of the rest of portions 52 and 54.

[0009] A portion 60 of base 46 extends beyond side portions 34 and 36 with two resilient arms (retaining members) 62, 64 depending downwardly therefrom. A shoulder 66 is defined at the lower end of each arm 62, 64. Shoulders 66 engage the ledge in the channel openings of low voltage apparatus 10, as previously described, for retaining terminal protector 30 on low voltage apparatus 10. Arms 62, 64 are urged outwardly as sloped surfaces 68 contact a surface in the low voltage apparatus until the shoulders 66 pass the ledge within the low voltage apparatus, where the arms snap

back and the shoulders engage the ledge. Also, rearwardly facing surfaces 72 of end portion 32 abut surfaces 74 of contactor 10.

[0010] Prior to inserting a wire (not shown) into a terminal 12a, 12b, 12c, 14a, 14b, or 14c of low voltage apparatus 10, the portions 52 or 54 may require removal depending upon the diameter of the wire (where terminal protectors 30 are installed on the low voltage apparatus). Accordingly, it will be appreciated that the purpose of openings 48-51, the tapered sides 58 and reduced thickness of portions 52 and 54 is to facilitate the removal of portions 52 and 54. More specifically, portion 54 is removed by inserting a blade of a screwdriver (or the like) into opening 50 and applying an appropriate force on portion 54 to break it away at the taper sides. Portion 52 is removed by inserting a blade of a screwdriver (or the like) into opening 49 and applying an appropriate force on portion 52 to break it away at the taper sides. It will also be appreciated that a wire having a diameter that would allow insertion through one of the openings 49 and 50 will not require removal of any of the portions 52 and 54.

[0011] In a preferred embodiment, portion 53 has beveled upper edges 70 to cooperate with insertion of a screwdriver as described above. The terminal protectors do not interfere with the insertion of wires or the operation (or use) of the low voltage apparatus.

[0012] Referring to FIGURES 3A-E, a terminal protector in accordance with a second embodiment of the present invention is generally shown at 130. Terminal protector 130 has a generally rectangularly shaped end portion 132 which has two opposite side portions 134, 136 extending rearwardly therefrom. Each side portion 134, 136 has opposing inner and outer side surfaces 138, 140, respectively, an inner angled side surface 142, upper and lower surfaces 144, 145 and an inner side surface 143. A base (or plate) 146 extends between surfaces 143 of each side portion.

[0013] Base 146 has openings 147-151 therein defining portions 152-156. Portions 153, 154 and 156 are removable portions and are about one half the thickness (FIGURE 3C) of portions 152 and 155 (and the remainder of base 146). Opening 147, 148 and 151 extend at 157 along the sides of the terminal protector, as best shown in FIGURE 3D. Further, portions 153, 154 and 156 are tapered (FIGURE 3D) along the sides of the terminal protector at a length 158 to a thickness of about one quarter of that of the rest of portions 153, 154 and 156.

[0014] A portion 160 of base 146 extending from side portions 134 and 136 defines a generally U-shaped angled surface 161. Two resilient arms (retaining members) 162, 164 depend downwardly from portion 160. A shoulder 166 is defined at the lower end of each arm 162, 164. Shoulders 166 engage the ledge in the channel openings of low voltage apparatus 10, as previously described, for retaining terminal protector 130 on low voltage apparatus 10. Arms 162, 164 are urged out-

wardly as sloped surfaces 168 contact a surface in the low voltage apparatus until the shoulders 166 pass the ledge within the low voltage apparatus, where the arm snap back and the shoulders engage the ledge, also, rearwardly facing surfaces 172 of end portion 132 abut surfaces 74 of low voltage apparatus 10.

[0015] Prior to inserting a wire (not shown) into a terminal 12a, 12b, 12c, 14a, 14b, or 14c of low voltage apparatus 10 the portions 153, 154 or 156 may require removal depending upon the diameter of the wire (where terminal protectors 130 are installed on the low voltage apparatus). Accordingly, it will be appreciated that the purpose of openings 147-151, the tapered sides 158 and reduced thickness of portions 153, 154 and 156 is to facilitate the removal of portions 153, 154 and 156. More specifically, portion 154 is removed by inserting a blade of a screwdriver (or the like) into opening 149 and applying an appropriate force on portion 154 to break it away at the taper sides. Portion 153 is removed by inserting a blade of a screwdriver (or the like) into opening 149 and applying an appropriate force on portion 153 to break it away at the taper sides. Portion 156 is removed by inserting a blade of a screwdriver (or the like) into opening 150 and applying an appropriate force on portion 156 to break it away at the taper sides. It will also be appreciated that a wire having a diameter that would allow insertion through one of the openings 149 and 150 will not require removal of any of the portions 153, 154 and 156.

[0016] In a preferred embodiment, portion 155 has beveled upper edges 170 to cooperate with insertion of a screwdriver as described above. The terminal protectors do not interfere with the insertion of wires or the operation (or use) of the low voltage apparatus.

[0017] Referring to FIGURES 4A-F, a terminal protector in accordance with a third embodiment of the present invention is generally shown at 230. Terminal protector 230 has a generally rectangularly shaped end portion 232 with an arcuate recess 237 defined therein. End portion 232 has two opposite side portions 234, 236 extending rearwardly therefrom. A corresponding arcuate recess 270 is defined in portion 254. Each side portion 234, 236 has opposing inner and outer side surfaces 238, 240, respectively, an upper surface 241, lower surfaces 242, 243 and end surface 244, 245. A base (or plate) 246 extends between surfaces 238 of each side portion.

[0018] Base 246 has openings 248-251 therein defining portions 252-256. Portions 253, and 255 are removable portions and are about one half the thickness (FIGURE 4C) of portions 252, 254 and 256 (and the remainder of base 246). Openings 248 and 251 extend at 257 along the sides of the terminal protector, as best shown in FIGURE 4C. Further, portions 253 and 255 are tapered (FIGURE 4C) along the sides or the terminal protector at a length 258 to a thickness of about one quarter of that of the rest of portions 253 and 255.

[0019] A resilient arm (retaining member) 262

depends downwardly from portion 256 of base 246. A shoulder 266 is defined at the lower end of arm 262. Shoulder 266 engages the ledge in the channel openings of low voltage apparatus 10, as previously described, for retaining terminal protector 230 on low voltage apparatus 10. Arm 262 is urged outwardly as sloped surface 268 contacts a surface in the low voltage apparatus until the shoulder 266 passes the ledge within the low voltage apparatus, where the arm snaps back and the shoulder engages the ledge. Also, rearwardly facing surfaces 272 of end portion 232 abut surfaces 74 of low voltage apparatus 10.

