US012394920B2

(12) **United States Patent**
Fabozzi et al.

(10) **Patent No.: US 12,394,920 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **SCREWLESS CONNECTION TERMINALS WITH WIRE MANAGER**

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(73) Assignee: **Hubbell Incorporated**, Shelton, CT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 340 days.

(21) Appl. No.: **17/953,067**

(22) Filed: **Sep. 26, 2022**

(65) **Prior Publication Data**

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Related U.S. Application Data

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(51) **Int. Cl.**
H01R 9/26 (2006.01)
H01R 4/48 (2006.01)

(52) **U.S. Cl.**
CPC ***H01R 9/26*** (2013.01); ***H01R 4/4833*** (2023.08); ***H01R 4/489*** (2013.01); *H01R 4/4816* (2023.08)

(58) **Field of Classification Search**
CPC H01R 4/4833; H01R 4/489; H01R 4/4816; H01R 24/30; H01R 24/78
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,994,880	A	3/1935	Wallbillich
2,015,858	A	10/1935	Leviton
2,082,994	A	6/1937	Wallbillich
2,163,722	A	6/1939	Wallbillich
2,175,098	A	10/1939	Wertzheiser
2,201,743	A	5/1940	Peterson

(Continued)

FOREIGN PATENT DOCUMENTS

CA	981354	1/1976
CA	1202095	3/1986

(Continued)

OTHER PUBLICATIONS

International Preliminary Report on Patentability in corresponding International Application No. PCT/US2022/044737 mailed on Apr. 11, 2024. (7 pages).

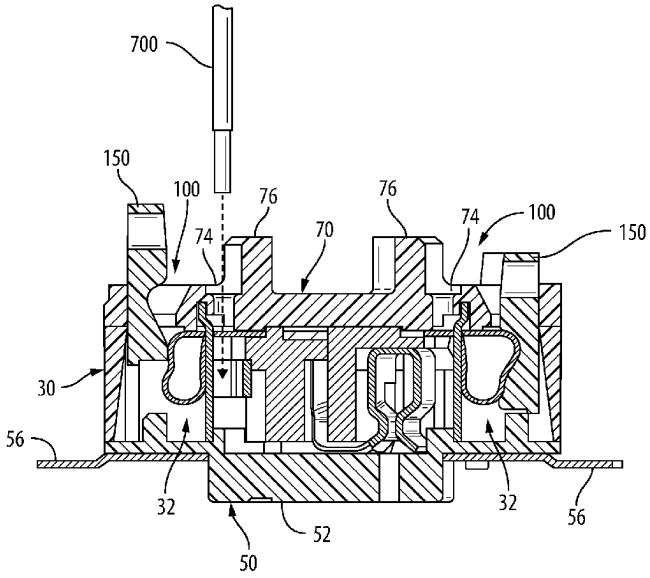
(Continued)

Primary Examiner — Jean F Duverne
(74) *Attorney, Agent, or Firm* — Wissing Miller LLP

(57) **ABSTRACT**

Electrical wiring devices that incorporate clamp-type wire terminal connections are described. The electrical wiring devices include for example, single and duplex blade-type electrical receptacles, blade-type locking electrical receptacles, single or multi-pole electrical switches, combination switches and blade-type receptacles, blade-type plugs for electrical cords and blade-type connectors for electrical cords. The electrical wiring devices include a plurality of contact assemblies. Each contact assembly includes a wire terminal having a wire manager and a plunger.

20 Claims, 35 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

2,201,751 A 5/1940 Wertzheiser
2,238,386 A 4/1941 Frank
2,463,033 A 3/1949 Harnett
2,466,930 A 4/1949 Cook
2,506,212 A 5/1950 Cook
2,556,491 A 6/1951 DeLorenzo
2,763,847 A 9/1956 Hubbell
2,952,831 A 9/1960 Ehrlich
3,431,546 A 3/1969 Averill
3,439,315 A 4/1969 Hamel et al.
3,660,728 A 5/1972 Carter
3,713,071 A 1/1973 Poliak et al.
3,740,613 A 6/1973 Strachan
3,793,607 A 2/1974 Smith et al.
3,891,293 A 6/1975 Jones
3,904,266 A 9/1975 Fitzpatrick
3,944,314 A 3/1976 Weitzman
3,945,711 A 3/1976 Hohorst et al.
3,999,829 A 12/1976 Glaesel
4,060,305 A 11/1977 Poliak et al.
4,099,826 A 7/1978 Mazzeo et al.
4,172,628 A 10/1979 Lingaraju
4,241,498 A 12/1980 Brandeau
4,255,655 A 3/1981 Kikuchi
4,296,987 A 10/1981 Lingaraju
4,372,693 A 2/1983 Lutz
4,537,560 A 8/1985 Emeterio et al.
4,748,431 A 5/1988 Saunders et al.
4,749,368 A 6/1988 Mouissie
4,759,726 A 7/1988 Naylor et al.
4,767,340 A 8/1988 Hohorst
4,768,981 A 9/1988 Hohorst
4,793,823 A 12/1988 Cozzens et al.
4,886,472 A 12/1989 Tsai
4,995,829 A 2/1991 Geib et al.
5,015,201 A 5/1991 Brezee et al.
5,057,649 A 10/1991 Ring
5,138,296 A 8/1992 Borchardt et al.
5,151,642 A 9/1992 Lombardi
5,181,310 A 1/1993 Josephson
5,262,749 A 11/1993 Kopelman
5,637,011 A 6/1997 Meyerhoefer et al.
5,685,735 A 11/1997 Hohorst
5,810,625 A 9/1998 Klein
5,825,602 A 10/1998 Tosaka et al.
5,866,844 A 2/1999 Osterbrock et al.
5,975,938 A 11/1999 Libby
5,975,940 A 11/1999 Hartmann et al.
5,995,350 A 11/1999 Kopelman
6,049,143 A 4/2000 Simpson et al.
6,146,217 A 11/2000 Osada
6,172,586 B1 1/2001 Ferree et al.
6,336,824 B1 1/2002 Sorig
6,368,149 B1 4/2002 Schmidt et al.
6,388,216 B1 5/2002 Puhalla et al.
6,406,323 B2 6/2002 Chung Long Shan
6,474,678 B1 11/2002 Ryan
6,477,021 B1 11/2002 Haun et al.
6,689,955 B2 2/2004 Doutaz
6,707,652 B2 3/2004 Engel
6,712,641 B2 3/2004 Beege et al.
6,743,029 B1 6/2004 Greene et al.
6,750,402 B2 6/2004 Geske
6,786,779 B2 9/2004 Feldmeier et al.
6,802,747 B1 10/2004 Orange
6,814,608 B2 11/2004 Kollmann
6,827,602 B2 12/2004 Greene et al.
6,861,189 B1 3/2005 Greene et al.
6,893,286 B2 5/2005 Drewes et al.
6,926,543 B2 8/2005 Poh et al.
6,943,310 B2 9/2005 Eisenhower
6,948,846 B2 9/2005 Engel
7,052,335 B2 5/2006 Matsuura et al.
7,097,518 B2 8/2006 Kraemer et al.
7,103,968 B2 9/2006 Karrasch
7,114,986 B1 10/2006 Toly
7,115,001 B1 10/2006 Brockman et al.
7,118,404 B2 10/2006 Ploesser
7,140,887 B2 11/2006 Poh et al.
7,150,646 B2 12/2006 Trumper
7,164,082 B2 1/2007 Kurek
7,175,485 B1 2/2007 Alderson et al.
7,241,188 B2 7/2007 Lin et al.
7,249,963 B2 7/2007 Ramm
7,270,581 B2 9/2007 Tiberio
7,507,106 B2 3/2009 Keswani et al.
7,544,103 B2 6/2009 Walter et al.
7,547,226 B2 6/2009 Koessler
7,651,363 B2 1/2010 Koellmann
7,704,106 B2 4/2010 Koellmann
7,815,463 B2 10/2010 Gerberding
7,845,970 B2 12/2010 Stromiedel
7,909,664 B2 3/2011 Ilkhanov
7,963,812 B2 6/2011 Ilkhanov
8,047,883 B2 11/2011 Montalbano et al.
8,137,145 B2 3/2012 Joy
8,251,738 B2 8/2012 Heckert et al.
8,292,677 B2 10/2012 Gassauer
8,328,588 B2 12/2012 Ramm et al.
8,388,387 B2 3/2013 Koellmann
8,408,952 B2 4/2013 Wu
8,480,424 B2 7/2013 Koellmann et al.
8,535,084 B2 9/2013 Koellmann
8,632,355 B2 1/2014 Hartmann
8,794,994 B2 8/2014 Koellmann et al.
8,998,634 B2 4/2015 Koellmann
9,124,034 B2 9/2015 Koellmann et al.
9,130,285 B2 9/2015 Scanzillo et al.
9,209,530 B2 12/2015 Gassauer et al.
9,287,638 B2 3/2016 Germani
9,413,082 B2 8/2016 Gassauer
9,466,895 B2 10/2016 Kollmann et al.
9,466,911 B1 10/2016 Wu
9,478,874 B2 10/2016 Stolze
9,502,790 B2 11/2016 Kollmann et al.
9,525,219 B2 12/2016 Kollmann et al.
9,543,700 B2 1/2017 Kollmann et al.
9,601,844 B2 3/2017 Gassauer et al.
9,614,301 B2 4/2017 Ludewig et al.
9,614,302 B2 4/2017 Harwath et al.
9,761,964 B2 9/2017 Meyer
9,842,408 B2 12/2017 Milne et al.
10,131,061 B2 11/2018 Krans et al.
10,141,674 B2 11/2018 Scanzillo et al.
10,427,201 B2 10/2019 Bungter et al.
10,431,950 B2 10/2019 Rzasa et al.
10,461,444 B2 10/2019 Scanzillo et al.
10,630,036 B2 4/2020 Rzasa et al.
10,637,165 B2 4/2020 Scanzillo et al.
10,965,042 B2 3/2021 Scanzillo et al.
10,992,067 B2 4/2021 Geske et al.
11,063,396 B2 7/2021 Iaconis et al.
11,495,895 B2 11/2022 Scanzillo et al.
11,563,281 B2 1/2023 Scanzillo et al.
2004/0077210 A1 4/2004 Kollmann
2004/0248457 A1 12/2004 Walter
2005/0042912 A1 2/2005 Drewes et al.
2005/0090159 A1 4/2005 Luther et al.
2005/0212646 A1 9/2005 Watchorn et al.
2006/0028316 A1 2/2006 Fabian et al.
2006/0288140 A1 12/2006 Lin
2007/0006558 A1 1/2007 Ramm
2007/0026701 A1 2/2007 Kurek et al.
2007/0207662 A1 9/2007 Germani
2007/0238348 A1 10/2007 Kopelman
2010/0186234 A1 7/2010 Binder
2010/0304596 A1 12/2010 Ilkhanov
2010/0304597 A1 12/2010 Ilkhanov
2011/0207361 A1 8/2011 Heckert et al.
2014/0227914 A1 8/2014 Tedeschi
2015/0257636 A1 9/2015 Kohler
2015/0314434 A1 11/2015 Bevins, Jr.
2018/0198216 A1* 7/2018 Scanzillo H01R 4/4833
2019/0160643 A1 5/2019 Lefavour et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2019/0221951	A1	7/2019	Lotkemann et al.	
2020/0235541	A1	7/2020	Rzasa	
2021/0203087	A1	7/2021	Scanzillo et al.	
2023/0024505	A1*	1/2023	Scanzillo	H01R 4/48365

FOREIGN PATENT DOCUMENTS

CA	1203591		4/1986
CA	2939110		8/2015
CA	2996306		3/2017
CN	101051711	A	10/2007
CN	201233969		5/2009
CN	101807756		8/2010
CN	202564566		11/2012
CN	103606765		2/2014
CN	103682774		3/2014
CN	103840294		6/2014
CN	205004486		1/2016
CN	205016755		2/2016
DE	102015119247		5/2017
EP	0131425		2/1991
EP	1553660		7/2005
EP	1490928		10/2005
EP	1608039		12/2005
FR	2312767		12/1976
GB	2272799		5/1994
GB	2292850		3/1996
GB	2393043		3/2004
JP	61014529		1/1986
WO	97003480		1/1997
WO	2017035469		3/2017
WO	2017035518		3/2017
WO	2017125441		7/2017

OTHER PUBLICATIONS

Wago Cage Clamp Tech Brochure Sep. 2010 (22 pages).
Marinco Power Products, Straight Blade Clamp-Lock (TM) Devices (15A & 20A), 2016 (3 pages).
Lex_Connector_Power_Conn_Brochure_2019_(12pgs).
International Search Report and Written Opinion mailed Dec. 28, 2022 in corresponding PCTU.S. Pat. No. 2022044737 (8 pages).

* cited by examiner

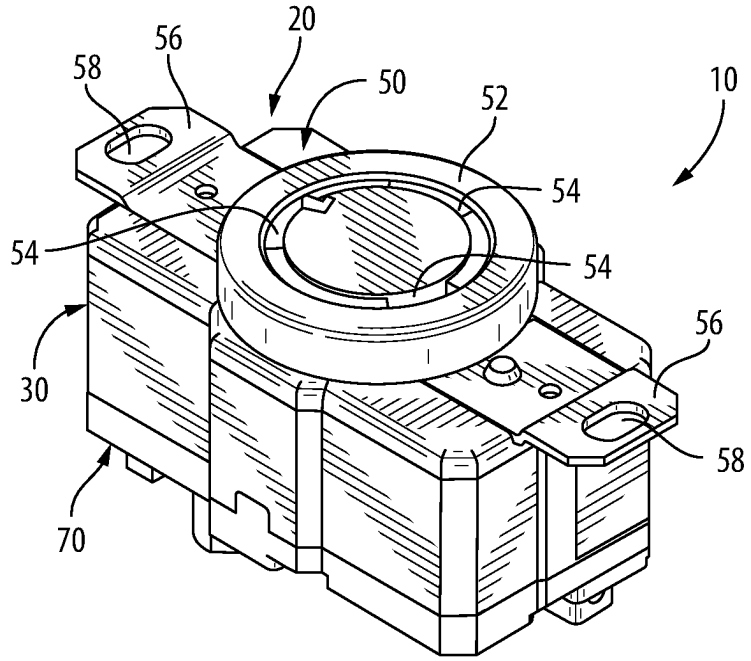

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FIG. 1

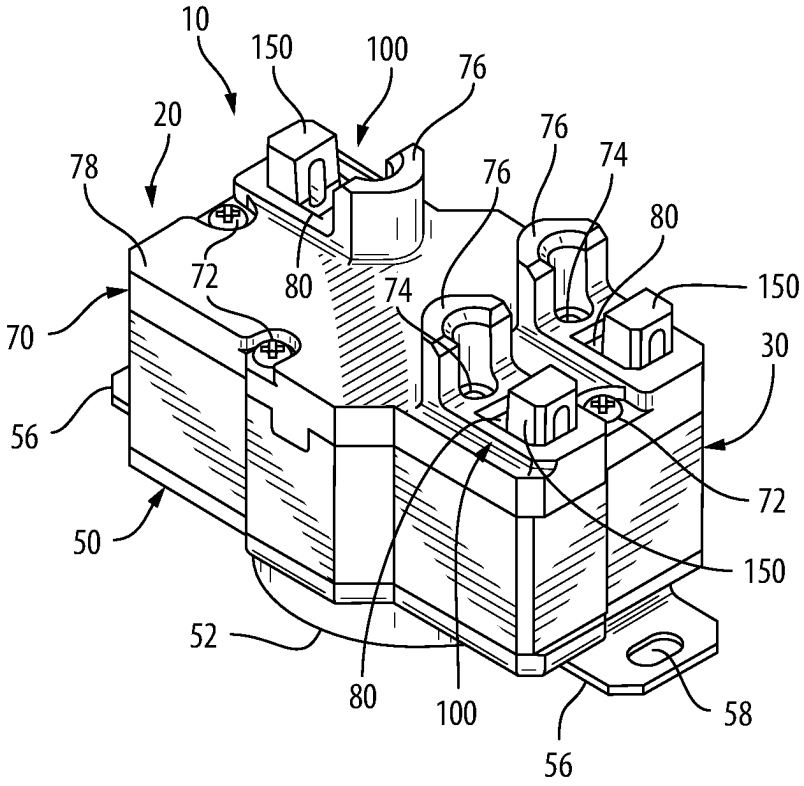
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FIG. 2

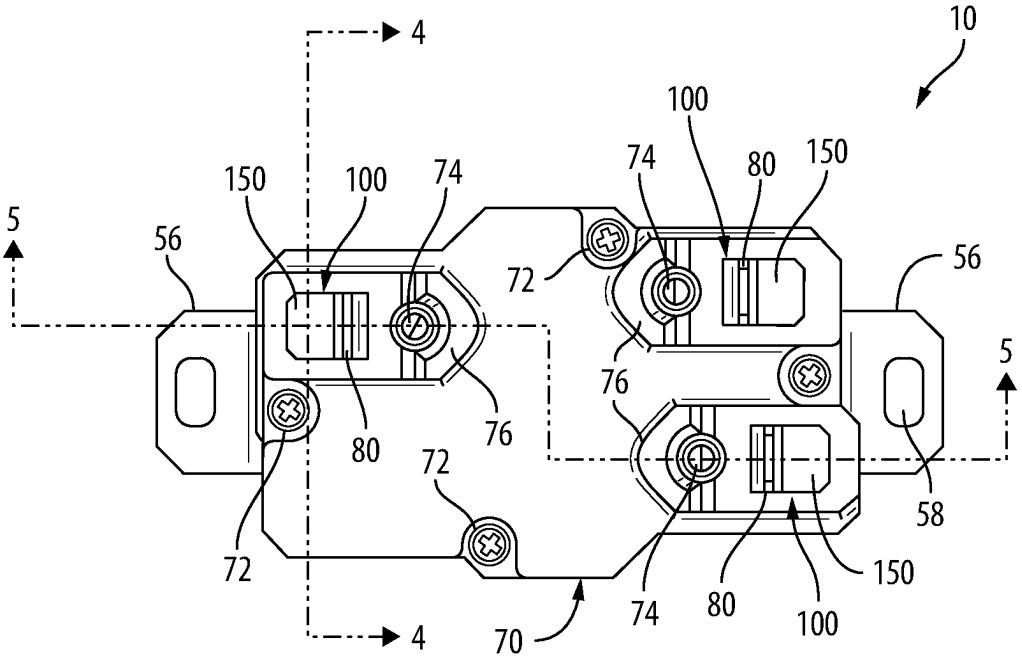
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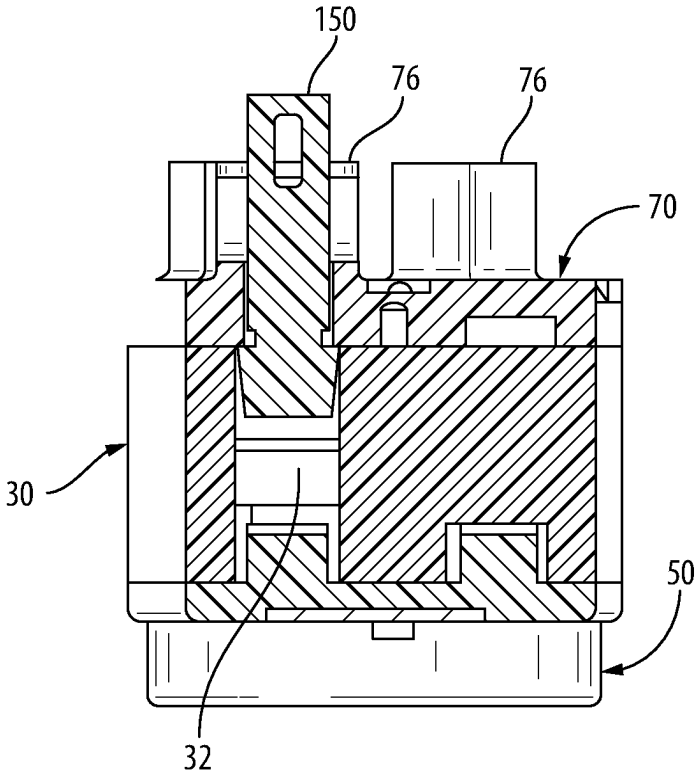
FIG. 3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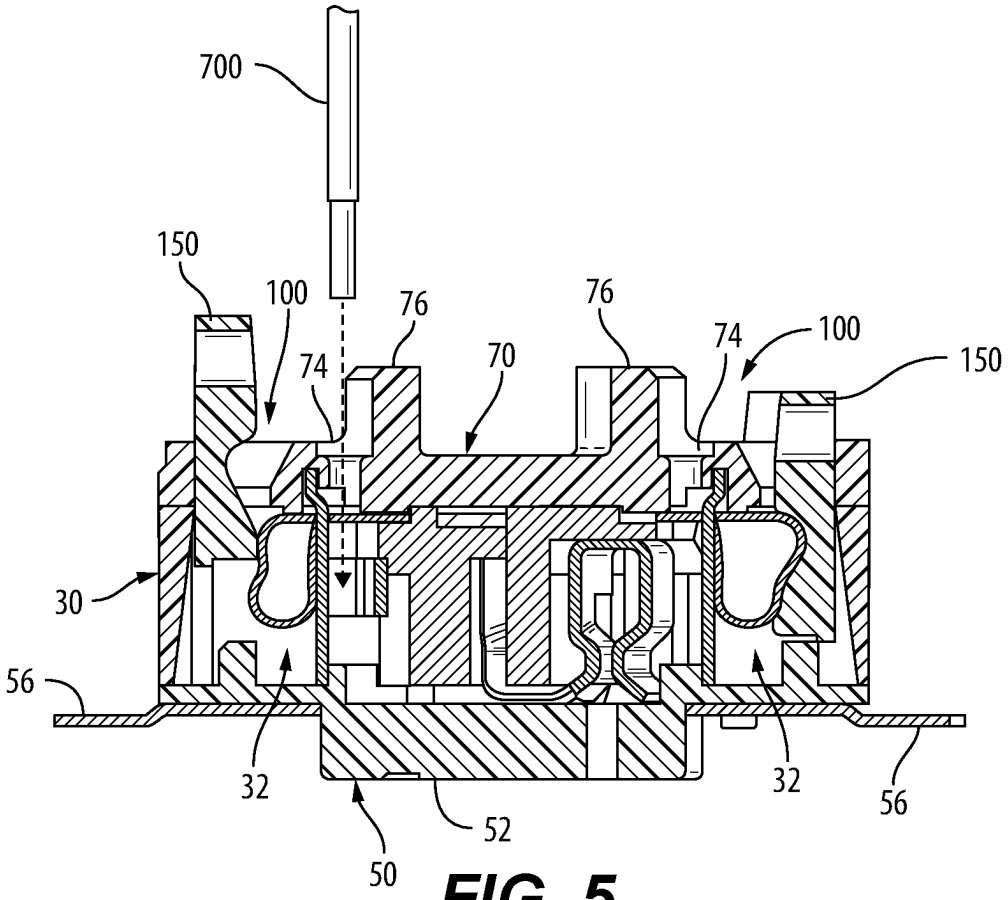
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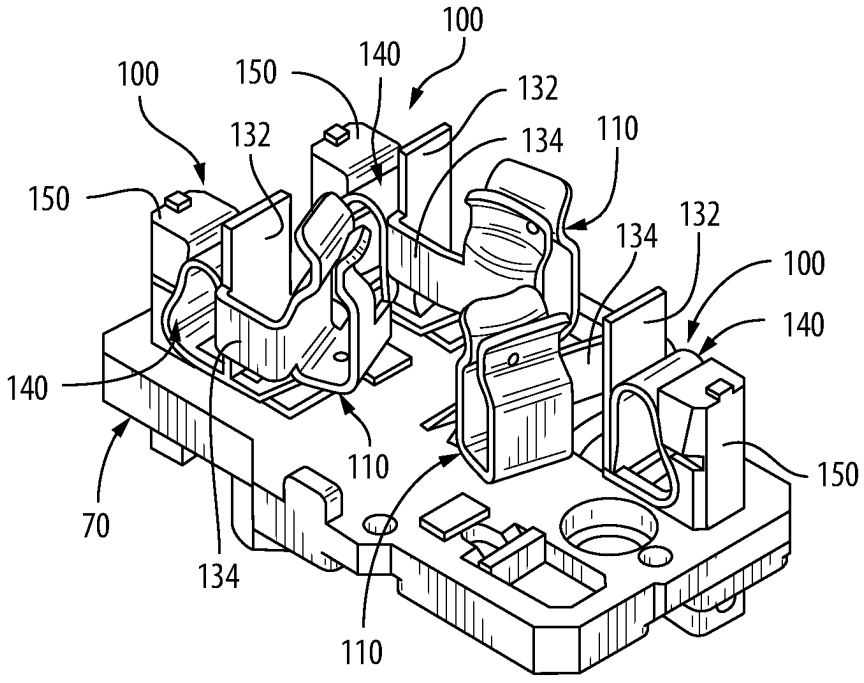
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FIG. 6

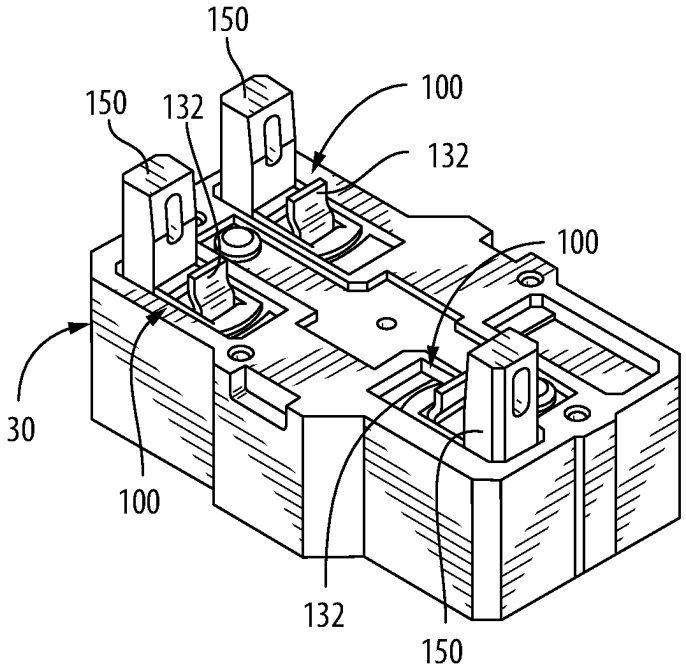
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FIG. 7

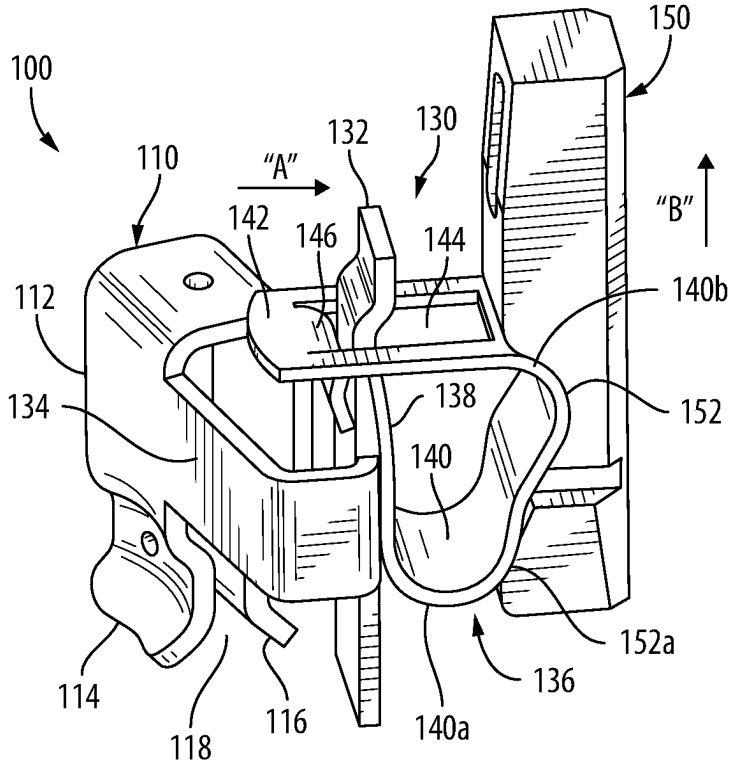
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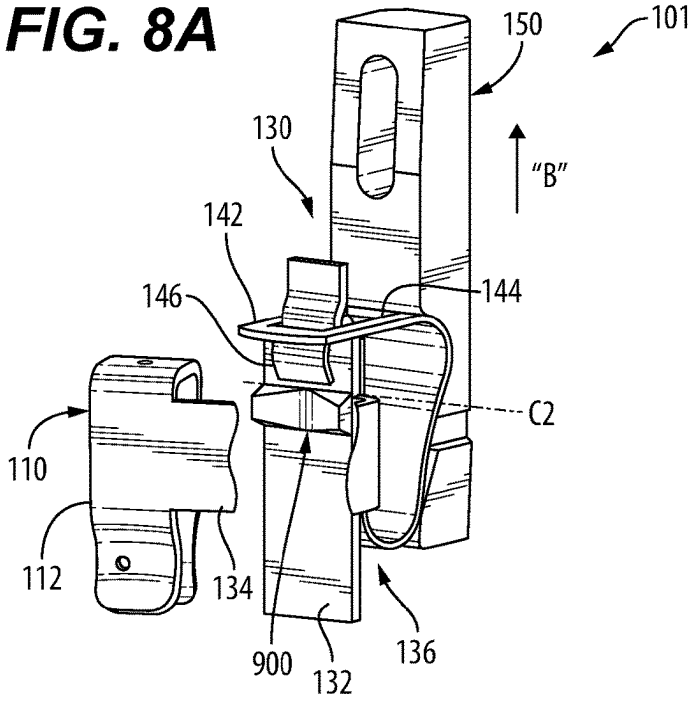
FIG. 8

FIG. 8A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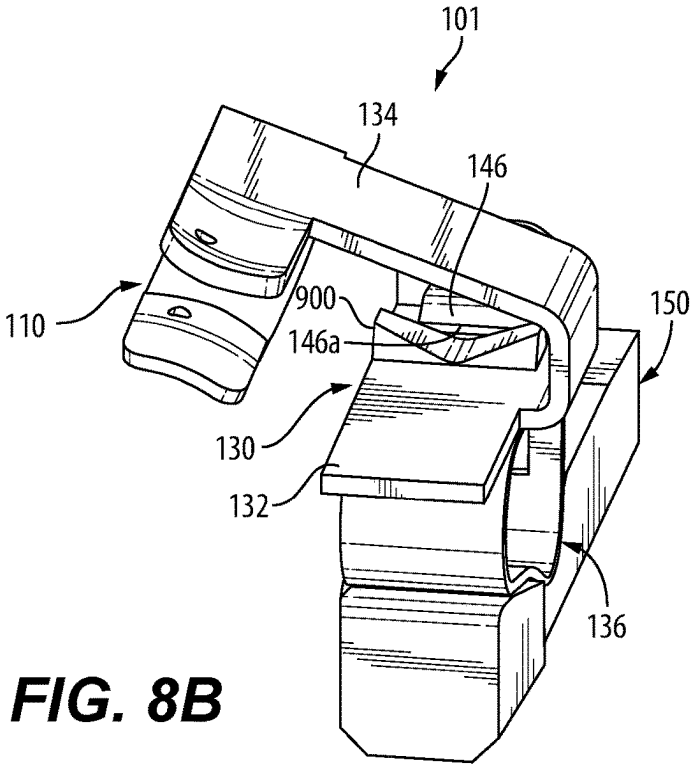
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FIG. 8B

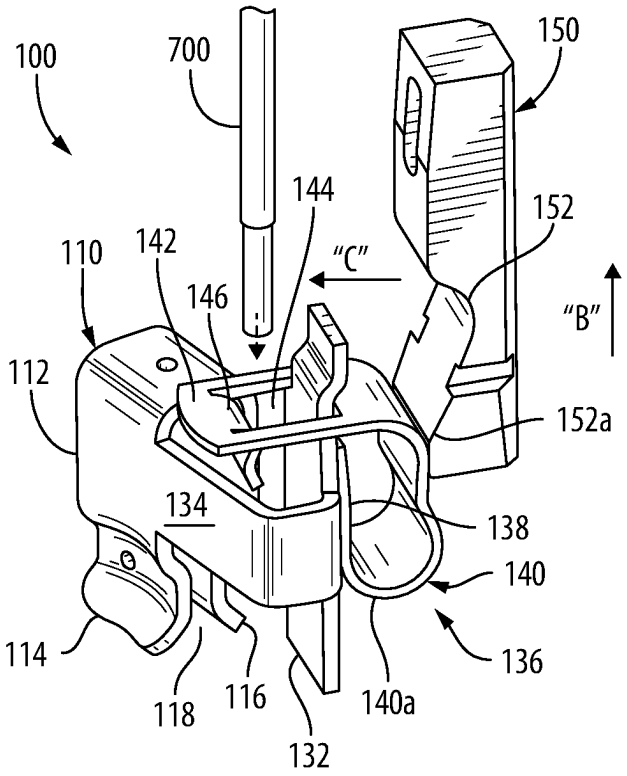
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FIG. 9

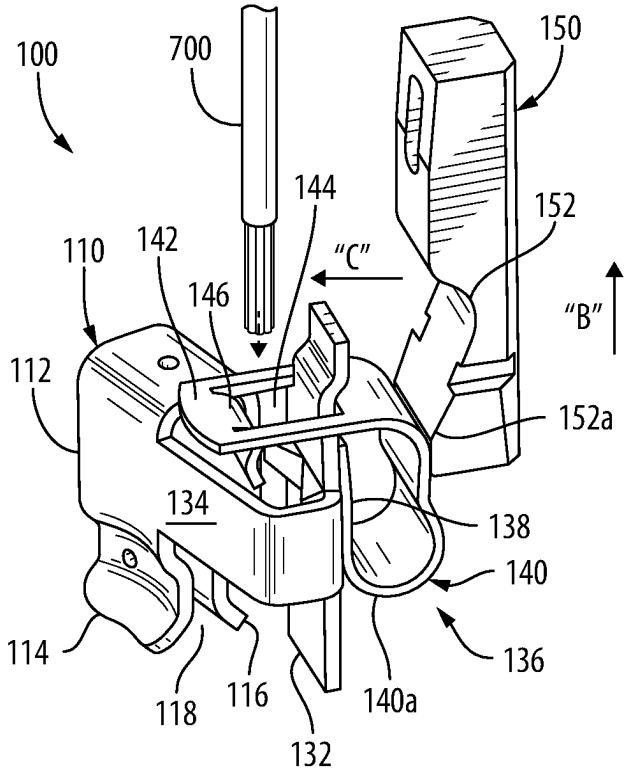
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FIG. 9A

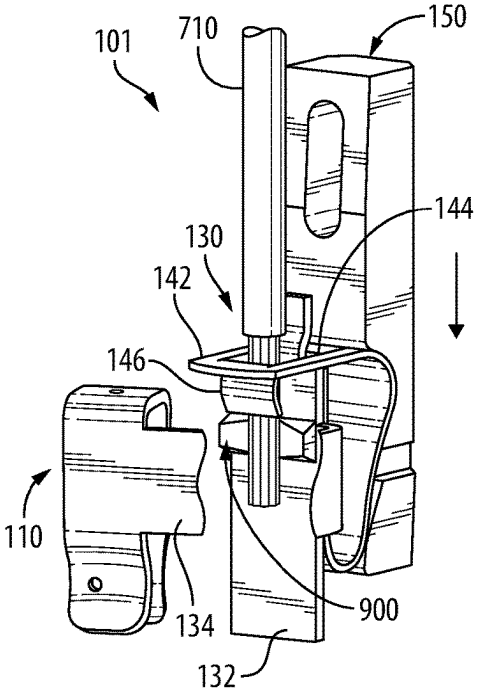


FIG. 9B

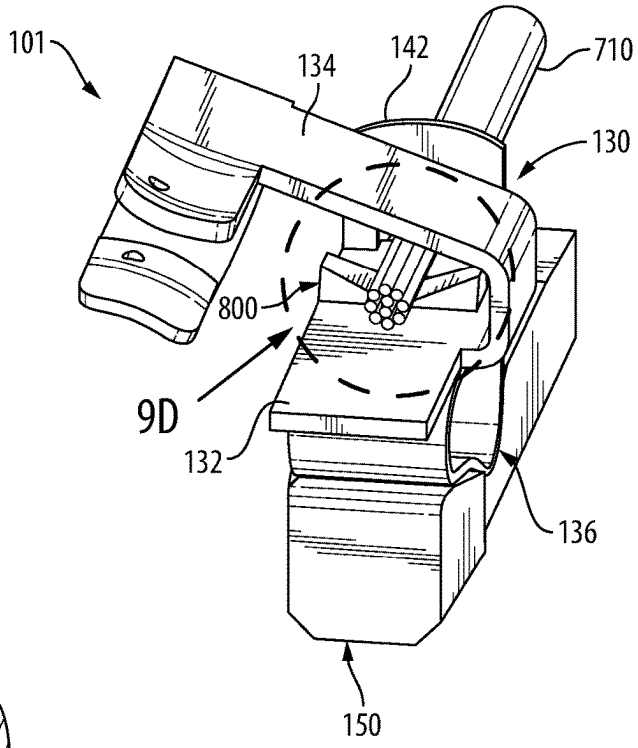


FIG. 9C

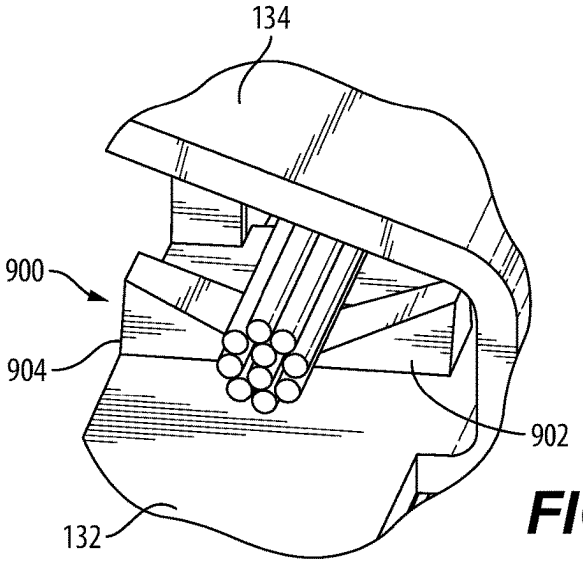
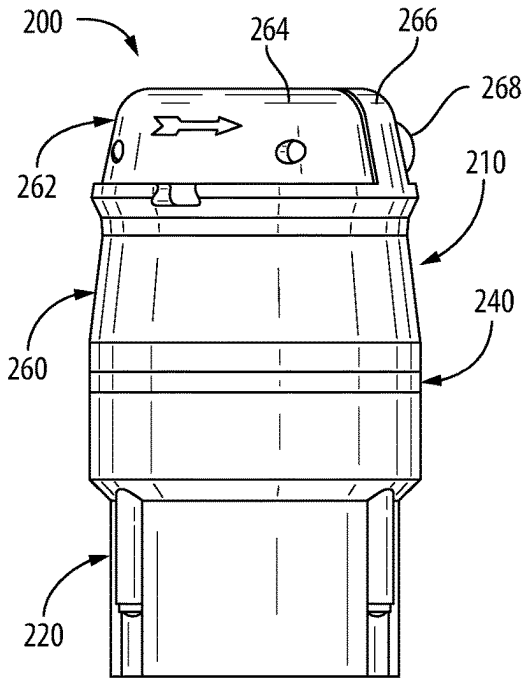


FIG. 9D



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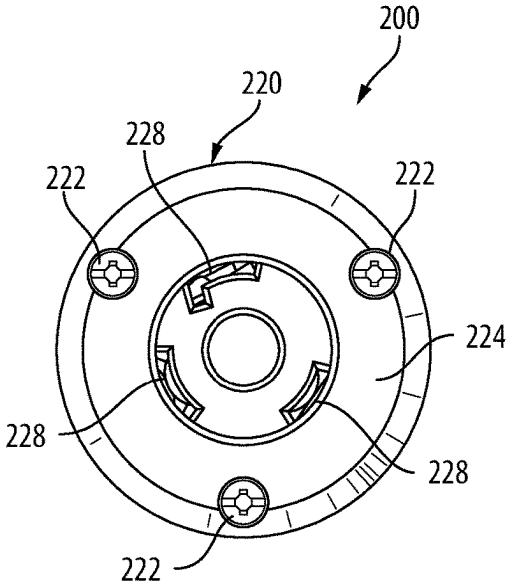
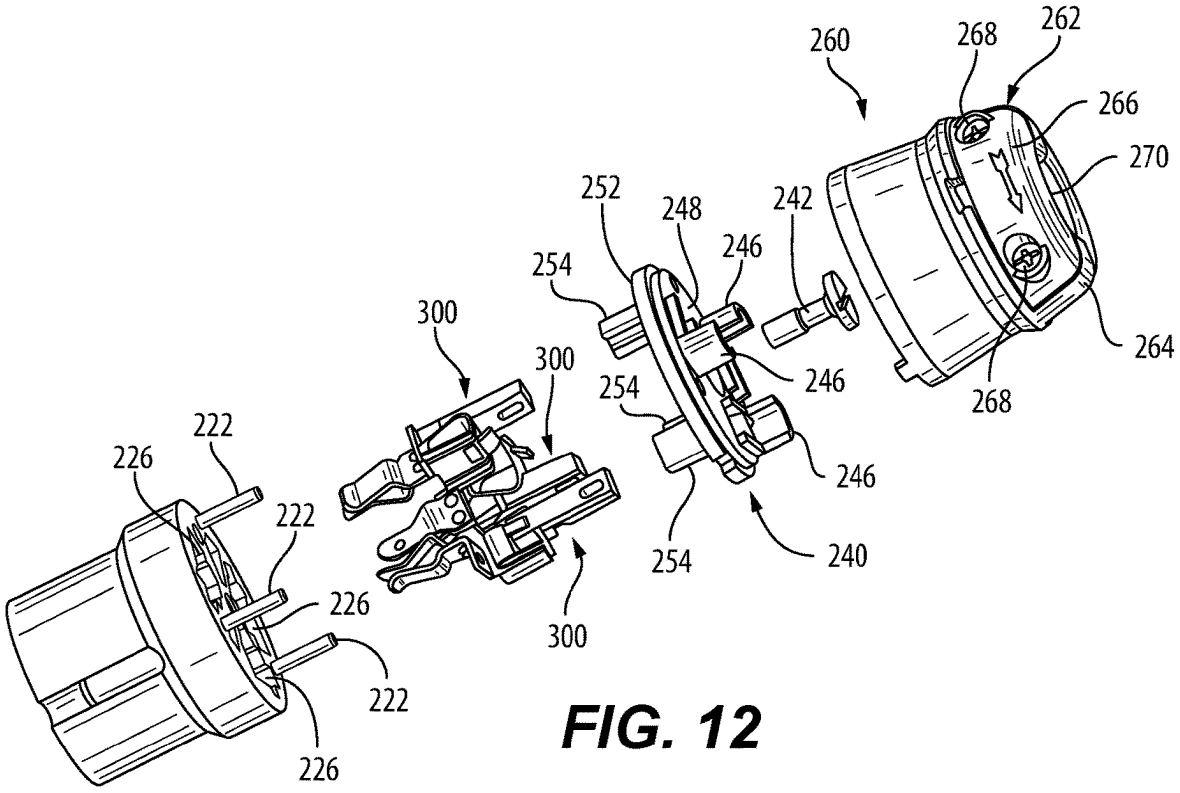