[0020] Prior to inserting a wire (not shown) into a terminal 12a, 12b, 12c, 14a, 14b, or 14c of low voltage apparatus 10, as is well known to one of ordinary skill in the art, the portions 253 or 255 may require removal depending upon the diameter of the wire (where terminal protectors 230 are installed on the contactor). Accordingly, it will be appreciated that the purpose of openings 248-251, the tapered sides 258 and reduced thickness of portions 253 and 255 is to facilitate the removal of portions 253 and 255. More specifically, portion 253 is removed by inserting a blade of a screwdriver (or the like) into opening 249 and applying an appropriate force on portion 253 to break it away at the taper sides. Portion 255 is removed by inserting a blade of a screwdriver (or the like) into opening 250 or 251 and applying an appropriate force on portion 255 to break it away at the taper sides. It will also be appreciated that a wire having a diameter that would allow insertion through one of the openings 249 and 250 will not require removal of any of the portions 253 and 255.

[0021] Arcuate recess 237 and 270 provide clearance for the insertion of a screwdriver as described above. The terminal protectors do not interfere with the insertion of wires or the operation (or use) of the low voltage apparatus.

[0022] Referring to FIGURES 5A-F, a terminal protector in accordance with a fourth embodiment of the present invention is generally shown at 330. Terminal protector 330 has a generally rectangularly shaped end portion 332 with an arcuate recess 337 defined therein. End portion 332 has two opposite side portions 334, 336 extending rearwardly therefrom. Each side portion 334, 336 has opposing inner and outer side surfaces 338, 340, respectively, upper surfaces 341, 342, lower surfaces 343, 344 and an end surface 345. A base (or plate) 346 extends between surfaces 338 of each side portion.

[0023] Base 346 has openings 348-351 therein defining portions 352-356. Portions 353 and 355 are removable portions and are about one half the thickness (FIGURE 5C) of portions 352, 354 and 356 (and the remainder of base 346). Openings 348 and 351 extend at 357 along the sides of the terminal protector, as best shown in FIGURE 5E. Further portions 353 and 355 are tapered (FIGURE 5E) along the sides of the terminal protector at a length 358 to a thickness of about

one quarter of that of the rest of portions 353 and 355.

[0024] A resilient arm (retaining member) 362 depends downwardly from portion 356 or base 346. A shoulder 366 is defined at the lower end of arm 362. Shoulder 366 engages the ledge in the channel openings of low voltage apparatus 10, as previously described, for retaining terminal protector 330 on low voltage apparatus 10. Arm 362 is urged outwardly as sloped surfaces 368 contacts a surface in the low voltage apparatus until the shoulder 366 passes the ledge within the low voltage apparatus, where the arm snaps back and the shoulder engages the ledge. Also, rearwardly facing surfaces 272 of end portion 332 abut surfaces 74 of low voltage apparatus 10.

[0025] Prior to inserting a wire (not shown) into a terminal 12a, 12b, 12c, 14a, 14b, or 14c of low voltage apparatus 10, the portions 353 or 355 may require removal depending upon the diameter of the wire (where terminal protectors 330 are installed on the low voltage apparatus). Accordingly, it will be appreciated that the purpose of openings 348-351, the tapered sides 358 and reduced thickness of portions 353 and 355 is to facilitate the removal of portions 353 and 355. More specifically, portion 353 is removed by inserting a blade of a screwdriver (or the like) into opening 349 and applying an appropriate force on portion 353 to break it away at the taper sides. Portion 355 is removed by inserting a blade of a screwdriver (or the like) into opening 349 or 350 and applying an appropriate force on portion 355 to break it away at the taper sides. It will also be appreciated that a wire having a diameter that would allow insertion through one of the openings 349 and 350 will not require removal of any of the portions 353 and 355.

[0026] Arcuate recess 337 provides clearance for the insertion of a screw driver as described above. The terminal protectors do not interfere with the insertion of wires or the operation (or use) of the low voltage apparatus.

[0027] Referring to FIGURE 6, another low voltage apparatus, by way of example, is a contactor which is generally shown at 410. Low voltage apparatus 410 has line load stationary contacts (terminal) 412a-c, (opposing stationary contacts (terminals) are not shown) at opposing ends which are interconnected by moveable contacts (not shown) under control of a contactor coil (now shown). The contactor coil is receptive to connect and disconnect commands, as is well known in the art. Low voltage apparatus 410 in the present example is for use in a three phase system. The stationary contacts are typically of identical construction, and comprise a conductive support material, for example, copper, nickel, metal oxides, or mixtures of such materials and having a contact tip (such as a silver alloy) to provide the combination of electrical conductivity and physical robustness required for a particular contactor application. The conductive material provides a contact material having characteristics of low contact welding, high

electrical conductivity, low contact erosion, and controlled arc stability. The physical dimensions of contacts are typically determined based upon the current carrying capacity of the contact as required by the particular rating of low voltage apparatus 410.

[0028] Terminal protector 418 is provided at the line side and a terminal protector (now shown) is provided at the load side. The terminal protectors protect (when installed on low voltage apparatus 410) the terminals.

The terminal protectors are attached to low voltage apparatus 410 at the respective terminals. In general, the overall size and shape of the terminal protectors is dictated by the terminal configuration they are to protect. For each terminal protector a channel 414 is formed in each side of low voltage apparatus 410 at the respective terminals. A plurality of protuberances 416 extend outwardly from a surface 418 of the channel 414. The protuberances 416 are used for retaining the terminal protectors. Terminal protector 418 has a plate 420 with sides (retaining members) 422 and 424 extending rearwardly therefrom. A plurality of terminal protector sections 426a-c are provided in plate 420 and are located to protect corresponding terminals 412a-c, respectively. Each terminal protector section 426a-c is the same, whereby only terminal section 426a is described in detail herein.

[0029] Terminal protector section 426a has openings 448-451 therein defining portions 452-454. Portions 452 and 454 are removable portions and are about one half the thickness of portion 453 (and the remainder of plate 420). Openings 448 and 451 extend along the sides of the terminal protector, similar to that shown in the other embodiments. Further portions 452 and 454 are tapered along the sides to a thickness of about one quarter of that of the rest of portions, also similar to that shown in the other embodiments.