FIG. 11



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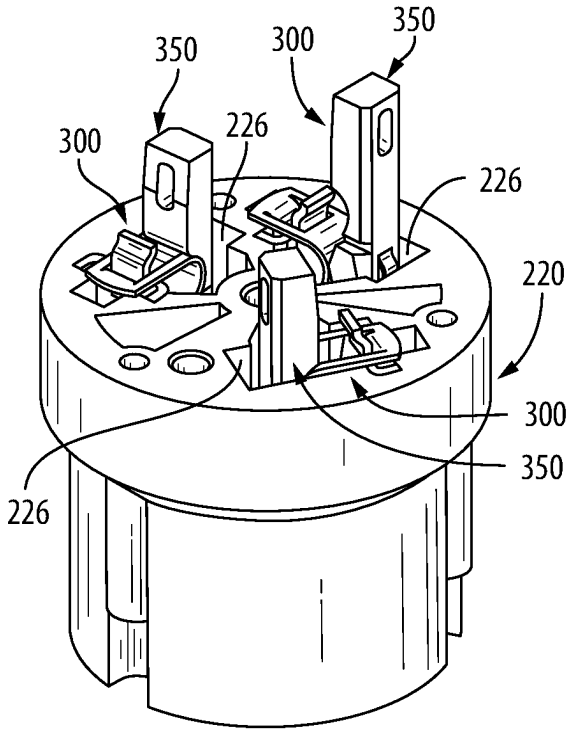
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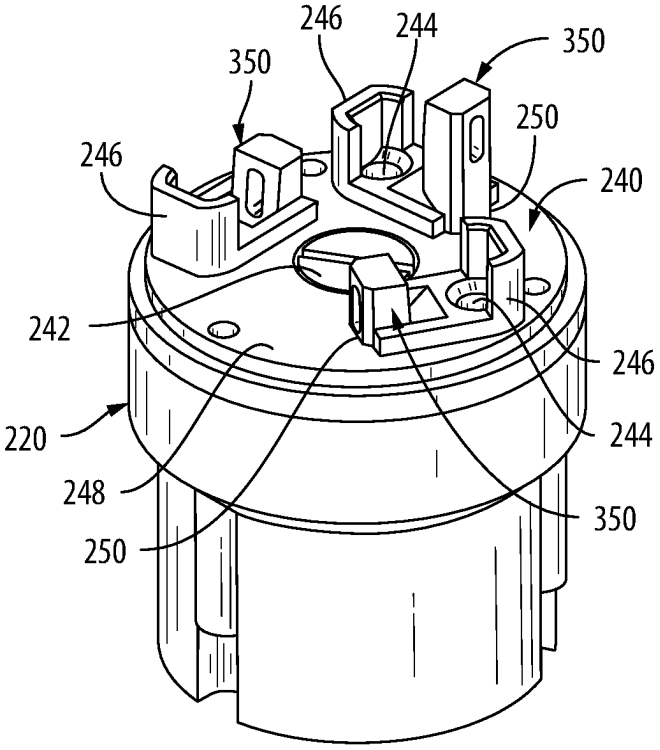
FIG. 13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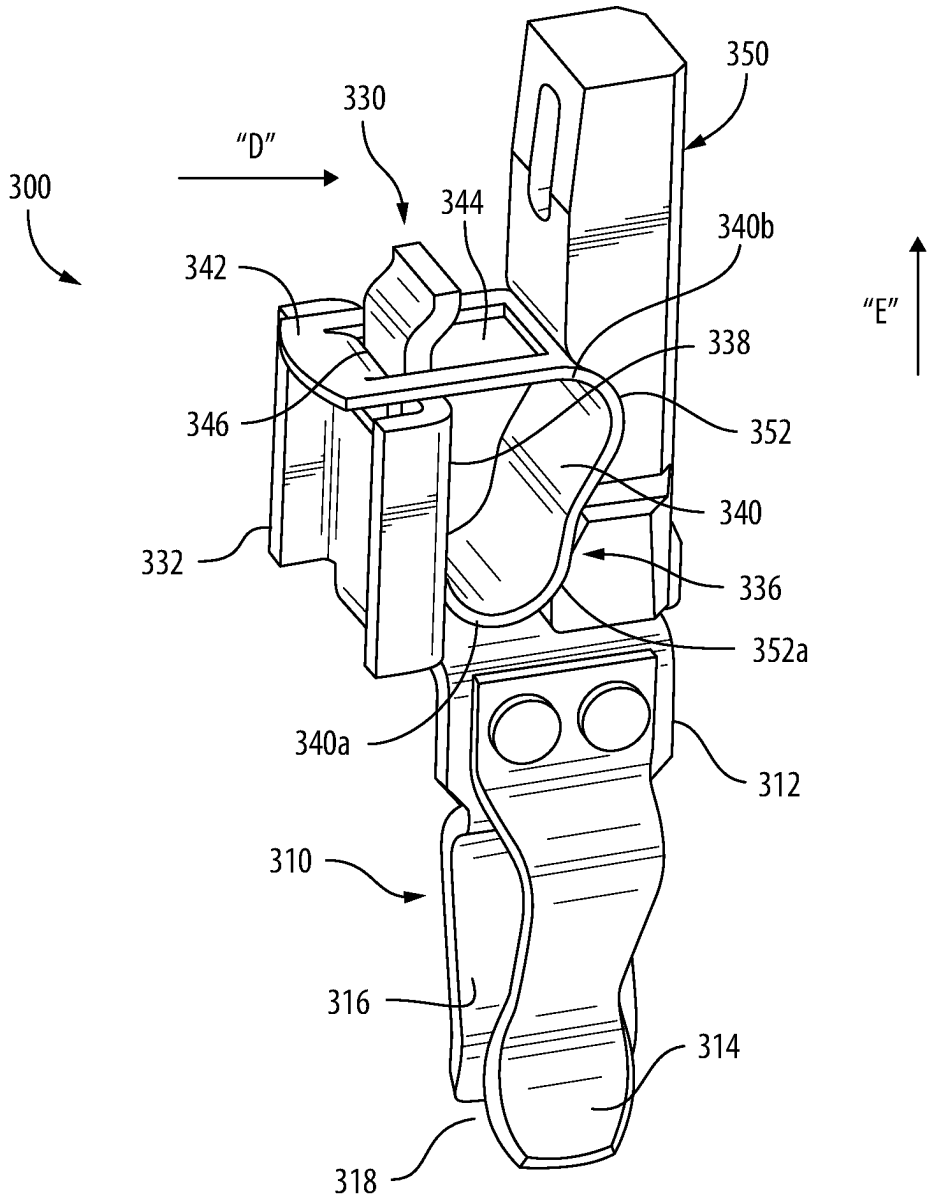
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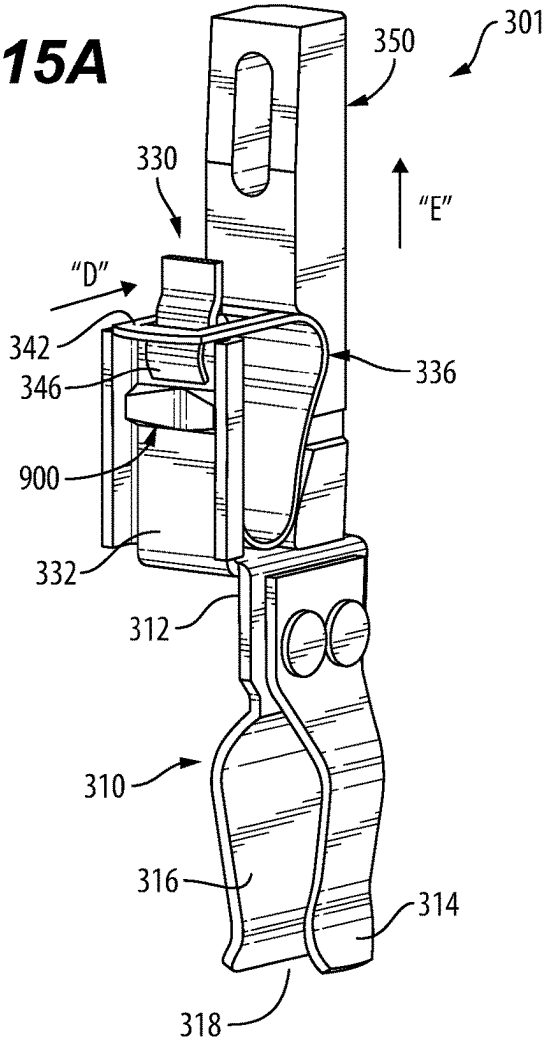
FIG. 15

FIG. 15A



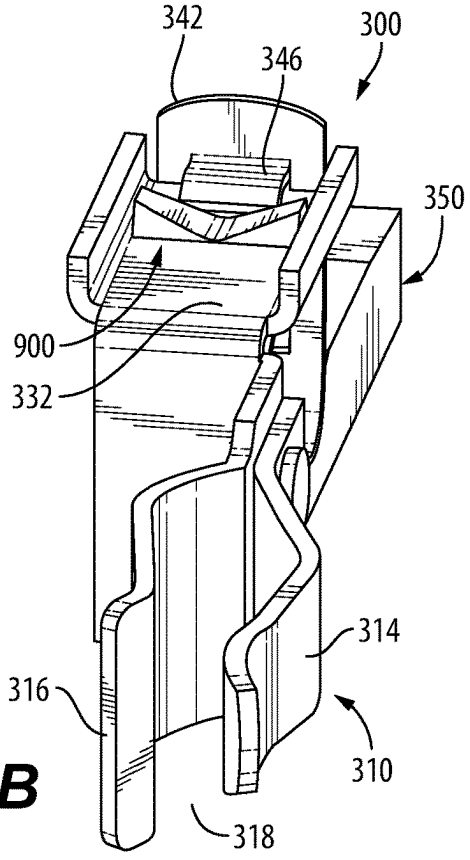


FIG. 15B

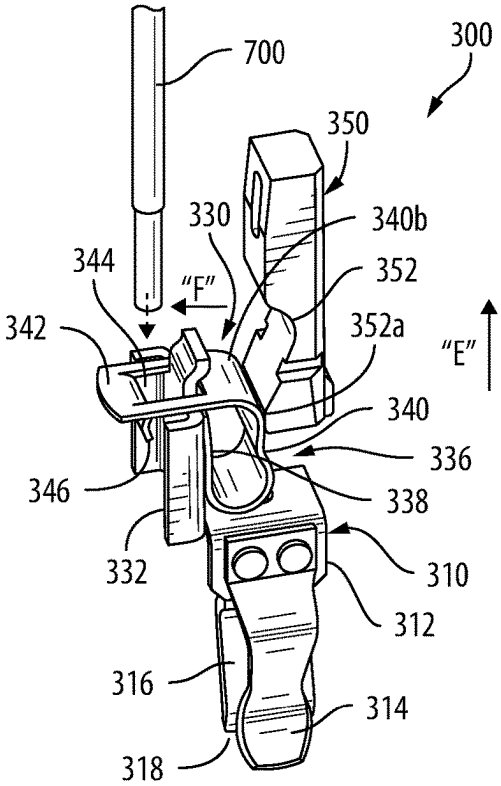


FIG. 16

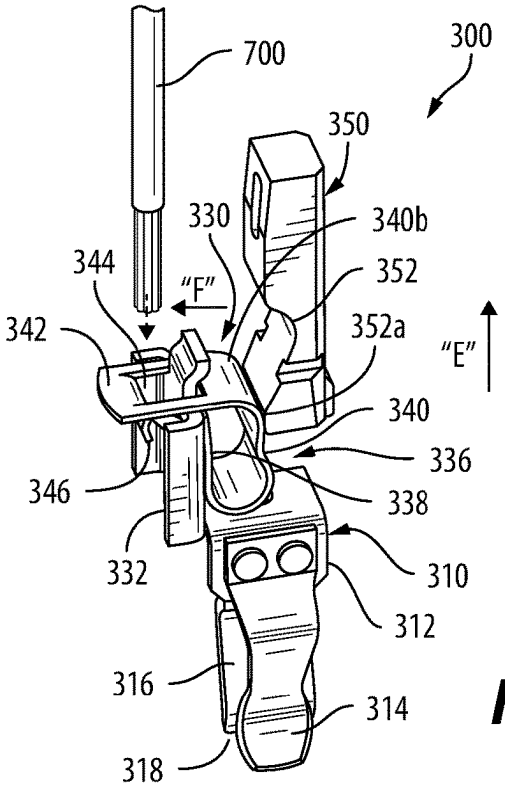


FIG. 16A

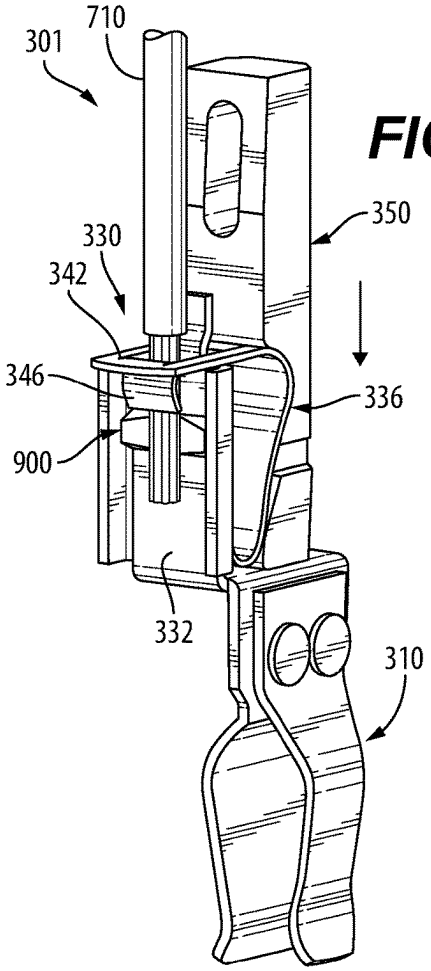


FIG. 16B

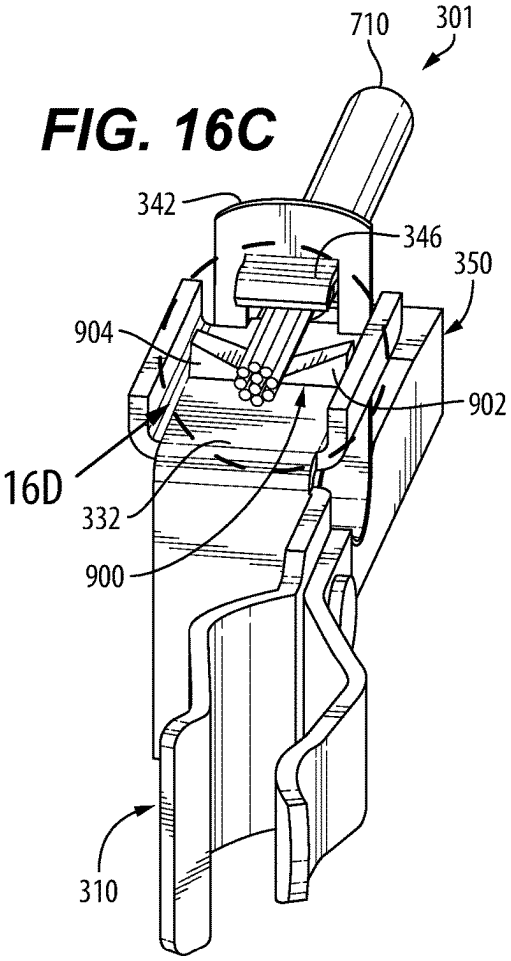


FIG. 16C

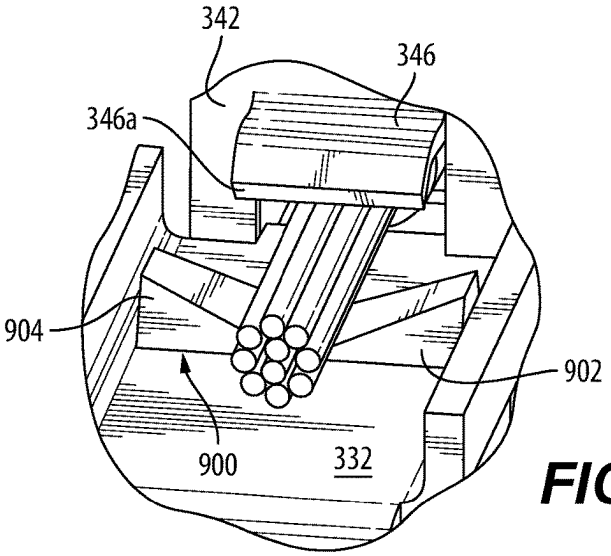
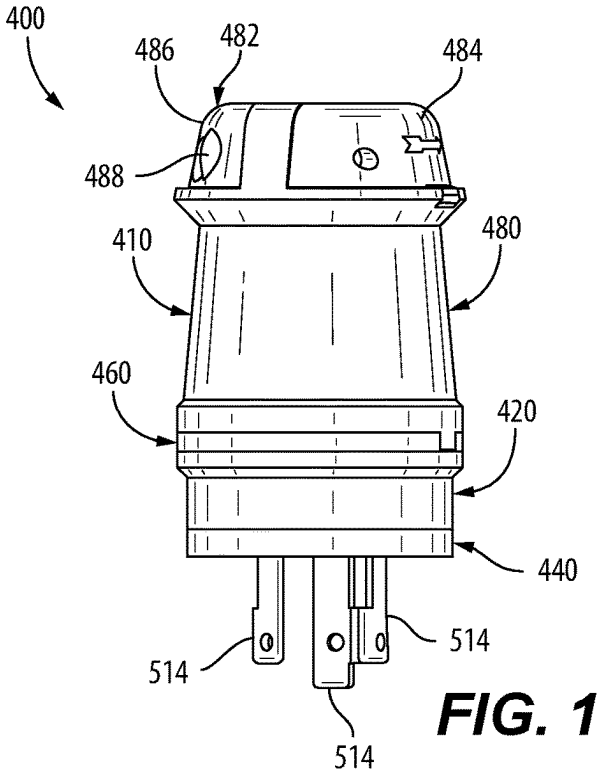


FIG. 16D


400
486
482
484
488
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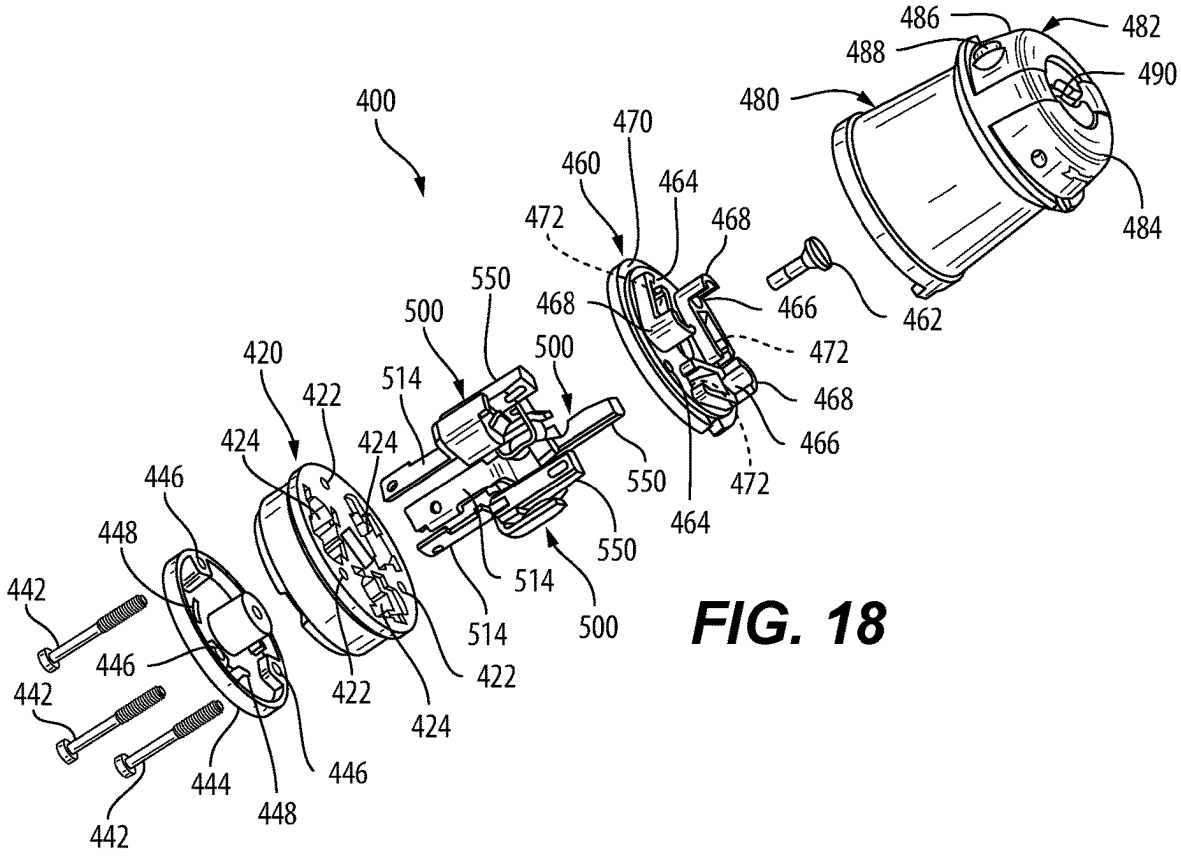
410
460
420
440
514
514
514

FIG. 17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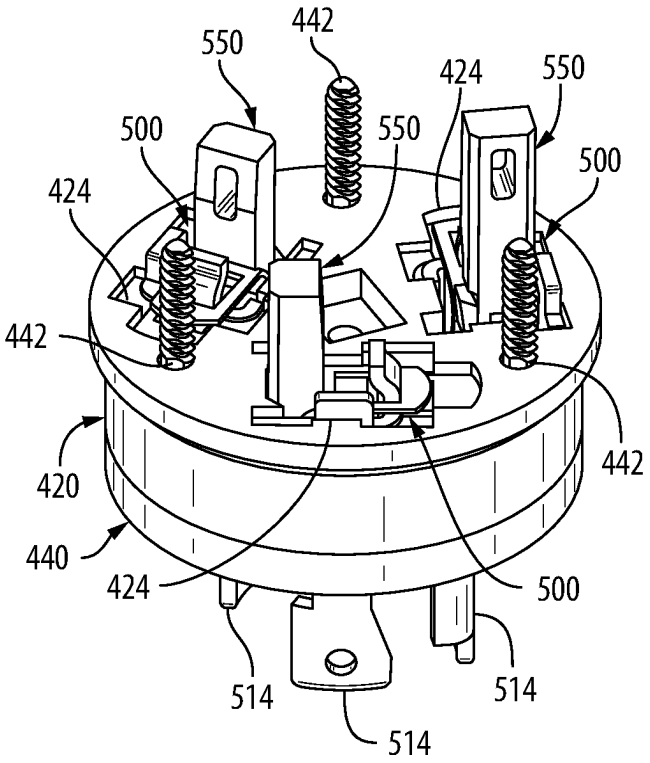
424
446
448
442
444

FIG. 18


442
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424
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442
420
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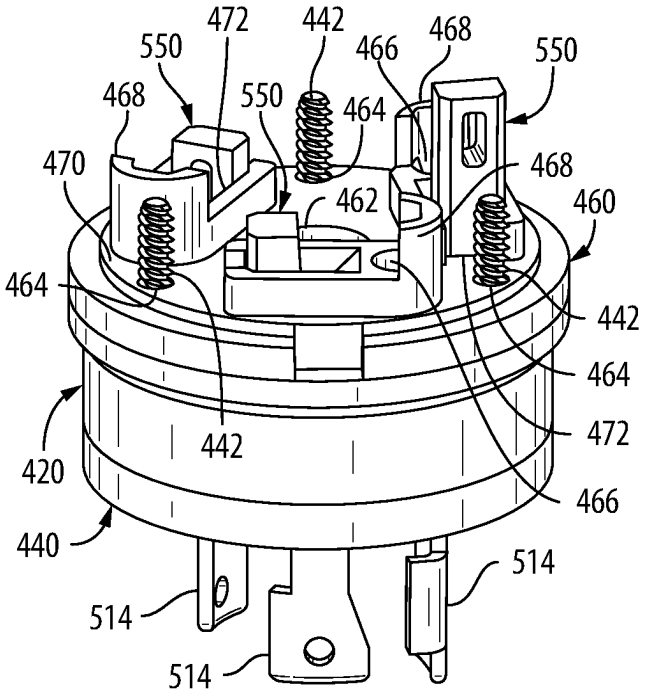
FIG. 19


472
442
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466
468
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420
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514

FIG. 20

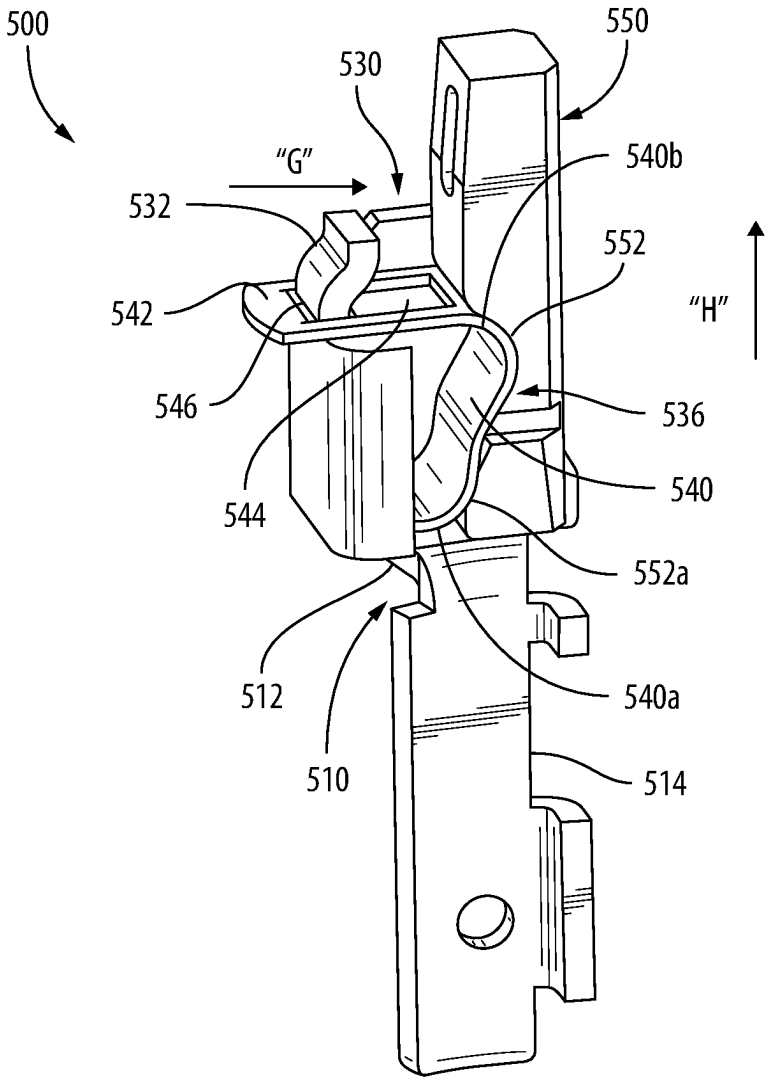
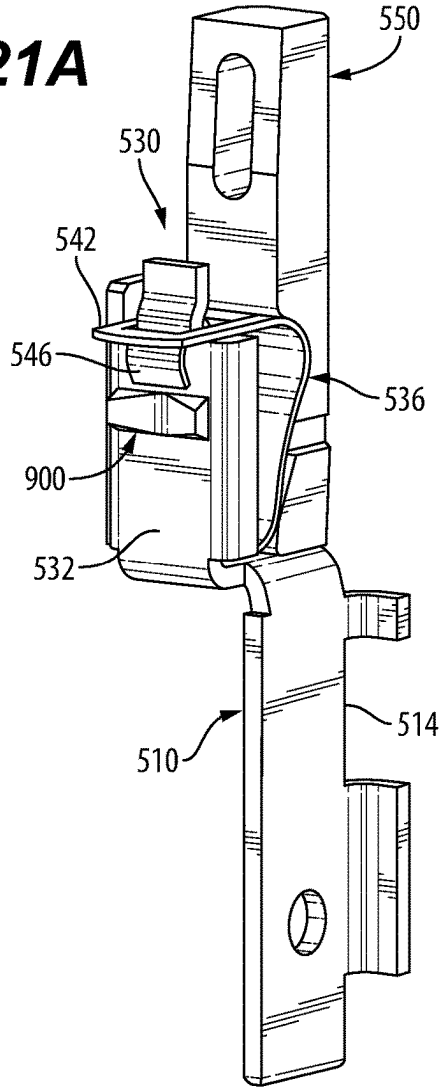

500
550
530
"G"
540b
532
552
542
"H"
546
536
540
544
552a
512
540a
510
514

FIG. 21

FIG. 21A



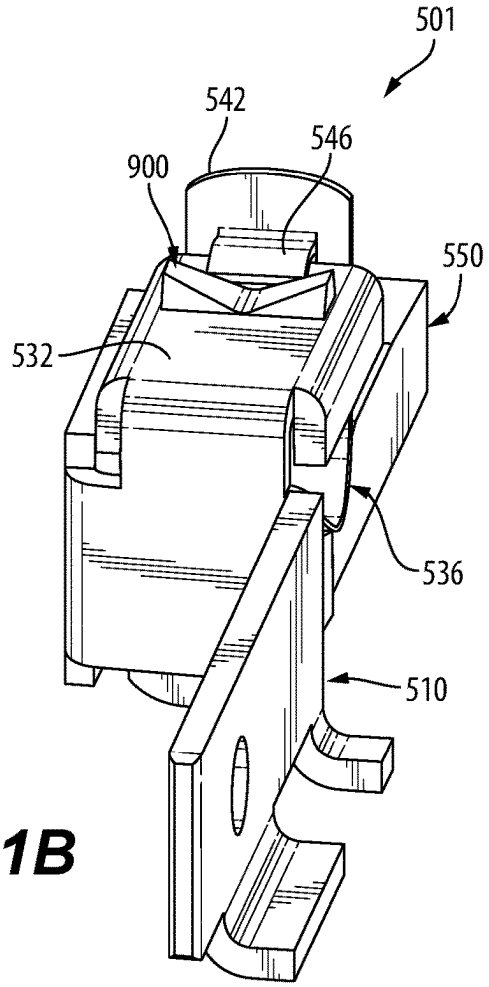


FIG. 21B

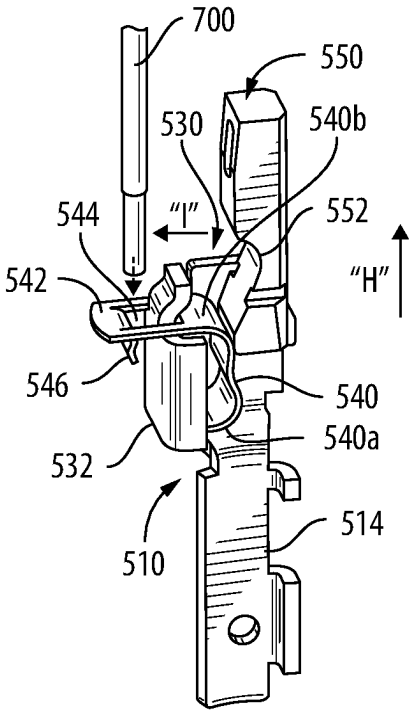


FIG. 22

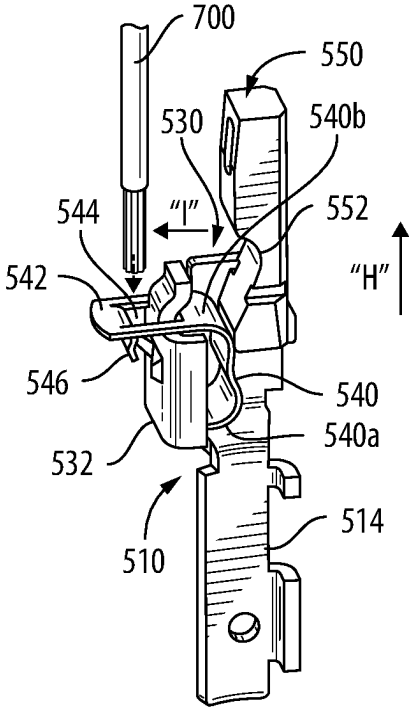


FIG. 22A

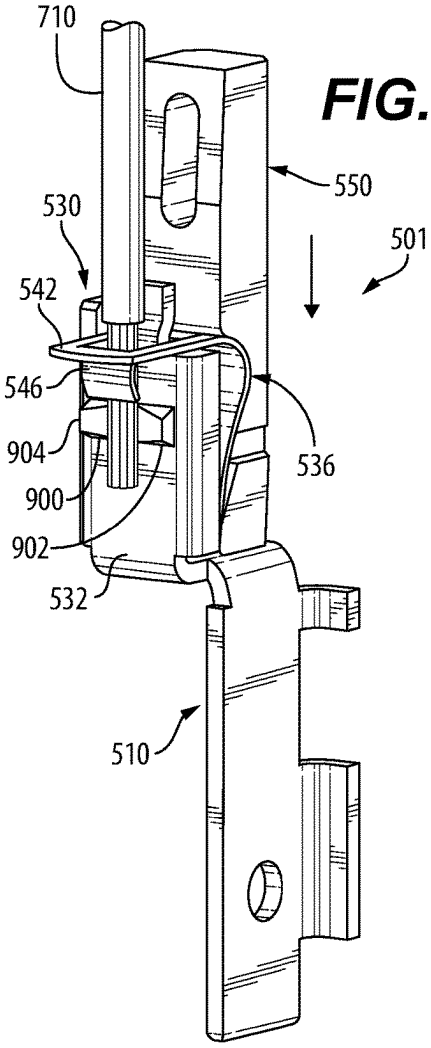


FIG. 22B

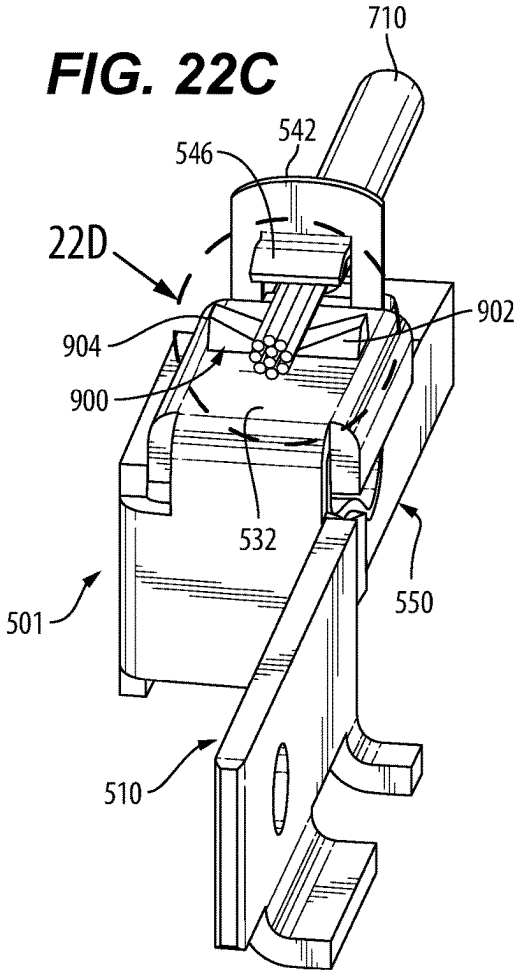


FIG. 22C

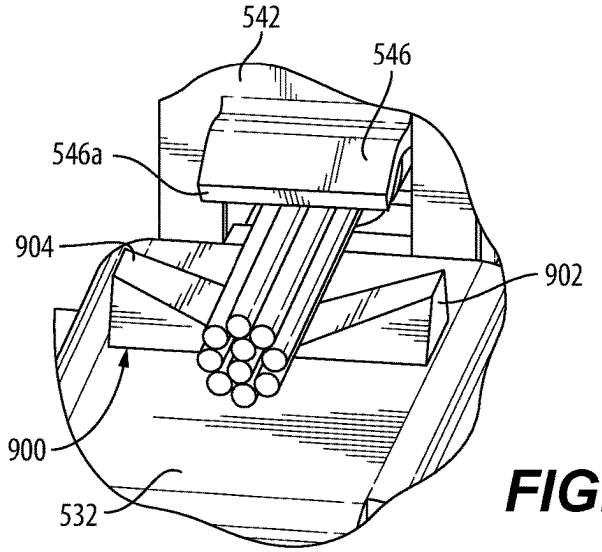


FIG. 22D

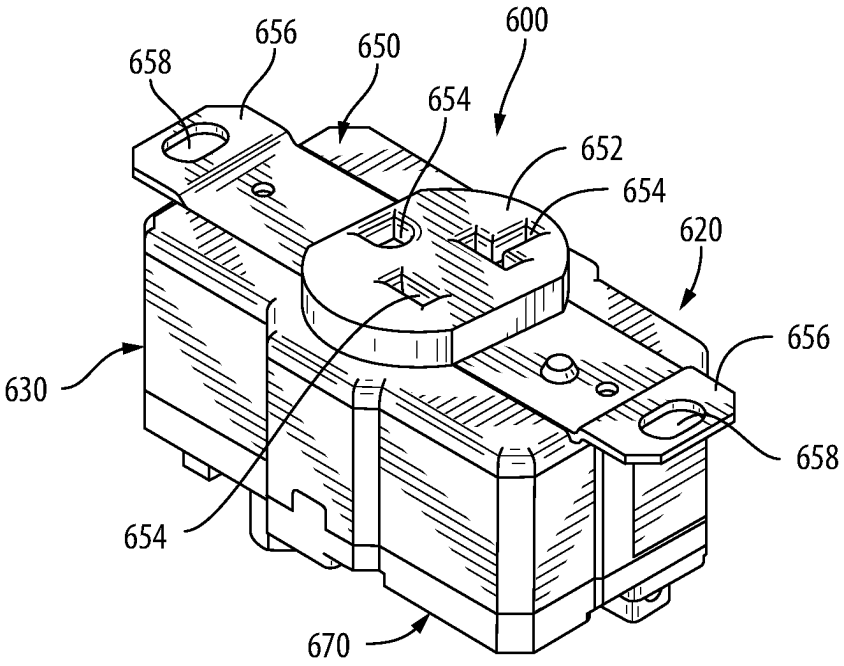
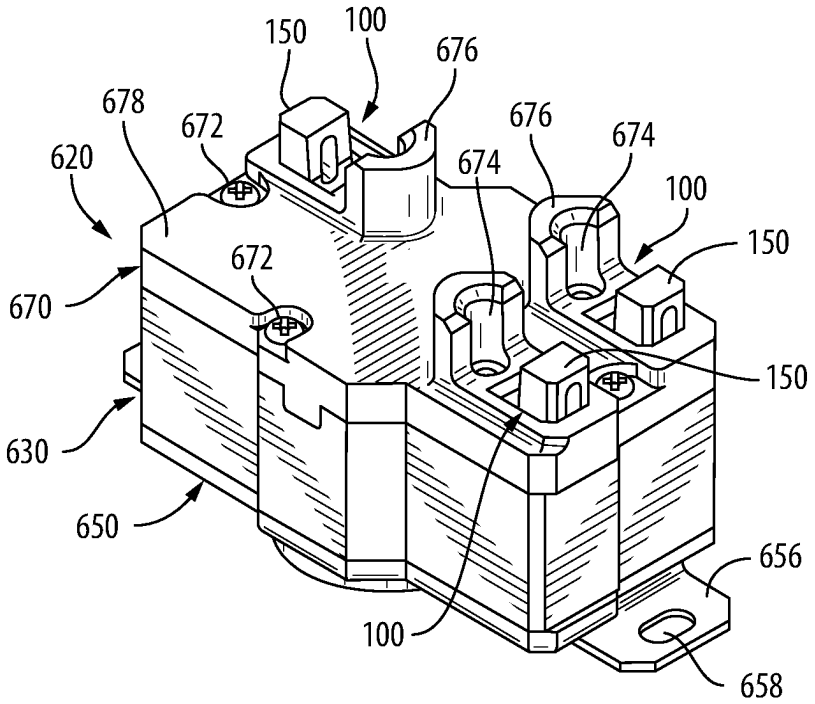

658
656
650
600
654
652
654
620
656
630
658
654
670

FIG. 23


150
100
676
678
672
676
674
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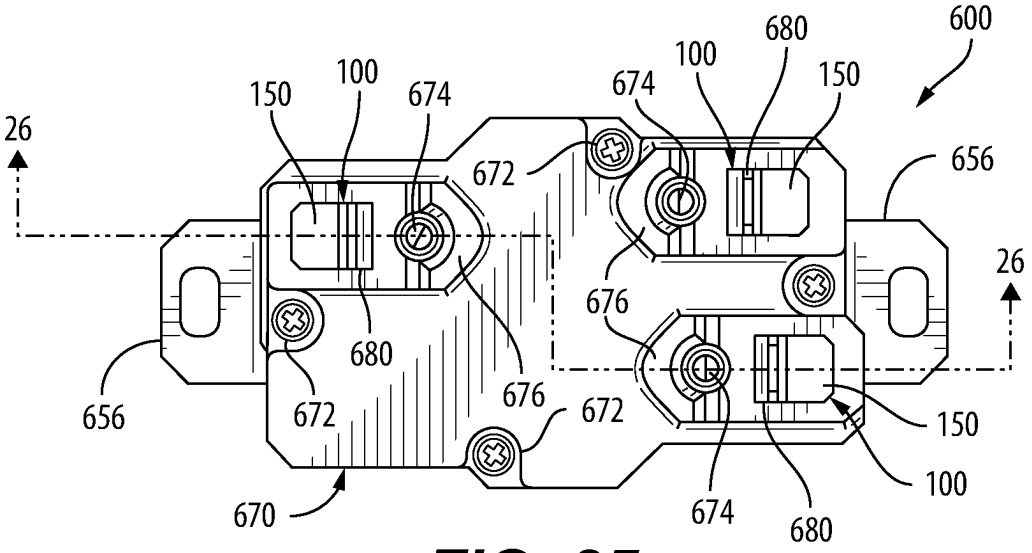
674
100
672
150
670
150
630
650
656
100
658