[0030] Sides 422 and 424 are resilient to provide a retention force for retaining terminal protector 418 on low voltage apparatus 410. More specifically, inner surfaces 456 and 458 of sides 422 and 424, respectively, include a plurality of detents (not shown) for receiving corresponding protuberances 416 when terminal protector 418 is mounted on low voltage apparatus 410. Sides 422 and 424 are urged outwardly as inner surfaces 456 and 458 contact protuberances 416 of the low voltage apparatus until these protuberances 416 are received in respective detents at surfaces 456, where the sides snap back.

[0031] The thickness of sides 422 and 424 of the low voltage apparatus 410 is selected to be about the same as the depth of the channels 414 of the terminal protector 410. This causes the outer surfaces 460 and 462 to be generally flush with the outer side surfaces of the low voltage apparatus when the terminal protector is mounted thereon. An upper end of the terminal protector has a tapered surface 464. A lower end 466 of the terminal protector is flush with the bottom surface of the low voltage apparatus when the terminal protector is

mounted thereon. The flush mounted sides, lower end and the upper tapered surface of the terminal protector are provided for aesthetic purposes.

[0032] Prior to inserting a wire (not shown) into a terminal of low voltage apparatus 410, the portions 452 and 454 may require removal depending upon the diameter of the wire (where terminal protectors are installed on the low voltage apparatus). Accordingly, it will be appreciated that the purpose of openings 448-451, the tapered sides and the reduced thickness of portions 452 and 454 is to facilitate the removal of portions 452 and 454. More specifically, portion 452 is removed by inserting a blade of a screwdriver (or the like) into opening 449 and applying an appropriate force on portion 452 to break it away at the taper sides. Portion 454 is removed by inserting a blade of a screwdriver (or the like) into opening 450 or 451 and applying an appropriate force on portion 454 to break it away at the taper sides. It will also be appreciated that a wire having a diameter that would allow insertion through one of the openings 449 and 450 will not require removal of any of the portions 452 and 454. The terminal protectors do not interfere with the insertion of wire or the operation (or use) of the low voltage apparatus.

[0033] For completeness, various aspects of the invention are set out in the following numbered clauses:-

1. A protection device for use with a low voltage apparatus, comprising:

a plate (46) having a plurality of openings (48, 49, 50, 51) therein for defining at least one portion (52, 54) of said plate (46) for removal, said at least one portion (52, 54) of said plate (46) for removal having reduced material sections (58) defining at least one location at which said at least one portion (52, 54) of said plate (46) for removal is breakable away from said plate (46); and
a retaining member (62, 64) depending from said plate, said retaining member (62, 64) for retaining said protector device on the low voltage apparatus.

2. The protection device of clause 1 wherein said retaining member includes:

an end member (32) disposed at one end of said plate (46), said end member (32) having a surface (72) that intersects with said plate (46); and
at least one resilient arm (62, 64) depending downwardly from said plate (46), said at least one resilient arm (62, 64) having a defined shoulder (66), said resilient arm (62, 64) and said end member (32) for cooperating to retain said protection device on the low voltage appa-

ratus.

3. The protection device of clause 2 further comprising side members (34, 36) disposed at opposing sides of said plate (46).

4. The protection device of clause 2 wherein said at least one resilient arm comprises two spaced apart resilient arms (62, 64).

5. The protection device of clause 1 wherein said at least one portion of said plate (146) for removal comprises two or three portions (153, 154, 156) of said plate (146) for removal.

6. The protection device of clause 1 wherein said reduced material sections (58) defining said at least one location at which said at least one portion (52, 54) of said plate (46) for removal is breakable away from said plate (46) comprises opposing side locations.

7. The protection device of clause 6 wherein said reduced material sections (58) further comprise said at least one portion (52, 54) of said plate (46) for removal having a thickness less than other portions (53) of said plate (46).

8. The protection device of clause 1 wherein said retaining member includes:

at least one resilient side member (422, 424) depending from said plate (420), said at least one resilient side member (422, 424) having a detent or a protrusion at a surface thereof, said resilient side member and said detent or protrusion for cooperating to retain said protection device on the low voltage apparatus.

9. The protection device of clause 1 wherein the low voltage apparatus is a contactor.

10. An interconnection assembly comprising:

a low voltage apparatus (10) having first and second terminals (12, 14) interconnected by a movable contact, each of said first and second terminals (12, 14) being receptive to a conductor; and

a terminal protection device (20) disposed at, at least one of said first and second terminals (12, 14) of said low voltage apparatus (10) for protecting said at least one of said first and second terminals (12, 14).

11. The interconnection assembly of clause 10 wherein:

said low voltage apparatus further has a plurality of said first terminals (412) and a corresponding plurality of said second terminals interconnected by a plurality of said movable contacts, wherein each said first terminal and said corresponding said second terminal corre-

spond to a pole; and

said terminal protection device (418) is disposed at said plurality of said first terminals (412) or said plurality of said second terminals.

12. The interconnection assembly of clause 11 wherein said poles comprises three or four poles.

13. The interconnection assembly of clause 10 wherein said terminal protection device comprises:

a plate (46) having a plurality of openings (48, 49, 50, 51) therein for defining at least one portion (52, 54) of said plate (46) for removal, said at least one portion (52, 54) of said plate (46) for removal having reduced material sections (58) defining at least one location at which said at least one portion (52, 54) of said plate (46) for removal is breakable away from said plate (46); and

a retaining member (62, 64) depending from said plate, said retaining member for retaining said protector device (20) on said low voltage apparatus (10).

14. The interconnection assembly of clause 10 wherein said retaining member includes:

an end member (32) disposed at one end of said plate (46), said end member having a surface (72) that intersects with said plate (46); and

at least one resilient arm (62, 64) depending downwardly from said plate (46), said at least one resilient arm (62, 64) having a defined shoulder (66), said resilient arm (62, 64) and said end member (32) for cooperating to retain said protection device (20) on the low voltage apparatus (10).

15. The interconnection assembly of clause 14 further comprising side members disposed at opposing sides of said plate (46).

16. The interconnection assembly of clause 14 wherein said at least one resilient arm comprises two spaced apart resilient arms (62, 64).

17. The interconnection assembly of clause 10 wherein said at least one portion of said plate (146) for removal comprises two or three portions (153, 154, 156) of said plate (146) for removal.

18. The interconnection assembly of clause 10 wherein said reduced material sections (58) defining said at least one location at which said at least one portion (52, 54) of said plate (46) for removal is breakable away from said plate (46) comprises opposing side locations.

19. The interconnection assembly of clause 18 wherein said reduced material sections (58) further comprise said at least one portion (52, 54) of said

plate (46) for removal having a thickness less than other portions (53) of said plate (46).

20. The interconnection assembly of clause 13 wherein:

said low voltage apparatus (410) has a detent or protrusion at a surface hereof; and

a surface thereof, said resilient said retaining member includes at least one resilient side member (422, 424) depending from said plate, said at least one resilient side member (422, 424) having a detent or a protrusion at side member (422, 424) and said detent or protrusion thereof cooperating with corresponding said detent or protrusion of said low voltage apparatus (410) to retain said protection device (418) on said low voltage apparatus (410).

21. The interconnection assembly of clause 10 wherein said low voltage apparatus (10) comprises a contactor.

22. A method of protecting terminals of a low voltage apparatus, comprising:

attaching a terminal protection (20) device onto a low voltage apparatus (10) at a terminal (12, 14) thereof; and

connecting a conductor to said terminal (12, 14) with said conductor passing through an access opening (49, 50) in a plate (46) of said terminal protection device (20).

23. The method of clause 22 further comprising:

removing a removable portion (52, 54) of said plate (46) of said terminal protection device (20) to increase said access opening (49, 50) in said plate (46).

24. The method of clause 22 wherein said terminal (12, 14) of said low voltage apparatus (10) comprises one of first and second terminals which are interconnected by third movable contacts.

25. The method of clause 23 wherein said plate further includes a plurality of first openings (48, 51) therein defining said removable portion (52, 54), said removable portion (52, 54) having reduced material sections (58) defining at least one location where said removable portion (52, 54) is broken away from said plate (46).

26. The method of clause 22 wherein said terminal protection device further includes:

a retaining member (62, 64) depending from said plate (46), said retaining member (62, 64) for retaining said protection device (20) on said low voltage apparatus (10).

27. The method of clause 22 wherein said terminal protection device further includes:

an end member (32) disposed at one end of said plate (46), said end member (32) having a surface (72) that intersects with said plate (46), and
at least one resilient arm (62, 64) depending downwardly from said plate (46), said at least one resilient arm (62, 64) having a defined shoulder (66), said resilient arm (62, 64) and said end member (32) cooperating to attaching said protection device (20) on said low voltage apparatus (10).

28. The method of clause 25 wherein said reduced material sections (58) defining said at least one location where said removable portion (52, 54) is broken away from said plate (46) comprises opposing side locations.

29. The method of clause 28 wherein said reduced material sections (58) further comprise said removable portion (52, 54) having a thickness less than other portions (53) of said plate (46).

30. The method of clause 26 wherein:

said low voltage apparatus (410) has a detent or protrusion at a surface thereof; and
said retaining member includes at least one resilient side member (422, 424) depending from said plate, said at least one resilient side member (422, 424) having a detent or a protrusion at a surface thereof, said resilient side member (422, 424) and said detent or protrusion thereof cooperating with corresponding said detent or protrusion of said low voltage apparatus (410) to retain said protection device (418) on said low voltage apparatus (410).

31. The method of clause 22 wherein said low voltage apparatus (10) comprises a contactor.

Claims

1. A protection device for use with a low voltage apparatus, comprising:

a plate (46) having a plurality of openings (48, 49, 50, 51) therein for defining at least one portion (52, 54) of said plate (46) for removal, said at least one portion (52, 54) of said plate (46) for removal having reduced material sections (58) defining at least one location at which said at least one portion (52, 54) of said plate (46) for removal is breakable away from said plate (46); and
a retaining member (62, 64) depending from said plate, said retaining member (62, 64) for

retaining said protector device on the low voltage apparatus.

2. The protection device of claim 1 wherein said retaining member includes:

an end member (32) disposed at one end of said plate (46), said end member (32) having a surface (72) that intersects with said plate (46); and
at least one resilient arm (62, 64) depending downwardly from said plate (46), said at least one resilient arm (62, 64) having a defined shoulder (66), said resilient arm (62, 64) and said end member (32) for cooperating to retain said protection device on the low voltage apparatus.

3. The protection device of claim 1 wherein said reduced material sections (58) defining said at least one location at which said at least one portion (52, 54) of said plate (46) for removal is breakable away from said plate (46) comprises opposing side locations.

4. The protection device of claim 1 wherein said retaining member includes:

at least one resilient side member (422, 424) depending from said plate (420), said at least one resilient side member (422, 424) having a detent or a protrusion at a surface thereof, said resilient side member and said detent or protrusion for cooperating to retain said protection device on the low voltage apparatus.

5. An interconnection assembly comprising:

a low voltage apparatus (10) having first and second terminals (12, 14) interconnected by a movable contact, each of said first and second terminals (12, 14) being receptive to a conductor; and

a terminal protection device (20) disposed at, at least one of said first and second terminals (12, 14) of said low voltage apparatus (10) for protecting said at least one of said first and second terminals (12, 14).

6. The interconnection assembly of claim 5 wherein:

said low voltage apparatus further has a plurality of said first terminals (412) and a corresponding plurality of said second terminals interconnected by a plurality of said movable contacts, wherein each said first terminal and said corresponding said second terminal correspond to a pole; and

said terminal protection device (418) is disposed at said plurality of said first terminals (412) or said plurality of said second terminals.

7. The interconnection assembly of claim 5 wherein said terminal protection device comprises:

a plate (46) having a plurality of openings (48, 49, 50, 51) therein for defining at least one portion (52, 54) of said plate (46) for removal, said at least one portion (52, 54) of said plate (46) for removal having reduced material sections (58) defining at least one location at which said at least one portion (52, 54) of said plate (46) for removal is breakable away from said plate (46); and
a retaining member (62, 64) depending from said plate, said retaining member for retaining said protector device (20) on said low voltage apparatus (10).