FIG. 24


600
680
100
150
674
100
150
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26
672
656
26
676
680
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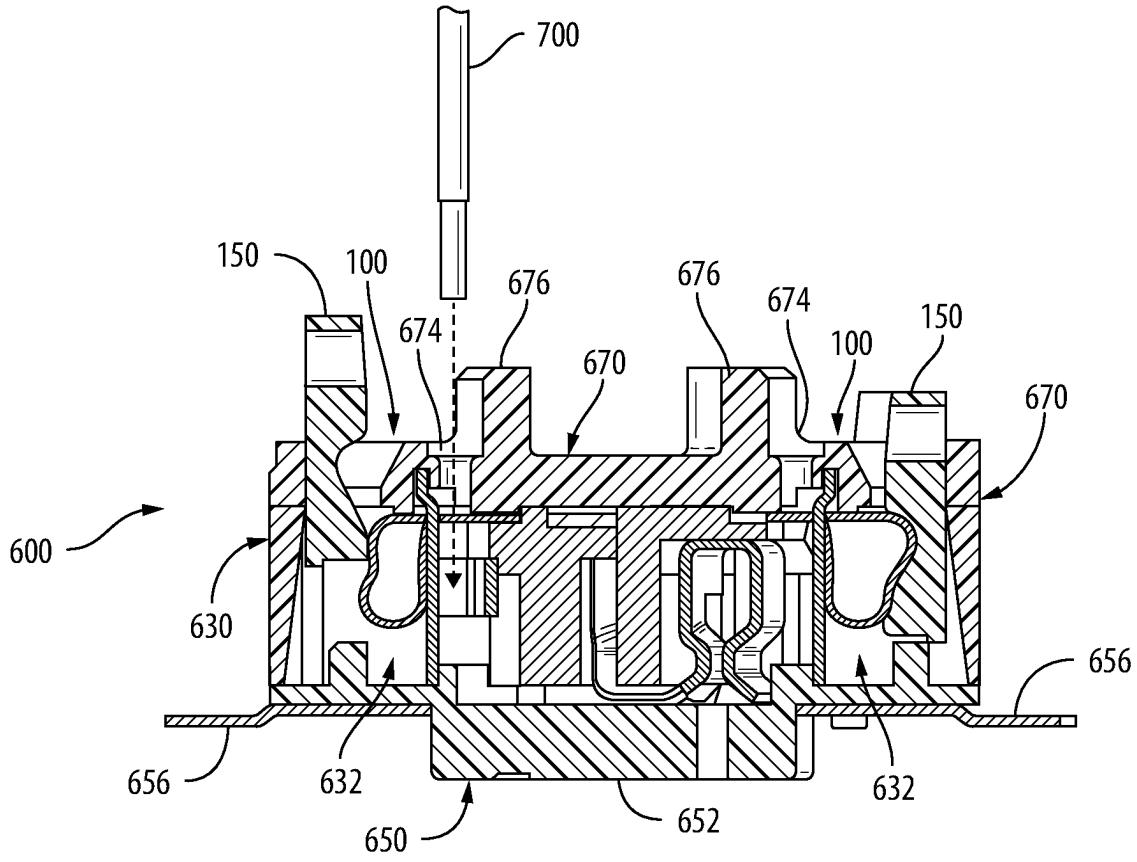
676
672
150
100
656
670
674
680

FIG. 25


700
150
100
676
676
674
674
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670
670
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630
656
656
632
632
650
652

FIG. 26

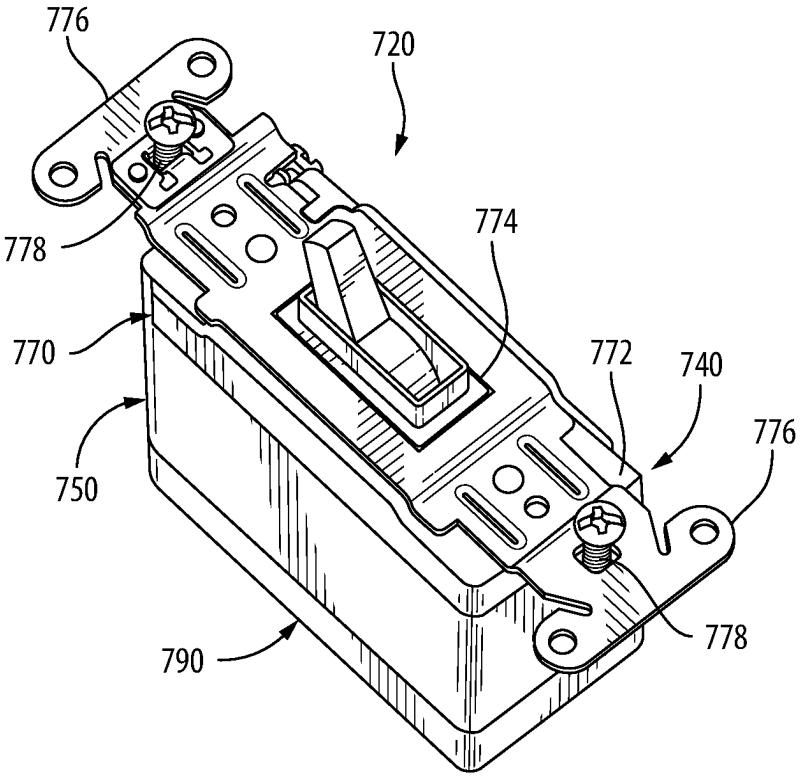
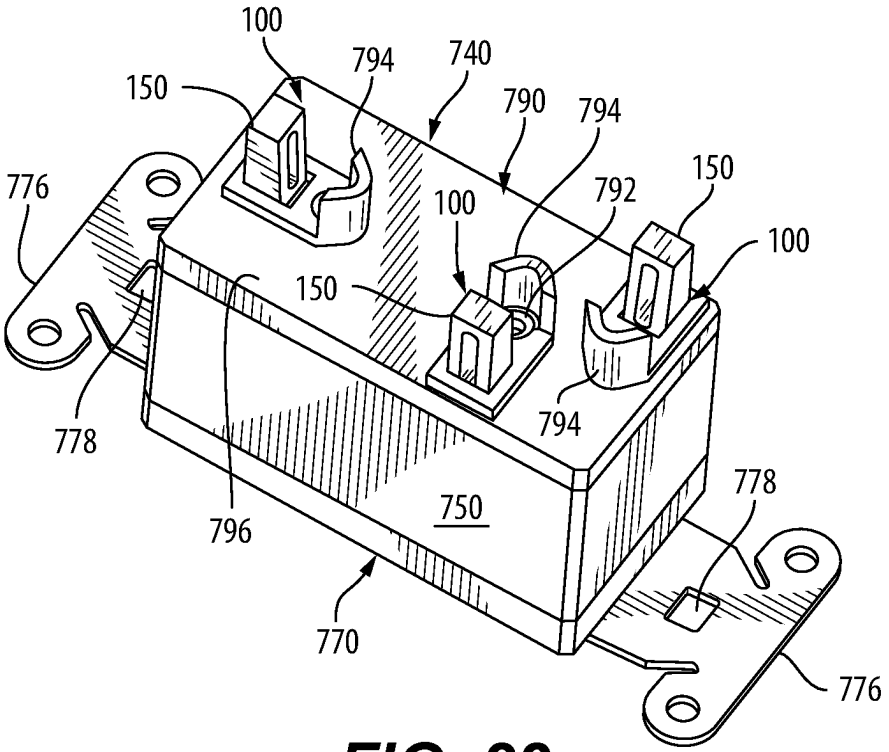

776
720
778
774
770
772
740
776
750
778
790

FIG. 27


100
794
740
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790
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776
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792
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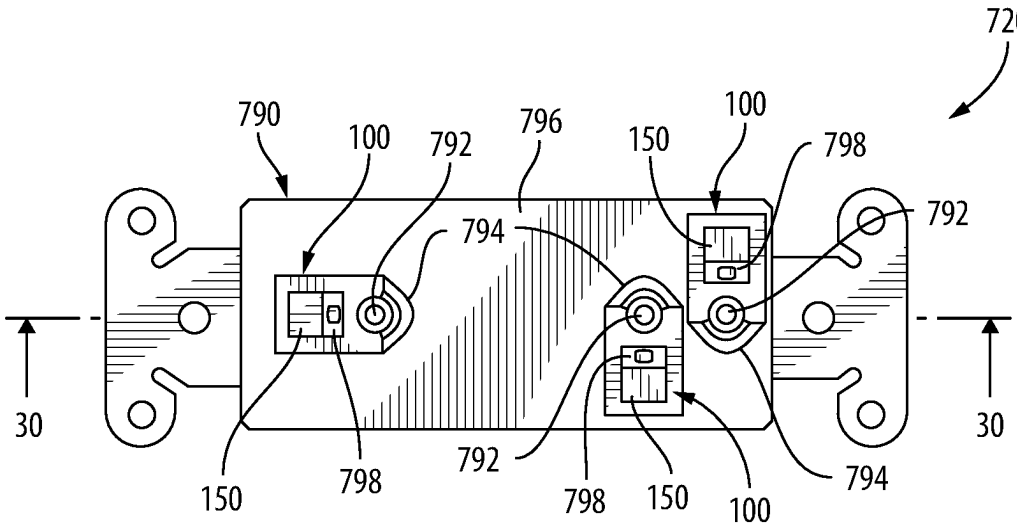
796
750
770
776

FIG. 28


720
790
100
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794
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30
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798
150
100
794

FIG. 29

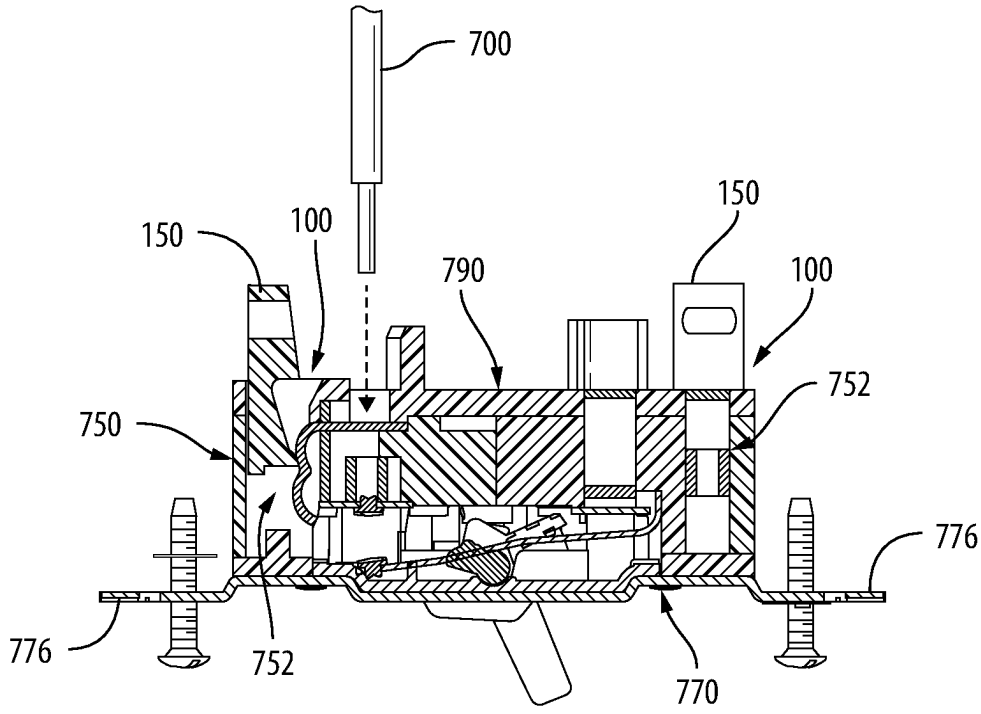

700
150
100
150
100
790
752
750
776
776
752
770

FIG. 30

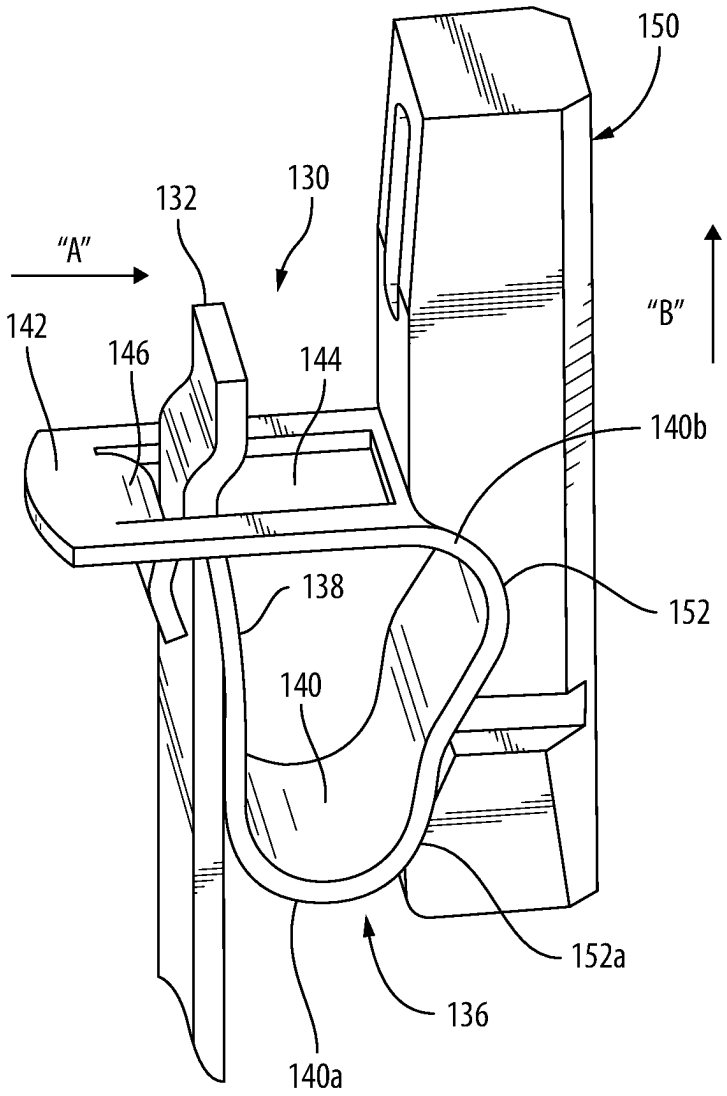
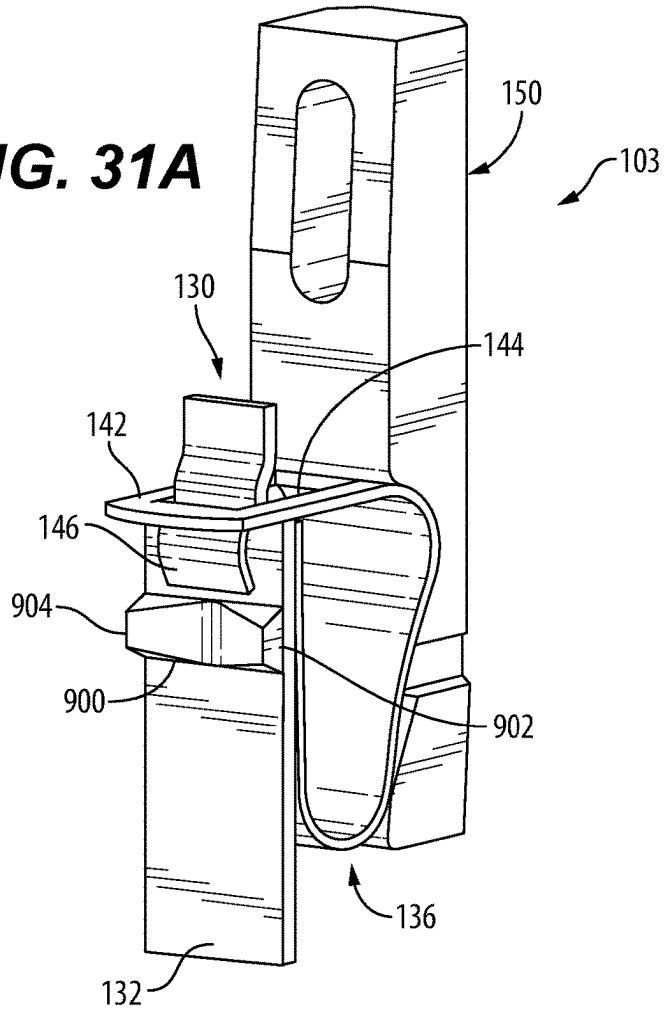


FIG. 31

FIG. 31A



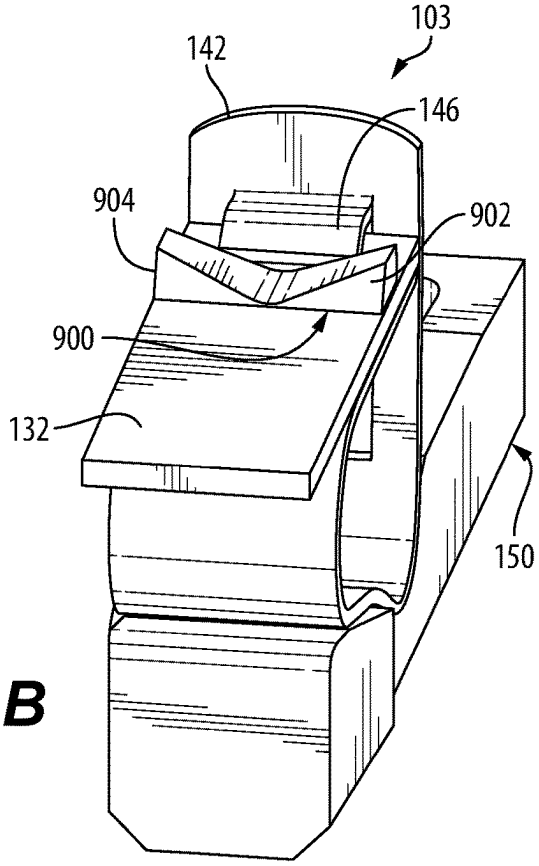


FIG. 31B

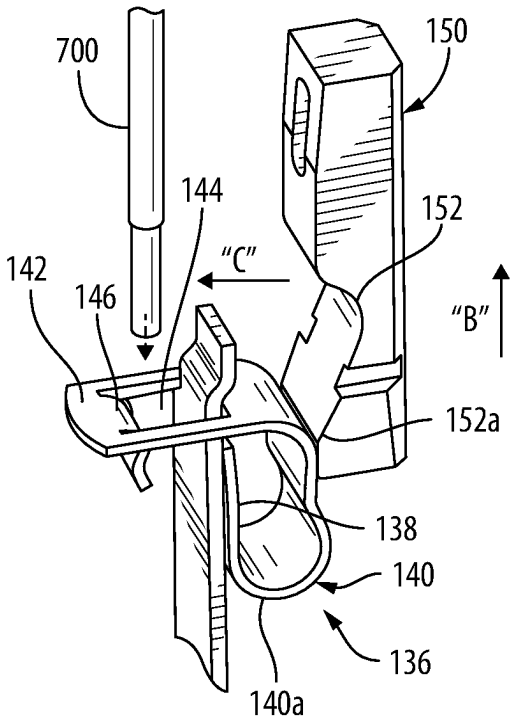


FIG. 32

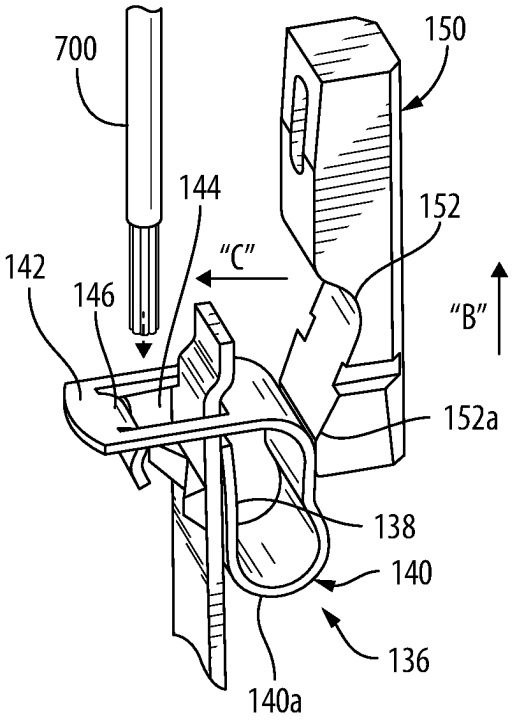


FIG. 32A

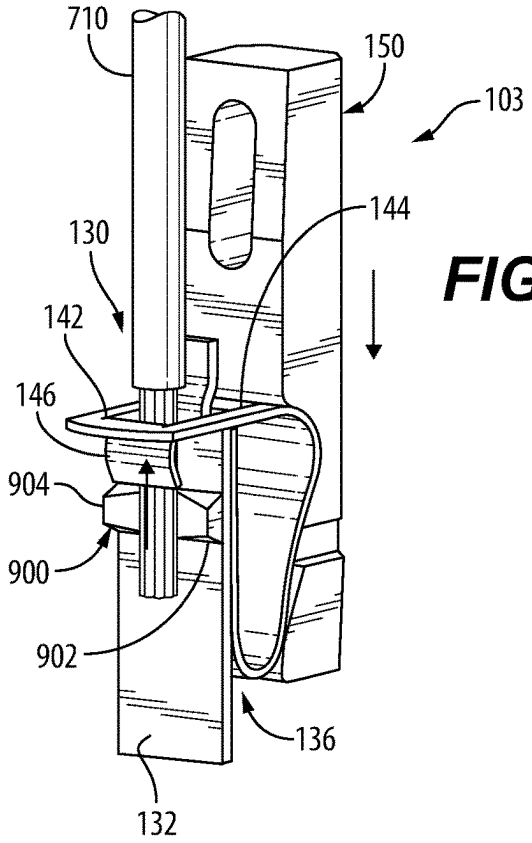
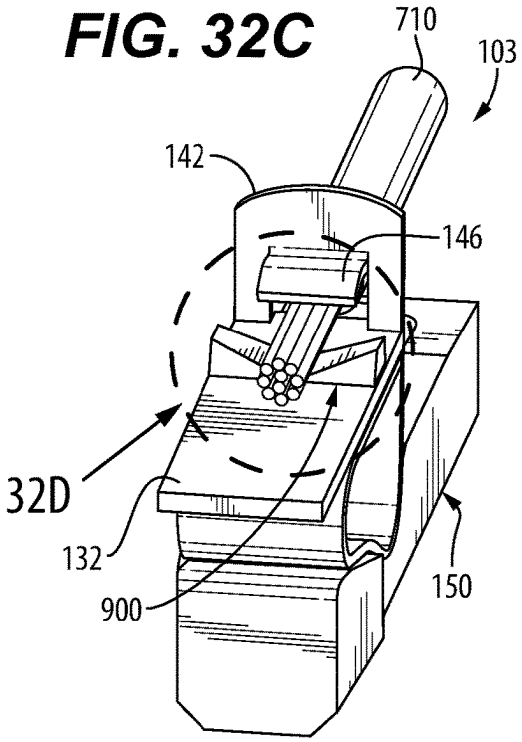


FIG. 32B

FIG. 32C



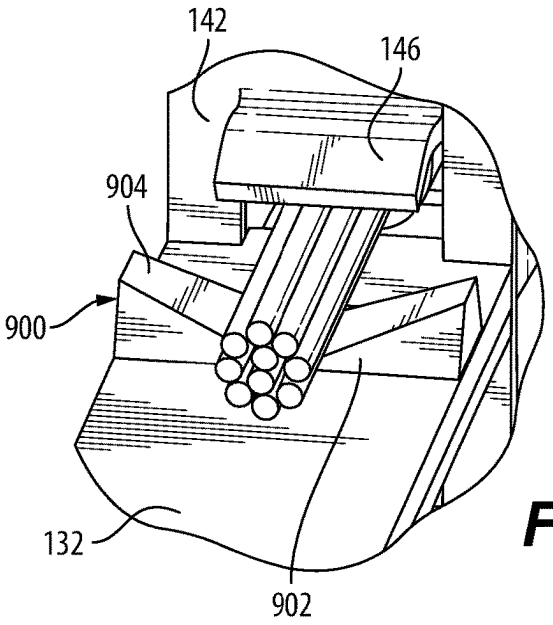
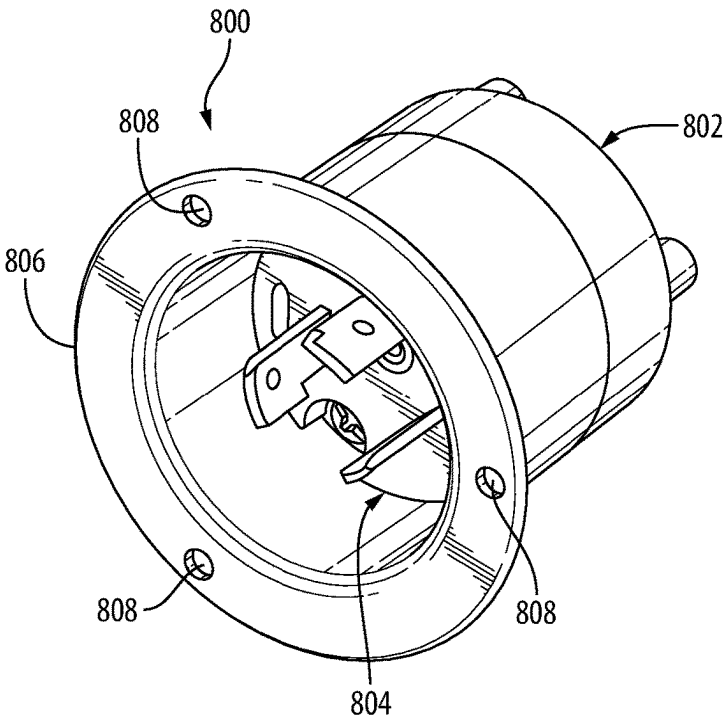


FIG. 32D


800
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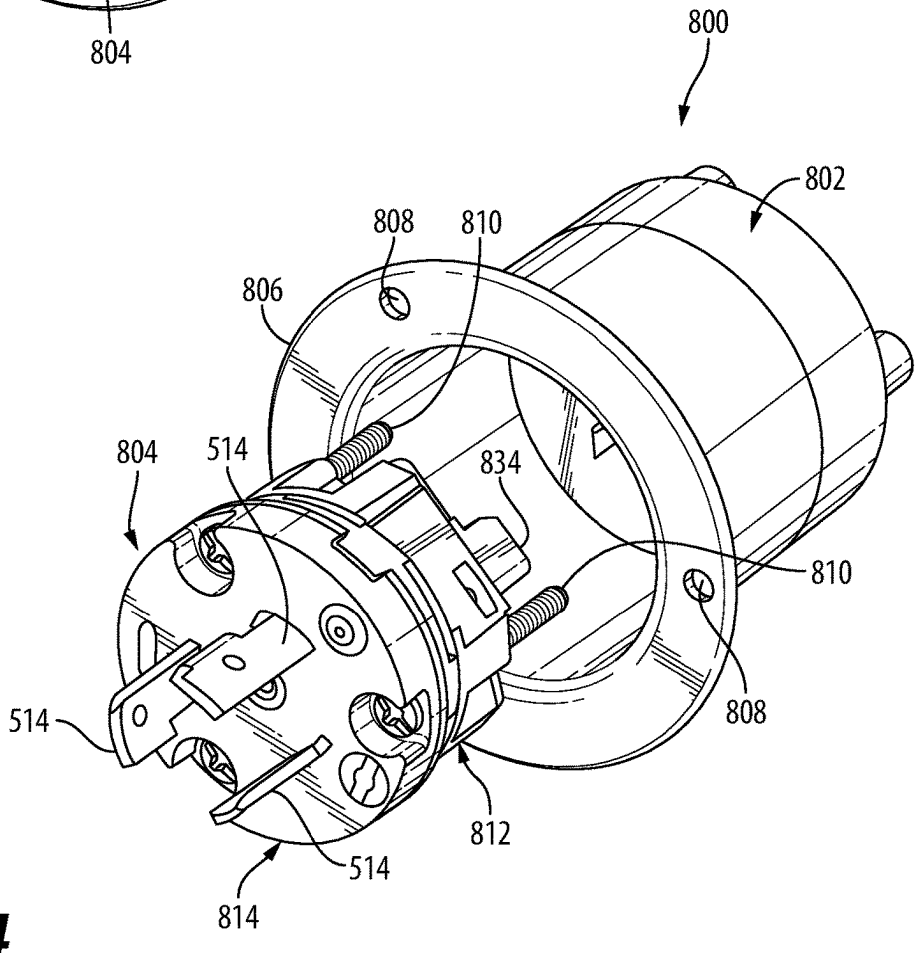
804

FIG. 33


800
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804
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812
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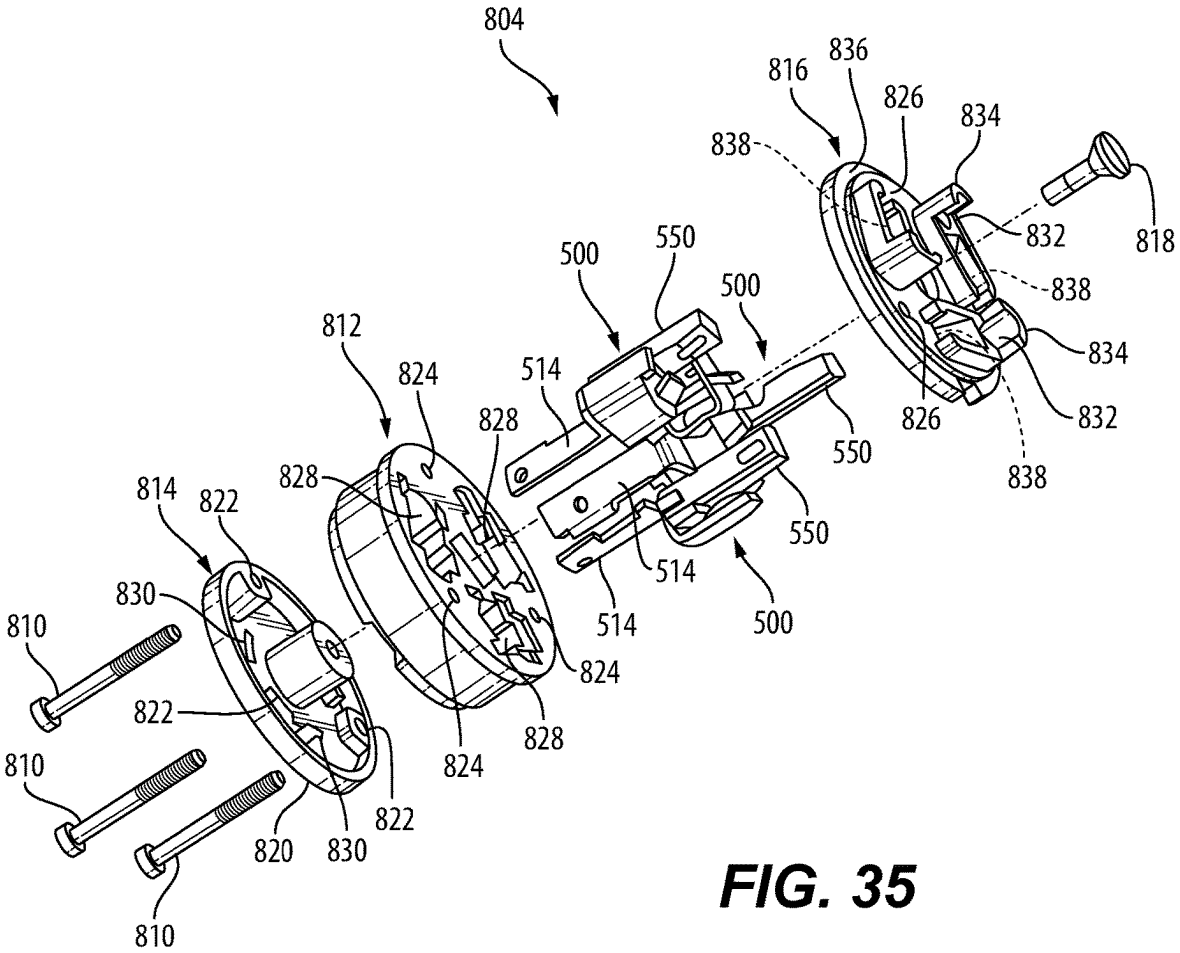
814

FIG. 34


804
816
836
826
834
838
832
818
838
500
550
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812
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828
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832
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838
828
814
822
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500
830
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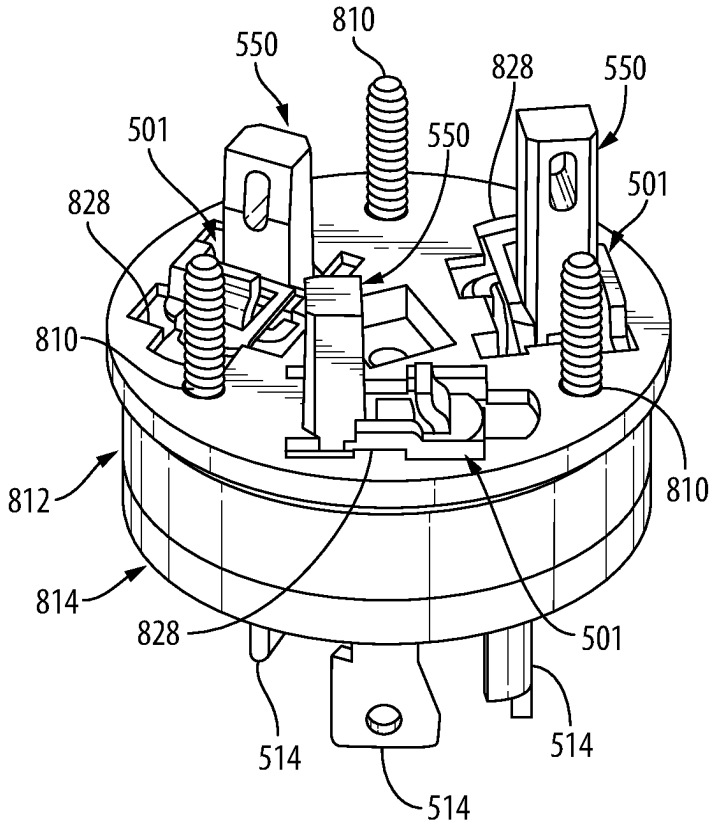
828
822
810
824
820
830
810

FIG. 35

FIG. 36


810
550
828
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501
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501
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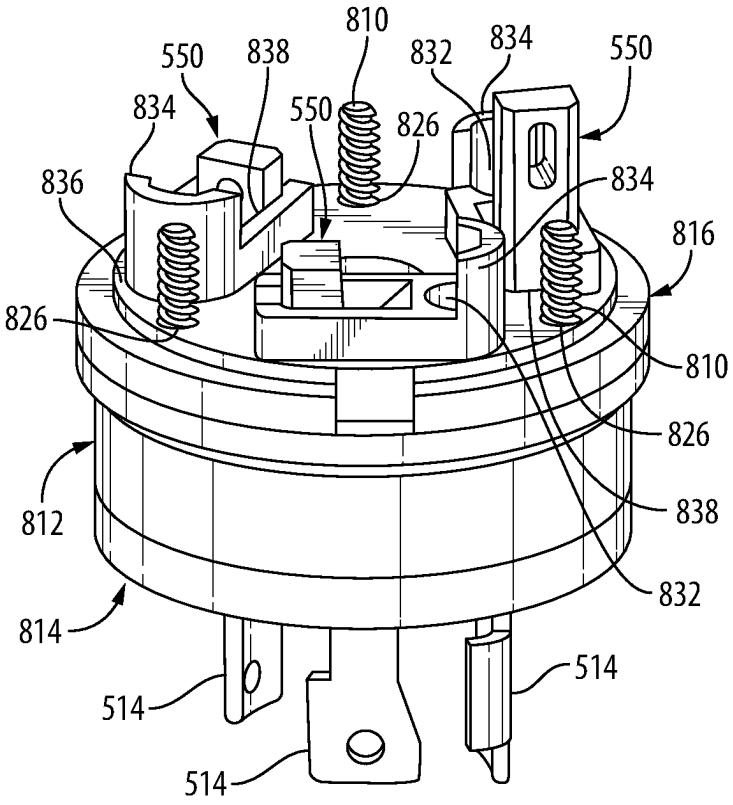
810
812
810
814
828
501
514
514
514


810
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838
832
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838
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814
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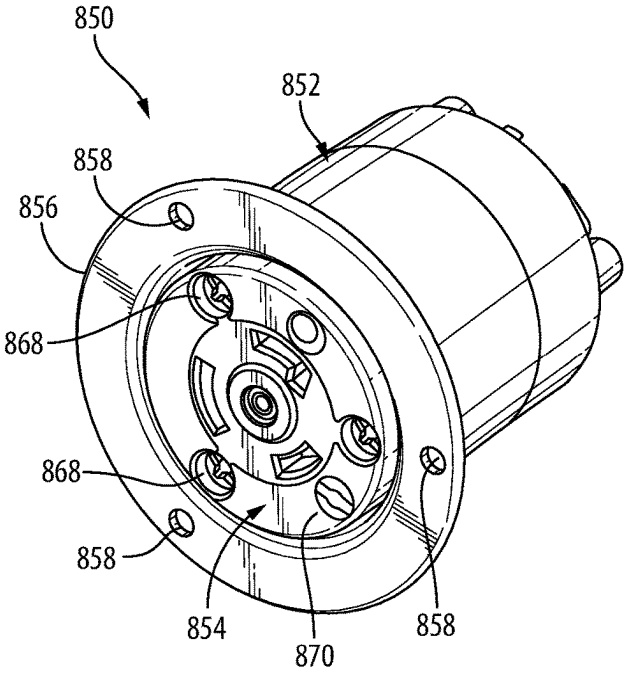
514

FIG. 37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852
858
856
868
868
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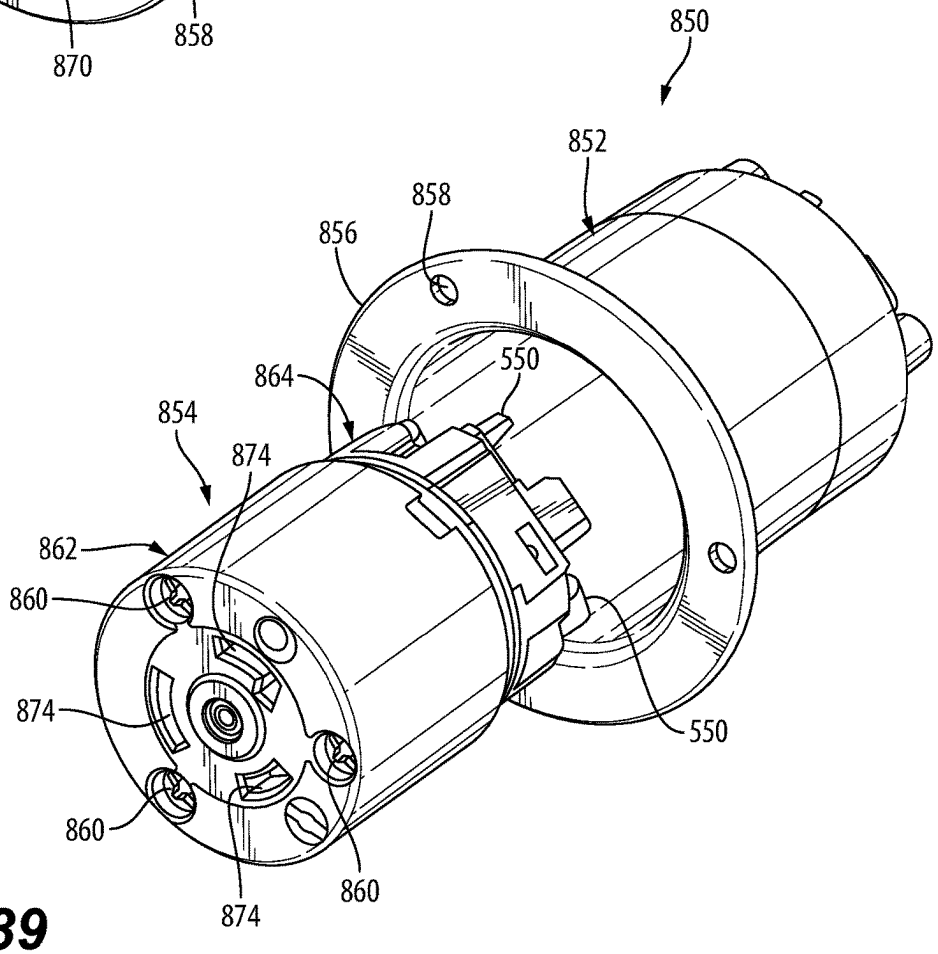
870
858