8. The interconnection assembly of claim 5 wherein said retaining member includes:

an end member (32) disposed at one end of said plate (46), said end member having a surface (72) that intersects with said plate (46); and
at least one resilient arm (62, 64) depending downwardly from said plate (46), said at least one resilient arm (62, 64) having a defined shoulder (66), said resilient arm (62, 64) and said end member (32) for cooperating to retain said protection device (20) on the low voltage apparatus (10).

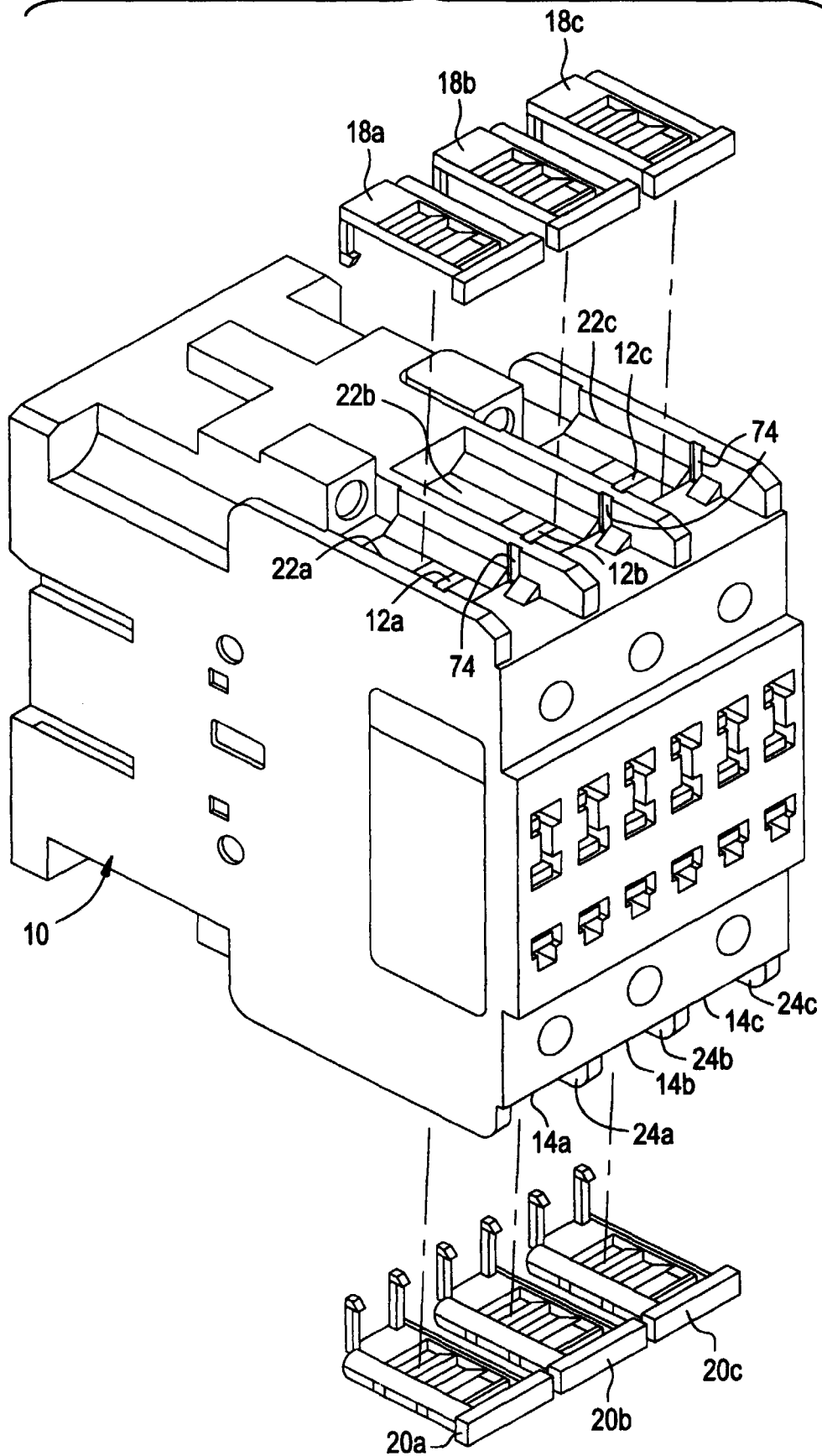
9. A method of protecting terminals of a low voltage apparatus, comprising:

attaching a terminal protection (20) device onto a low voltage apparatus (10) at a terminal (12, 14) thereof; and
connecting a conductor to said terminal (12, 14) with said conductor passing through an access opening (49, 50) in a plate (46) of said terminal protection device (20).

10. The method of claim 9 further comprising:

removing a removable portion (52, 54) of said plate (46) of said terminal protection device (20) to increase said access opening (49, 50) in said plate (46).

FIG. 1



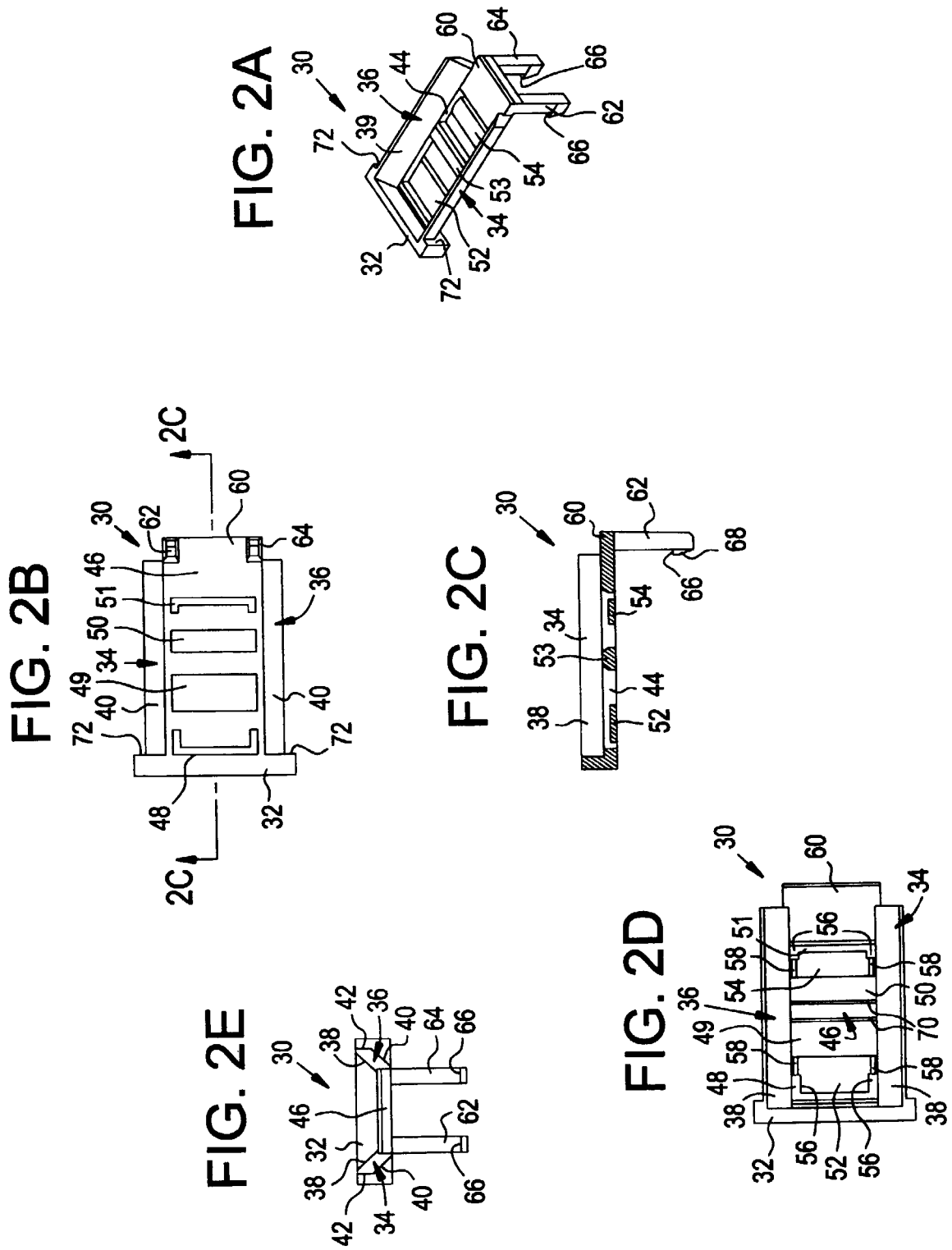


FIG. 3E

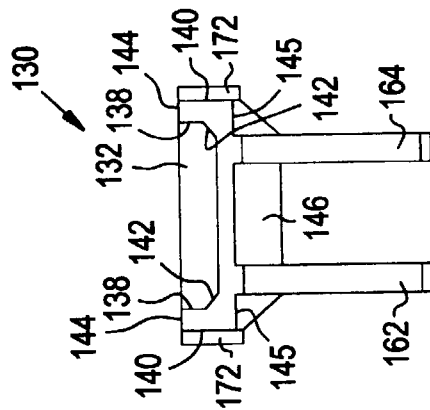


FIG. 3B

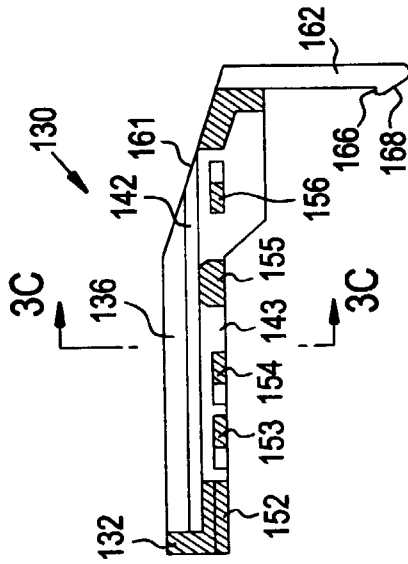


FIG. 3C