FIG. 38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864
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874
862
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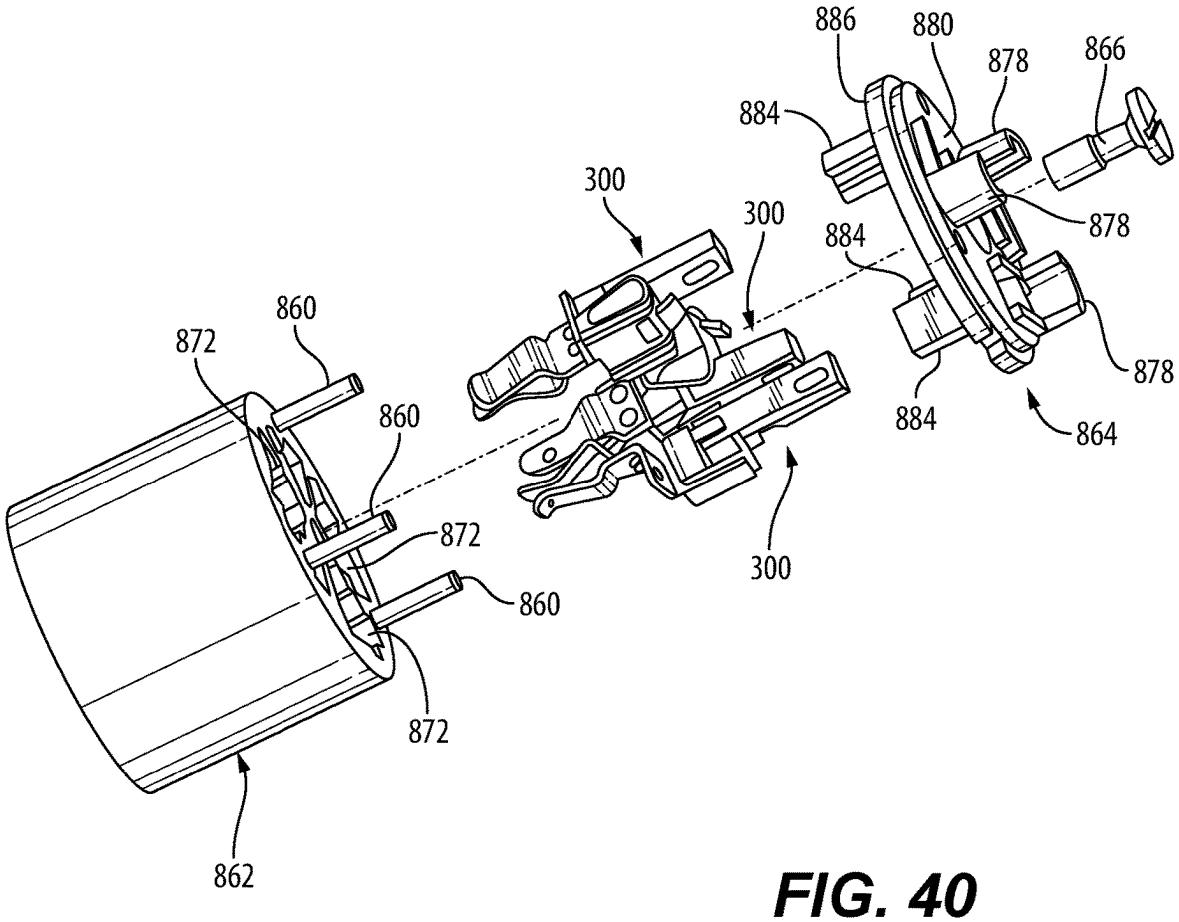
860

FIG. 39


886
880
878
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878
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872
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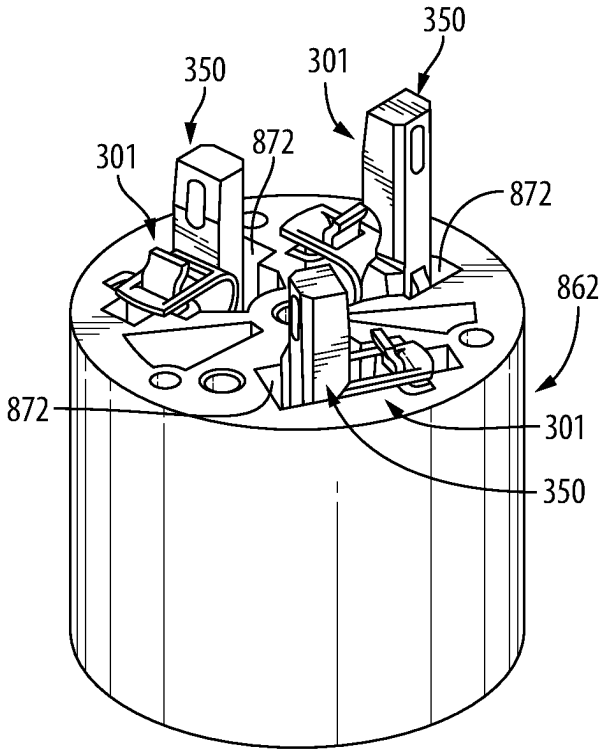
862

FIG. 40

FIG. 41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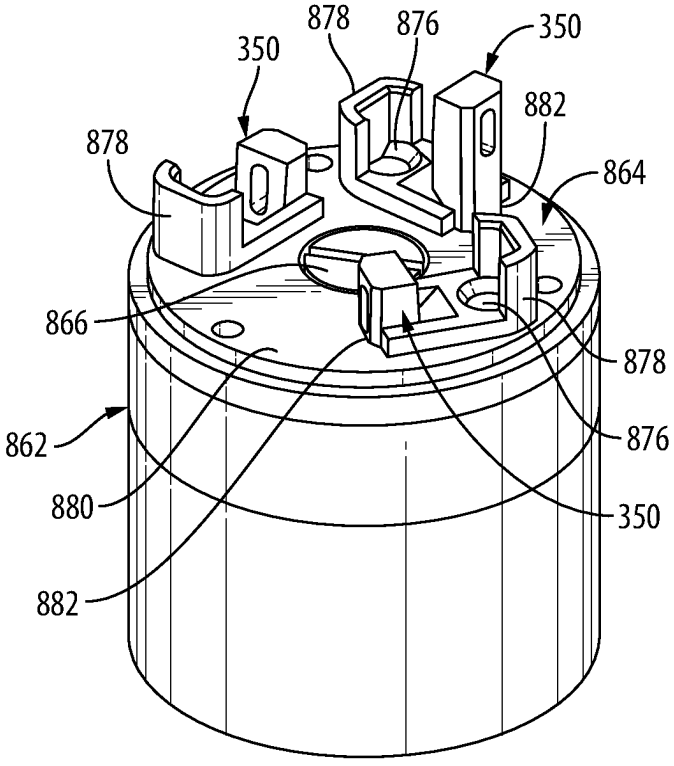
301
301
872
872
862
872
301
350


878
876
350
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882
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864
866
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862
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880
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882

FIG. 42

FIG. 43

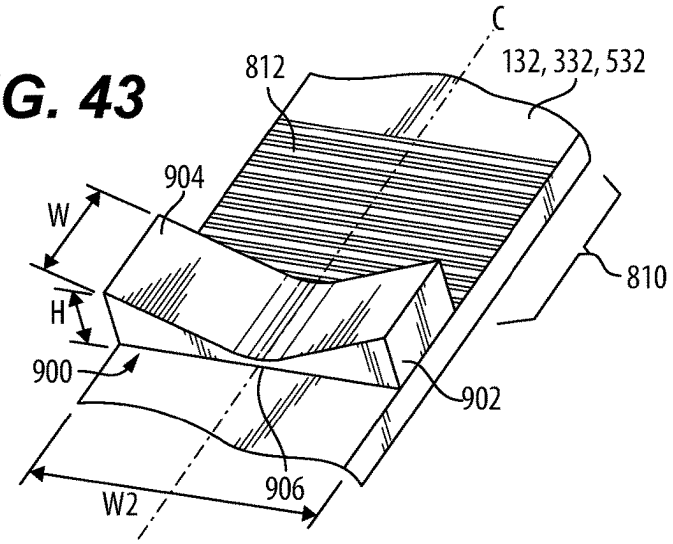


FIG. 44

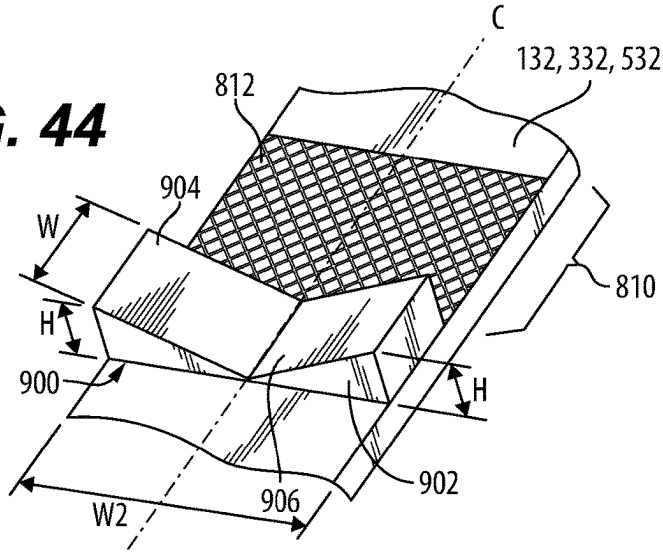
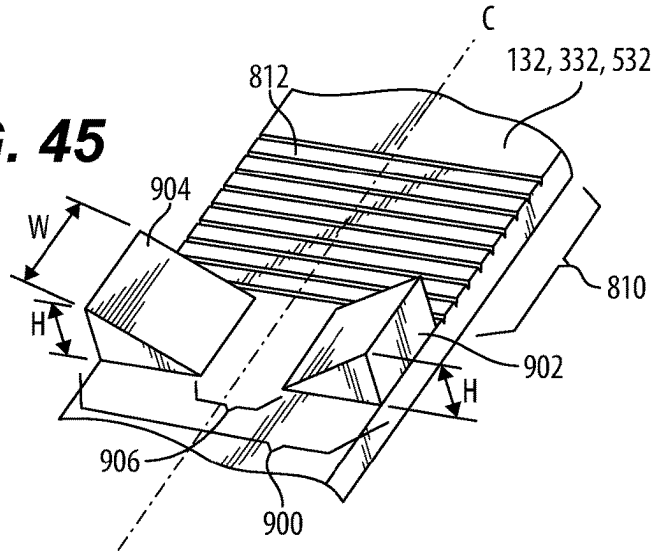


FIG. 45



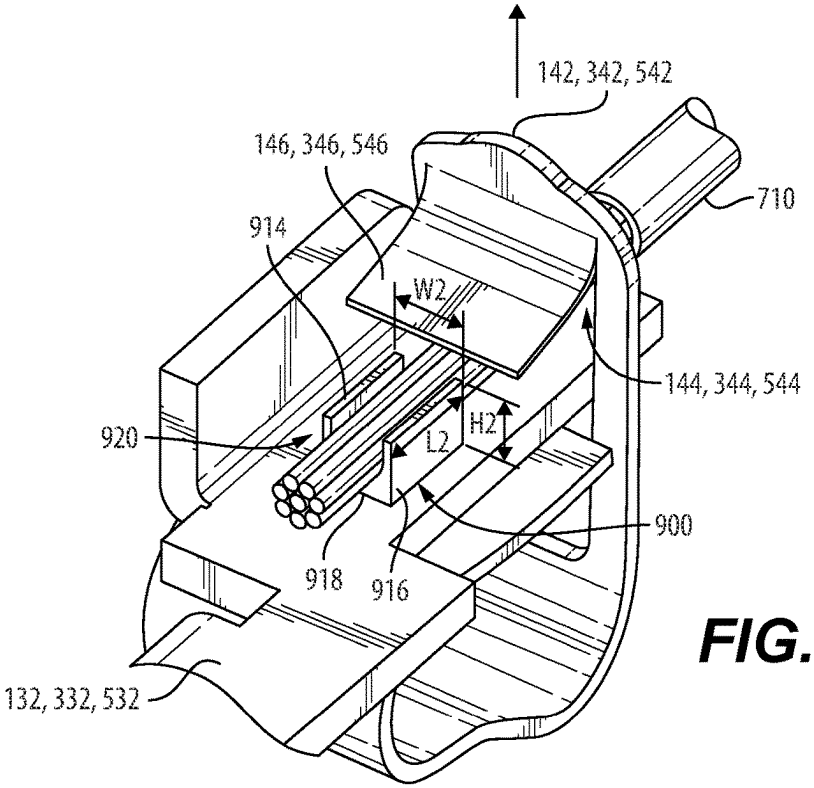

142, 342, 542
146, 346, 546
710
914
W2
144, 344, 544
920
L2
H2
900
918
916
132, 332, 532

FIG. 46

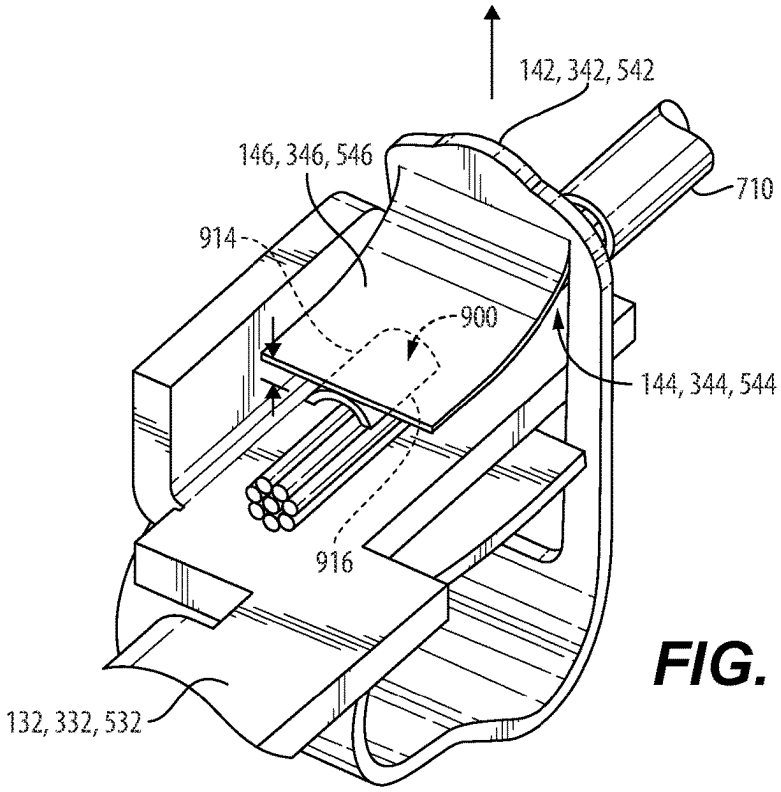

142, 342, 542
146, 346, 546
710
914
900
144, 344, 544
916
132, 332, 532

FIG. 47

SCREWLESS CONNECTION TERMINALS WITH WIRE MANAGER

CROSS REFERENCE TO RELATED APPLICATIONS

The present disclosure is based on and claims benefit from U.S. Provisional Patent Application No. 63/248,609 filed on Sep. 27, 2021 entitled "Screwless Connection Terminals With Wire Manager" the contents of which are incorporated herein in their entirety by reference.

BACKGROUND

Field

The present disclosure relates generally to connection terminals for electrical wiring devices and more particularly to screwless connection terminals for use in receptacles, plug assemblies, plug connectors, switches, and other electrical wiring devices.

Description of the Related Art

Present electrical wire terminations in many electrical wiring devices are either direct pressure type terminations or screw and clamp type terminations. In direct pressure type terminations, a terminal screw is tightened directly against an electrical wire to press the wire against a fixed plate. In screw and clamp type terminations, a wire is inserted between a fixed plate and a movable plate, and a terminal screw is tightened so that the wire is clamped between the plates. With direct pressure type terminations, stranded or solid wires if incorrectly installed can be cut or nicked. Cut or nicked wires can result in poor electrical connections increasing the resistance in the connections which can cause overheating. In addition, with stranded wires, both direct pressure type terminations and screw and clamp type terminations may be susceptible to strand relaxation. Strand relaxation is a result of copper wire heating and cooling under the stress of the termination, either direct pressure type or screw and clamp type causing the electrical connection between the stranded wire and the termination to loosen increasing the resistance in the connections which can cause overheating. To alleviate strand relaxation concerns, installers typically re-torque terminal screws after some duration of time after original installation increasing costs to consumers.

SUMMARY

The present disclosure provides embodiments of various electrical wiring devices, including receptacles, power cord plugs and connectors, and switches. In an exemplary embodiment, a blade-type electrical receptacle includes a housing and a plurality of contact assemblies. The housing has a main body with a plurality of cavities, a front cover and a rear cover. The front cover is removably secured to a first side of the main body and includes a plurality of blade receiving slots. The rear cover is removably secured to a second side of the main body and includes a plurality of wire receiving apertures and a plurality of plunger openings.

In one exemplary embodiment, one of the plurality of contact assemblies is positioned at least partially within one of the plurality of cavities and is accessible from one of the plurality of wire receiving apertures, from one of the plurality of plunger openings in the rear cover and is accessible from one of the plurality of blade receiving slots in the front cover. Each of the plurality of the contact assemblies includes a contact member, a wire terminal and a plunger. In an exemplary embodiment, the contact member has a contact body and at least two contact fingers extending from the contact body. The at least two contact fingers are aligned with one of the plurality of blade receiving slots in the front cover. The wire terminal forms an electrically conductive path with the contact member and includes a contact arm secured to the contact body, a clamp brace secured to the contact arm, a clamp spring secured to the clamp brace and a wire manager. The clamp spring is movable relative to the clamp brace between a closed position where a wire can be clamped between the clamp spring and the clamp brace and an open position where a wire can be inserted through one of the plurality of wire receiving apertures in the rear cover and between the clamp spring and the clamp brace. The wire manager is positioned on the clamp brace in close proximity to where the wire can be clamped between the clamp spring and the clamp brace. The plunger is positioned within one of the plurality of cavities and extends at least partially through one of the plurality of plunger openings in the rear cover. The plunger is interactive with the clamp spring such that movement of the plunger in a first direction relative to the clamp brace causes the plunger to apply a mechanical load to the clamp spring to cause the clamp spring to move from the closed position to the open position, and movement of the plunger in a second direction relative to the clamp brace removes the mechanical load from the clamp spring so that to the clamp spring is biased from the open position to the closed position.

The present disclosure also provides embodiments of blade type electrical power cord connectors. In an exemplary embodiment, a blade-type electrical power cord connector includes a housing and a plurality of contact assemblies. The housing includes a main body, a cover and a retainer. The main body has a plurality of cavities and a plurality of blade receiving slots. The cover is removably secured to the main body and has a cable receiving aperture. The retainer is removably secured to the main body between the main body and the cover and has a plurality of wire receiving apertures and a plurality of plunger openings.

In one exemplary embodiment, one of the plurality of contact assemblies is positioned at least partially within one of the plurality of a cavities and is accessible from one of the plurality of wire receiving apertures, from one of the plurality of plunger openings in the retainer and is accessible from one of the plurality of blade receiving slots in the main body. Each of the plurality of the contact assemblies includes a contact member, a wire terminal and a plunger. In an exemplary embodiment, the contact member has a contact body and at least two contact fingers extending from the contact body. The at least two contact fingers are aligned with one of the plurality of blade receiving slots in the main body of the housing. The wire terminal forms an electrically conductive path with the contact member and includes a clamp brace secured to the contact body, a clamp spring secured to the clamp brace and a wire manager. The clamp spring is movable relative to the clamp brace between a closed position where a wire can be clamped between the clamp spring and the clamp brace and an open position where a wire can be inserted through one of the plurality of wire receiving apertures in the retainer and between the clamp spring and the clamp brace. The wire manager is positioned on the clamp brace in close proximity to where the wire can be clamped between the clamp spring and the clamp brace. The plunger is positioned within one of the

plurality of cavities and extends at least partially through one of the plurality of plunger openings in the retainer. The plunger is interactive with the clamp spring such that movement of the plunger in a first direction relative to the clamp brace causes the plunger to apply a mechanical load to the clamp spring to cause the clamp spring to move from the closed position to the open position, and movement of the plunger in a second direction relative to the clamp brace removes the mechanical load from the clamp spring so that to the clamp spring is biased from the open position to the closed position.

The present disclosure also provides embodiments of blade type electrical power cord plugs. In an exemplary embodiment, a blade-type electrical power cord plug includes a housing and a plurality of contact assemblies. The housing includes a main body, a bottom cover, a top cover and a retainer. The main body has a plurality of cavities. The bottom cover is removably secured to a first side of the main body and has a plurality of blade receiving slots. The top cover is removably secured to a second side of the main body and has a cable receiving aperture. The retainer is removably secured to the second side of the main body between the main body and the top cover and has a plurality of wire receiving apertures and a plurality of plunger openings.

In one exemplary embodiment, one of the plurality of contact assemblies is positioned at least partially within one of the plurality of a cavities and is accessible from one of the plurality of wire receiving apertures, from one of the plurality of plunger openings in the retainer and is accessible from one of the plurality of blade receiving slots in the bottom cover. In an exemplary embodiment, the each of the plurality of the contact assemblies includes a contact member, a wire terminal and a plunger. The contact member has a contact body and a contact blade extending from the contact body. The contact blade is aligned with one of the plurality of blade receiving slots in the bottom cover such that the blade can pass through the blade receiving slot and extend from the housing. The wire terminal forms an electrically conductive path with the contact member and includes a clamp brace secured to the contact body, a clamp spring secured to the clamp brace and a wire manager. The clamp spring is movable relative to the clamp brace between a closed position where a wire can be clamped between the clamp spring and the clamp brace and an open position where a wire can be inserted through one of the plurality of wire receiving apertures in the retainer and between the clamp spring and the clamp brace. The wire manager is positioned on the clamp brace in close proximity to where the wire can be clamped between the clamp spring and the clamp brace. The plunger is positioned within one of the plurality of cavities and extends at least partially through one of the plurality of plunger openings in the retainer. The plunger is interactive with the clamp spring such that movement of the plunger in a first direction relative to the clamp brace causes the plunger to apply a mechanical load to the clamp spring to cause the clamp spring to move from the closed position to the open position, and movement of the plunger in a second direction relative to the clamp brace removes the mechanical load from the clamp spring so that to the clamp spring is biased from the open position to the closed position.