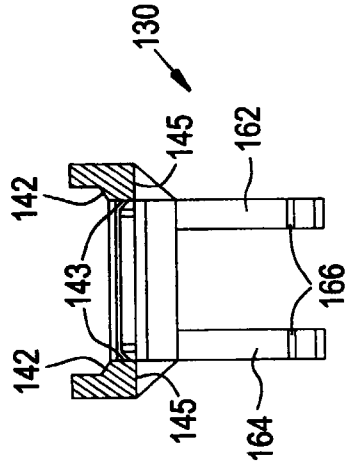


FIG. 3D

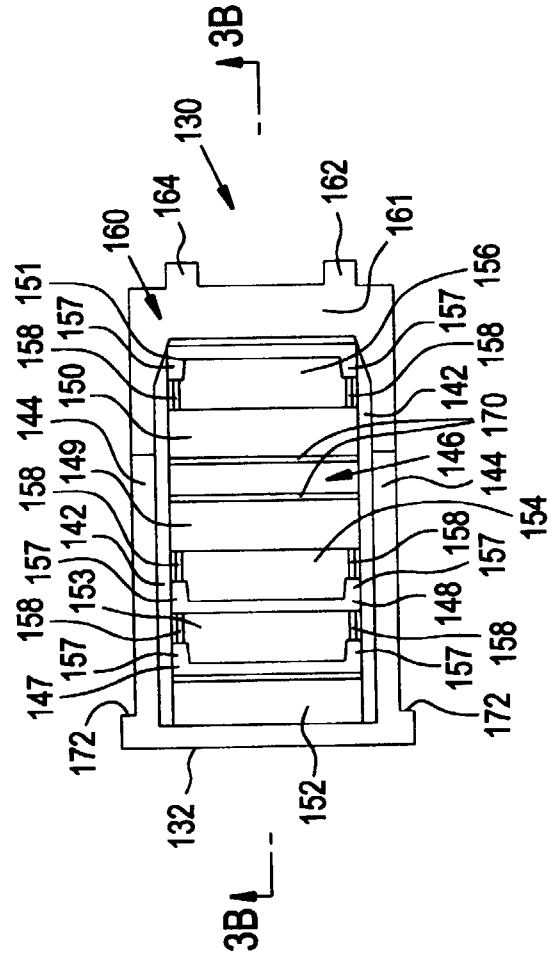
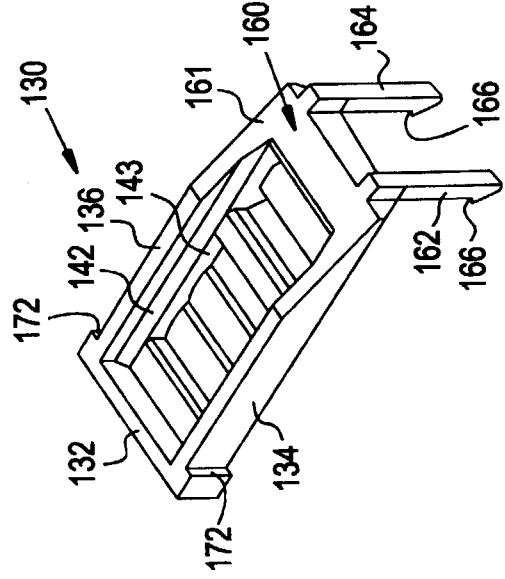
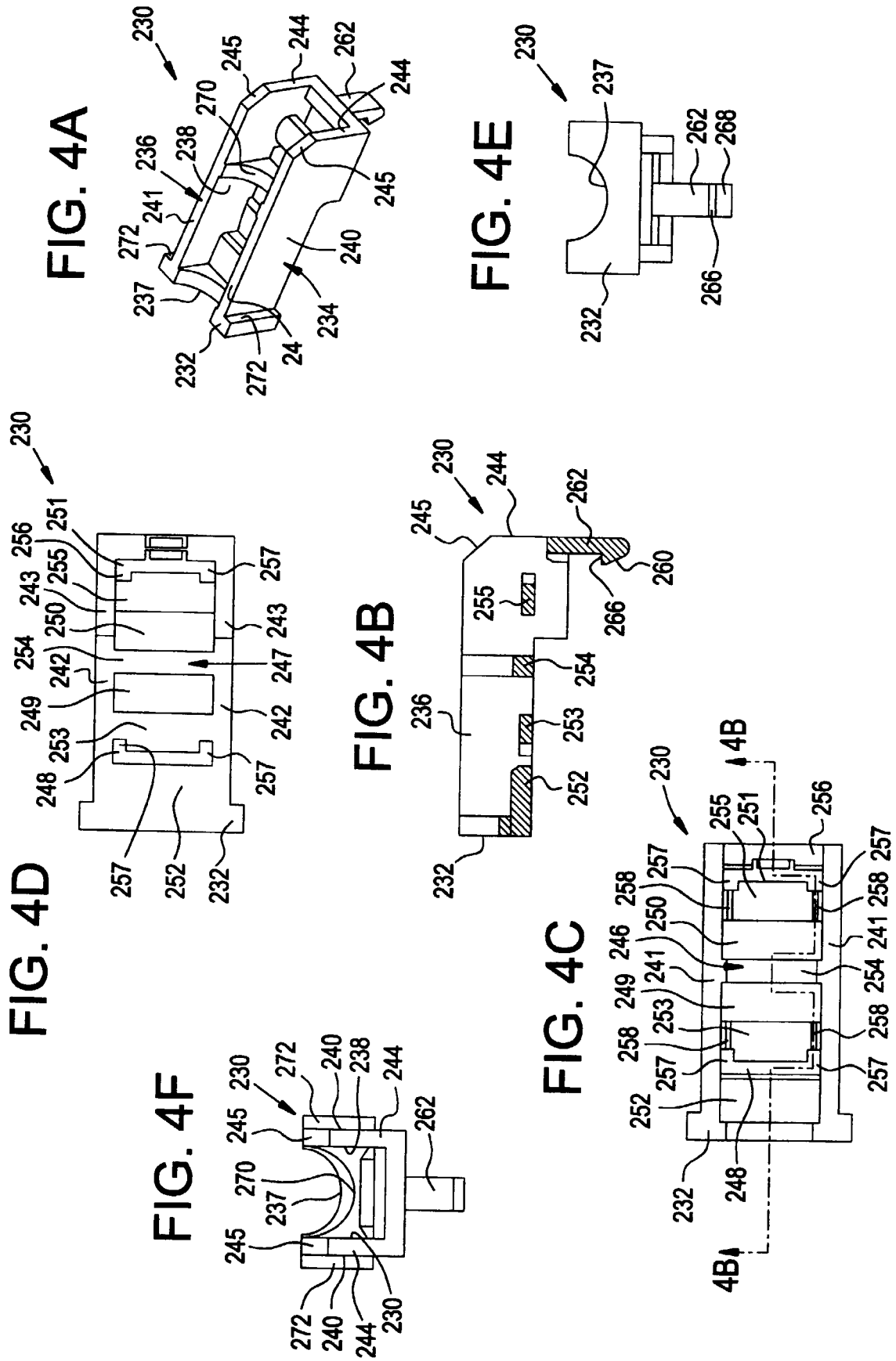


FIG. 3A





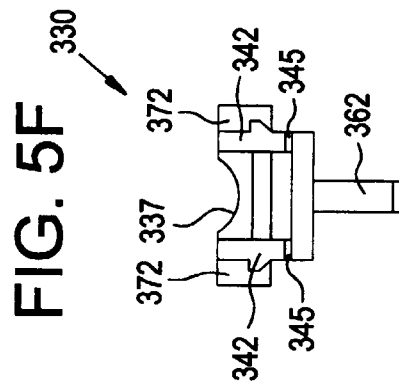
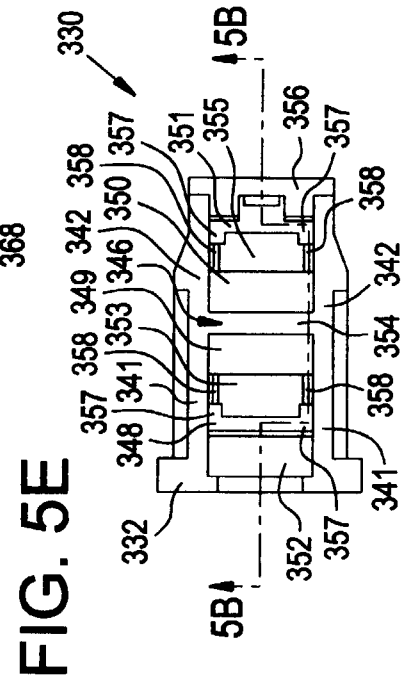
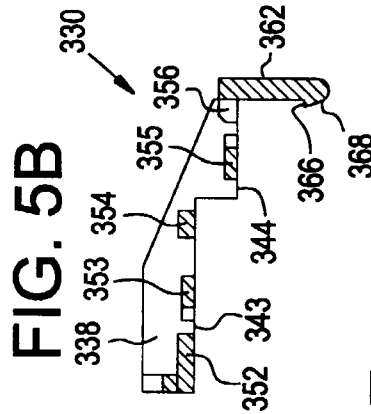
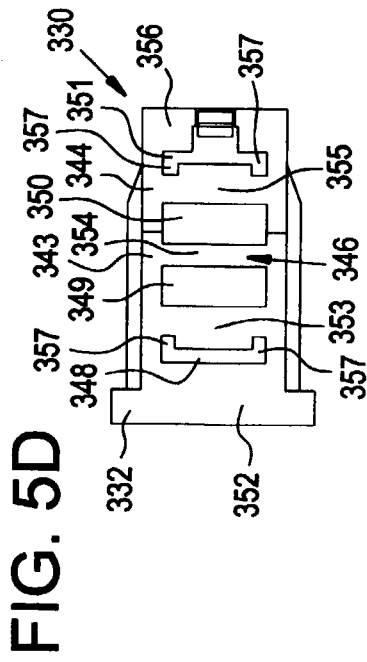
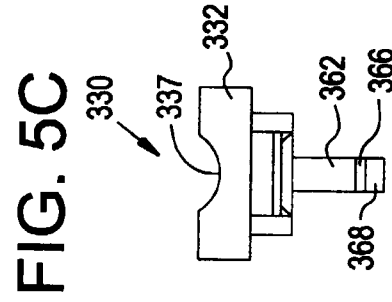
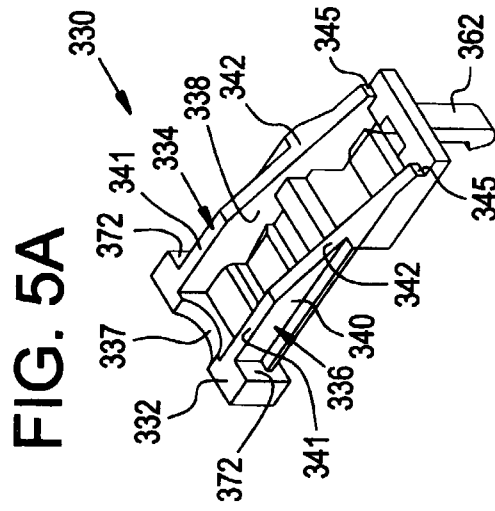
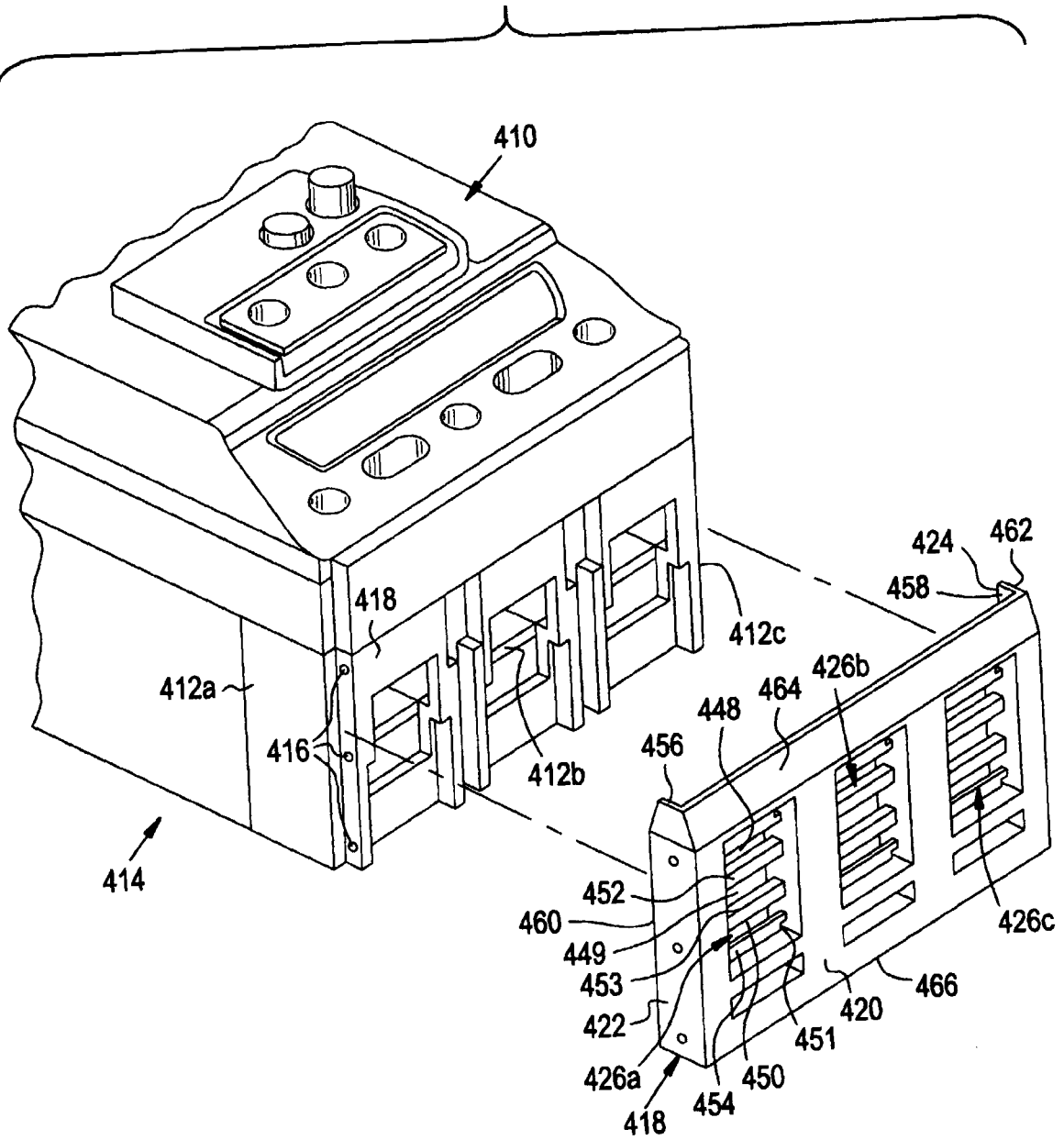


FIG. 6





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 5651

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)
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			H01H H01R H05K F16K F17C
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 8 November 2000	Examiner Marcolini, P
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82