The present disclosure also provides embodiments of electrical wiring device for installation into an electrical box. In an exemplary embodiment, the electrical wiring device includes a housing and a plurality of contact assemblies. The housing includes a main body portion having a plurality of cavities, a front cover portion removably secured to a first side of the main body portion, and a rear cover portion removably secured to a second side of the main body portion and having a plurality of wire receiving apertures and a plurality of plunger openings. In this embodiment, one of the plurality of contact assemblies is positioned at least partially within one of the plurality of a cavities and is accessible from one of the plurality of wire receiving apertures and one of the plurality of plunger openings in the rear cover portion. Each of the plurality of the contact assemblies includes a wire terminal and a plunger. The wire terminal includes a clamp brace secured to a clamp spring and a wire manager. The clamp spring is movable relative to the clamp brace between a closed position where a wire can be clamped between the clamp spring and the clamp brace, and an open position where a wire can be inserted through one of the plurality of wire receiving apertures in the rear cover and between the clamp spring and the clamp brace. The wire manager is positioned on the clamp brace in close proximity to where the wire can be clamped between the clamp spring and the clamp brace. The plunger is positioned within one of the plurality of cavities and extends at least partially through one of the plurality of plunger openings in the rear cover. The plunger is interactive with the clamp spring such that movement of the plunger in a first direction relative to the clamp brace causes the plunger to apply a mechanical load to the clamp spring to cause the clamp spring to move from the closed position to the open position and movement of the plunger in a second direction relative to the clamp brace removes the mechanical load from the clamp spring so that to the clamp spring is biased from the open position to the closed position.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the present disclosure and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. **1** is a top perspective view of an exemplary embodiment of an electrical receptacle having screwless connection terminals according to the present disclosure;

FIG. **2** is a bottom perspective view of the receptacle of FIG. **1**;

FIG. **3** is a bottom plan view of the receptacle of FIG. **1**;

FIG. **4** is a cross sectional view of the receptacle of FIG. **3** taken along line **4-4**;

FIG. **5** is a cross sectional view of the receptacle of FIG. **3** taken along line **5-5**;

FIG. **6** is a top perspective view of a rear cover of the receptacle housing of FIG. **1** with three contact assemblies resting on the rear cover;

FIG. **7** is a bottom perspective view of a housing of the receptacle of FIG. **1** having three cavities each housing a contact assembly;

FIG. **8** is a top perspective view of an exemplary embodiment of a screwless connection terminal for the receptacle of FIG. **1** in a closed position;

FIG. **8**A is a perspective view of another exemplary embodiment of a screwless connection terminal for the receptacle of FIG. **1**, illustrating a wire manager secured to a clamp brace of a wire terminal;

FIG. **8**B is a bottom perspective view of the screwless connection terminal of FIG. **8**A, illustrating the wire manager secured to the clamp brace;

FIG. **9** is a top perspective view of the screwless connection terminal of FIG. **8** in an open position;

FIG. **9**A is a top perspective view of the screwless connection terminal of FIG. **8**A in an open position and illustrating a stranded wire ready for insertion into the screwless connection terminal;

FIG. **9**B is a perspective view of the screwless connection terminal of FIG. **9**A with the stranded wire inserted into the screwless connection terminal and the stranded wire resting in the wire manager;

FIG. **9**C is a bottom perspective view of the screwless connection terminal of FIG. **9**B, illustrating the stranded wire resting in the wire manager;

FIG. **9**D is an enlarged perspective view of a portion of the screwless connection terminal of FIG. **9**C taken from detail **9**D, illustrating the stranded wire resting in the wire manager;

FIG. **10** is a side elevation view of an exemplary embodiment of an electrical power cord connector having the screwless connection terminals according to the present disclosure;

FIG. **11** is a bottom plan view of the cord connector of FIG. **10**;

FIG. **12** is a side perspective view with parts separated of the cord connector of FIG. **10**;

FIG. **13** is a top perspective view of a portion of the cord connector of FIG. **12**, illustrating a plurality of contact assemblies within a housing of the cord connector;

FIG. **14** is a top perspective view of the portion of the cord connector of FIG. **12** with a retainer secured to a main body of the housing;

FIG. **15** is a top perspective view of an exemplary embodiment of a screwless connection terminal for the cord connector of FIG. **10** in a closed position;

FIG. **15**A is a perspective view of another exemplary embodiment of a screwless connection terminal for the receptacle of FIG. **10**, illustrating a wire manager secured to a clamp brace of a wire terminal;

FIG. **15**B is a bottom perspective view of the screwless connection terminal of FIG. **15**A, illustrating the wire manager secured to the clamp brace;

FIG. **16** is a top perspective view of the screwless connection terminal of FIG. **15** in an open position;

FIG. **16**A is a top perspective view of the screwless connection terminal of FIG. **15**A in an open position and illustrating a stranded wire ready for insertion into the screwless connection terminal;

FIG. **16**B is a perspective view of the screwless connection terminal of FIG. **16**A with the stranded wire inserted into the screwless connection terminal and the stranded wire resting in the wire manager;

FIG. **16**C is a bottom perspective view of the screwless connection terminal of FIG. **16**B, illustrating the screwless connection terminal in the closed position and the stranded wire resting in the wire manager;

FIG. **16**D is an enlarged perspective view of a portion of the screwless connection terminal of FIG. **16**C taken from detail **16**D, illustrating the stranded wire resting in the wire manager;

FIG. **17** is a side elevation view of an exemplary embodiment of an electrical power cord plug having the screwless connection terminals according to the present disclosure;

FIG. **18** is a side perspective view with parts separated of the cord plug of FIG. **17**;

FIG. **19** is a top perspective view of a portion of the cord plug of FIG. **18**, illustrating a plurality of contact assemblies in a main body of a housing of the cord plug;

FIG. **20** is a top perspective view of the portion of the cord plug of FIG. **18** with a retainer secured to the main body of the cord plug housing;

FIG. **21** is a top perspective view of an exemplary embodiment of a screwless connection terminal for the cord plug of FIG. **17** in a closed position;

FIG. **21**A is a perspective view of another exemplary embodiment of a screwless connection terminal for the receptacle of FIG. **17**, illustrating a wire manager secured to a clamp brace of a wire terminal;

FIG. **21**B is a bottom perspective view of the screwless connection terminal of FIG. **21**A, illustrating the wire manager secured to the clamp brace;

FIG. **22** is a top perspective view of the screwless connection terminal of FIG. **21** in an open position;

FIG. **22**A is a top perspective view of the screwless connection terminal of FIG. **21**A in an open position and illustrating a stranded wire ready for insertion into the screwless connection terminal;

FIG. **22**B is a perspective view of the screwless connection terminal of FIG. **22**A with the stranded wire inserted into the screwless connection terminal and the stranded wire resting in the wire manager;

FIG. **22**C is a bottom perspective view of the screwless connection terminal of FIG. **22**B, illustrating the screwless connection terminal in the closed position and the stranded wire resting in the wire manager;

FIG. **22**D is an enlarged perspective view of a portion of the screwless connection terminal of FIG. **22**C taken from detail **22**D, illustrating the stranded wire resting in the wire manager;

FIG. **23** is a top perspective view if another exemplary embodiment of an electrical receptacle having screwless connection terminals according to the present disclosure;

FIG. **24** is a bottom perspective view of the receptacle of FIG. **23**;

FIG. **25** is a bottom plan view of the receptacle of FIG. **24**;

FIG. **26** is a cross sectional view of the receptacle of FIG. **25** taken along line **26**-**26**;

FIG. **27** is a top perspective view if an exemplary embodiment of an electrical switch having screwless connection terminals according to the present disclosure;

FIG. **28** is a bottom perspective view of the switch of FIG. **27**;

FIG. **29** is a bottom plan view of the switch of FIG. **28**;

FIG. **30** is a cross sectional view of the switch of FIG. **29** taken along line **30**-**30**;

FIG. **31** is a top perspective view of another exemplary embodiment of a screwless connection terminal for the electrical switch of FIG. **27** in a closed position;

FIG. **31**A is a perspective view of another exemplary embodiment of a screwless connection terminal for the receptacle of FIG. **27**, illustrating a wire manager secured to a clamp brace of a wire terminal;

FIG. **31**B is a bottom perspective view of the screwless connection terminal of FIG. **31**A, illustrating the wire manager secured to the clamp brace;

FIG. **32** is a top perspective view of the screwless connection terminal of FIG. **31** in an open position;

FIG. **32**A is a top perspective view of the screwless connection terminal of FIG. **31**A in an open position and illustrating a stranded wire ready for insertion into the screwless connection terminal;

FIG. **32**B is a perspective view of the screwless connection terminal of FIG. **32**A with the stranded wire inserted into the screwless connection terminal and the stranded wire resting in the wire manager;

FIG. **32**C is a bottom perspective view of the screwless connection terminal of FIG. **32**B, illustrating the screwless connection terminal in the closed position and the stranded wire resting in the wire manager;

FIG. **32**D is an enlarged perspective view of a portion of the screwless connection terminal of FIG. **32**C taken from detail **32**D, illustrating the stranded wire resting in the wire manager;

FIG. **33** is a perspective view of an exemplary embodiment of an electrical male flanged inlet having screwless connection terminals according to the present disclosure, illustrating a plug assembly within an inlet housing;

FIG. **34** is a perspective view of the electrical male flanged inlet of FIG. **33**, illustrating the plug assembly separated from the inlet housing;

FIG. **35** is a side perspective view with parts separated of the plug assembly of the electrical male flanged inlet of FIG. **34**;

FIG. **36** is a top perspective view of the contact assembly of FIG. **34**, illustrating a plurality of contact assemblies in a main body of the plug assembly;

FIG. **37** is a top perspective view of the contact assembly of FIG. **18**, with a retainer secured to the main body of the plug assembly;

FIG. **38** is a perspective view of an exemplary embodiment of an electrical female flanged receptacle having screwless connection terminals according to the present disclosure, illustrating a receptacle assembly within a receptacle housing;

FIG. **39** is a perspective view of the electrical female flanged receptacle of FIG. **38**, illustrating the receptacle assembly separated from the receptacle housing;

FIG. **40** is a side perspective view with parts separated of the receptacle assembly of the electrical female flanged receptacle of FIG. **39**;

FIG. **41** is a top perspective view of the receptacle assembly of FIG. **40**, illustrating a plurality of contact assemblies in a main body of the receptacle assembly;

FIG. **42** is a top perspective view of the contact assembly of FIG. **41**, with a retainer secured to the main body of the plug assembly;

FIG. **43** is a perspective view of an exemplary embodiment of a wire manager of the clamp brace, and illustrating a portion of a surface of the clamp brace with a textured surface in the form of striations;

FIG. **44** is a perspective view of another exemplary embodiment of a wire manager secured to the clamp brace, and illustrating a portion of a surface of the clamp brace with a textured surface in the form of knurling;

FIG. **45** is a perspective view of another exemplary embodiment of a wire manager secured to the clamp brace, and illustrating a portion of a surface of the clamp brace with a textured surface in the form of shallow grooves;

FIG. **46** is a perspective view of another exemplary embodiment of a wire manager according to the present disclosure, illustrating the wire manager associated with a clamp brace of a wire terminal; and

FIG. **47** is a perspective view of another exemplary embodiment of a wire manager according to the present disclosure, illustrating the wire manager associated with a clamp member of a clamp spring of a wire terminal.

DETAILED DESCRIPTION

Exemplary embodiments of electrical wiring devices that incorporate the screwless or clamp wire terminal of the present disclosure are shown and described. Non-limiting examples of the electrical wiring devices contemplated by the present disclosure include, single and duplex blade-type electrical receptacles, blade-type locking electrical receptacles, single or multi-pole electrical switches, combination switches and blade-type receptacles, blade-type plugs for electrical cords and blade-type connectors for electrical cords. Blade-type electrical wiring devices as described herein are; a) male blade-type electrical wiring devices with a plurality of non-circular, e.g., substantially flat or arcuate, power contact blades (hot and/or neutral contact blades) that can mate with corresponding finger contacts within a female blade-type electrical wiring device, or b) female blade-type electrical wiring devices with a plurality of non-circular, e.g., substantially flat or arcuate, power contact blade apertures (hot and/or neutral contact blade apertures) that provide access to contact fingers within the female electrical wiring devices that can mate with corresponding non-circular power contact blades of male blade-type electrical wiring devices. Examples of blade-type electrical wiring devices are described in NEMA standard WD6, which is publicly available and incorporated herein in its entirety by reference. In one exemplary embodiment, a blade-type electrical receptacle includes a housing and a plurality of female contact assemblies within the housing that are accessible from an exterior of the housing. In another exemplary embodiment, a blade-type electrical power cord connector includes a housing and a plurality of female contact assemblies within the housing that are accessible from an exterior of the housing and capable of receiving a plurality of blades of a plug. In another exemplary embodiment, a blade-type electrical power cord plug includes a housing and a plurality of male contact assemblies within the housing that extend beyond an exterior of the housing.

In some embodiments, the housing has a front cover and a main body. In other embodiments, the housing has a front cover, a main body and a rear cover. In each embodiment of an electrical wiring device, each contact assembly has a contact member, a wire terminal and a plunger. The contact member is used to form a portion of a conductive electrical path. The wire terminal is used to terminate an electrical conductor inserted into the housing, and the plunger moves the wire terminal between open and closed positions. The wire terminal includes a clamp brace, a contact arm and a clamp spring. The contact arm connects the wire terminal to the contact member, and the clamp spring is used to apply a constant and continuous load (or spring force) against an electrical conductor to electrically connect the electrical conductor to the clamp brace. The plunger is used to move the clamp spring between the open position permitting an electrical conductor to enter the wire terminal and the closed position binding or squeezing the electrical conductor within the wire terminal.

For the purposes of the present disclosure, the electrical conductor may also be referred to as the "wire." Further, the electrical conductor can be any size wire used to conduct electricity, such as 14 AWG wire, 12 AWG wire, 10 AWG wire or 8 AWG wire. Depending upon the number of conductors in a power cord, generally, 14 AWG wires are rated for between 15 and 18 amps, 12 AWG wires are rated for between 20 and 25 amps, 10 AWG wires are rated for between 25 and 30 amps, and 8 AWG wires are rated for between 35 and 40 amps.

Referring now to FIGS. **1**-**9**, an exemplary embodiment of a locking blade type electrical receptacle is shown. In this exemplary embodiment, the receptacle **10** has a housing **20** and a plurality of contact assemblies **100**, seen in detail in FIGS. **8** and **9**, within the housing that are accessible from

an exterior of the housing. The housing **20** has a main body **30**, a front cover **50** and a rear cover **70**. The front cover **50** is secured to one side of the main body **30** and the rear cover **70** is secured to the other side of the main body **30**. The housing **20** is made of a suitable electrical insulating material, such as plastic, including injection molded thermoplastic, and is configured to fit within an electrical box.

The main body **30** includes a plurality of chambers or cavities **32**, seen in FIGS. **4** and **5**. Each cavity **32** is configured to receive and position a contact assembly **100** within the main body **30**, as shown in FIGS. **6** and **7**. Each contact assembly **100** is configured to receive a wire, such as wire **700** shown in FIG. **5**, and to mate with a contact blade of a plug connector, such as the plug connector of FIG. **17**.

As shown in FIG. **1**, the front cover **50** of the receptacle **10** includes a face **52** having a plurality of blade-receiving slots **54** through which contact blades of a plug connector, such as the contact blades of the plug connector shown in FIG. **17**, can be inserted in the usual manner into adjacent cavities **32** within the main body **30**. The front cover **50** has one or more mounting straps **56** that are secured to an exterior surface of the front cover **50** using, for example, mechanical fasteners or adhesives. The mounting straps **56** are used to secure the receptacle **10** to an electrical box via apertures **58** as is known. The mounting straps **56** may also be connected to electrical ground via a contact assembly **100** within the main body **30**. The front cover **50** can be secured to the main body **30** using mechanical fasteners, adhesives or welds such as sonic welds.

Referring to FIGS. **2**, **3** and **5**, the rear cover **70** can be secured to the main body **30** using mechanical fasteners, such as screws **72**, adhesives or welds such as sonic welds. The rear cover **70** includes a plurality of wire receiving apertures **74**. Each wire receiving aperture **74** is positioned to align with a cavity **32** in the main body **30** so that a wire can pass through the rear cover **70** into a contact assembly **100** resting within a cavity **32** in the main body **30**. The rear cover **70** may also include a plurality of wire guides **76** extending outwardly from an exterior surface **78** of the rear cover, as shown. In the embodiment shown, one wire guide **76** corresponds to one wire receiving aperture **74**. Each wire guide **76** has an arcuate shape that corresponds to the round shape of a wire being inserted into the wire receiving aperture **74**. The rear cover **70** also includes a plurality of plunger openings **80**, seen in FIGS. **2** and **3**, that permits a portion of a plunger **150**, forming a portion of the contact assembly **100** described below, to extend outside the housing **20**.

Turning to FIGS. **8** and **9**, an exemplary embodiment of a contact assembly **100** according to the present disclosure is shown. In this exemplary embodiment, the contact assembly **100** includes a contact member **110**, a wire terminal **130** and a plunger **150**. The contact member **110** is made of an electrically conductive material, such as brass, copper or aluminum. The wire terminal **130** is made of an electrically conductive resilient material with sufficient stiffness to flex when a mechanical load is applied and return to its normal position when the mechanical load is removed. An example of such an electrically conductive resilient material is spring steel. The plunger **150** is made of a suitable rigid electrical insulating material, such as plastic materials. An example of a plastic material is injection molded thermoplastic. The contact member **110** and the wire terminal **130** can be formed as a unitary structure, or the contact member **110** and wire terminal **130** can be individual components secured together by, for example, a solder joint, a brazed joint, or a welded joint.

The contact member **110** includes a contact body **112** and a pair of flexible fingers **114** and **116** extending from the contact body **112**, as shown. The flexible fingers **114** and **116** form a female contact configured to engage a contact blade of a blade-type electrical power cord plug, such as a contact blade of the plug shown in FIG. **17**. The distal ends of the flexible fingers **114** and **116** contact each other or are in close proximity to each other to form a gripping portion **118** between the fingers. The gripping portion **118** is capable of receiving a contact blade so as to electrically couple or connect the contact member **110** to the contact blade. Thus, each contact assembly **100** is adapted to engage one of a plurality of contact blades of a blade-type electrical power cord plug.

The wire terminal **130** is a mechanical clamping terminal that uses one or more springs that can deflect under a mechanical load applied by the plunger **150** and recover to their initial shape when the mechanical load is removed. The energy stored by the one or more springs should be sufficient to apply a constant and continuous force to mechanically secure one or more wires, e.g., wire **700** shown in FIG. **5**, to the wire terminal **130**.

In the exemplary configuration shown in FIGS. **8** and **9**, the wire terminal **130** includes a clamp brace **132**, a contact arm **134** and a clamp spring **136**. The clamp brace **132** is a fixed terminal body that may be a substantially planar shaped member or an arcuate shaped member secured to the contact body **112** of the contact member **110** via the contact arm **134**. The contact arm **134** also provides an electrically conductive path between the contact member **110** and the wire terminal **130**. The clamp spring **136** includes an end portion **138**, a spring member **140** and a clamp arm **142**. The end portion **138** can be a substantially planar shaped member or an arcuate shaped member that is configured to mate with the clamp brace **132** and is secured to the clamp brace **132** by, for example, a solder joint, a brazed joint, or a welded joint. The spring member **140** has a lower lobe **140***a* and an upper lobe **140***b*. The lower lobe **140***a* and the upper lobe **140***b* are configured to interact with the plunger **150** so that vertical movement of the plunger **150** relative to the spring member **140** is translated to the application of a mechanical load on the spring member **140** or the removal of the mechanical load on the spring member **140**. For example, the plunger **150** can be a rectangular shaped member having a notch **152** that is configured to receive the upper lobe **140***b* of the spring member **140**, as shown in FIG. **8**. The notch **152** has a camming surface **152***a* that rides along the spring member **140** when the plunger **150** is moved in the direction of arrow "B" applying a mechanical load on the spring member **140** causing the spring member **140** to deflect in the direction of arrow "C" toward the open position, seen in FIG. **9**. The clamp arm **142** extends from the upper lobe **140***b* of the spring member **140** toward the clamp brace **132**, as shown. The clamp arm **142** has an elongated opening **144** configured to receive a portion of the clamp brace **132** and a clamp member **146** that contacts a wire, e.g., wire **700** seen in FIG. **5**, positioned between the clamp brace **132** and the clamp member **146** when the clamp spring **136** is in the closed position. The clamp arm **142** is movable relative to the clamp brace **132** between the closed position, seen in FIG. **8**, and the open position, seen in FIG. **9**.

As noted, the wire terminal **130** can connect to electrical conductors of different sizes. For example, if the blade-type

electrical receptacle **10** is rated for 15 amps, then the wire terminal **130** should also be configured and rated for at least 15 amps. The wire size, i.e., the bare conductor size, for 15 amps is 14 AWG wire such that the clamp arm **142** should be able to move to an open position where the outer diameter of 14 AWG wire can fit. As another example, if the blade-type electrical receptacle **10** is rated for 20 amps, then the wire terminal **130** should also be rated for at least 20 amps. The wire size, i.e., the bare conductor size, for 20 amps is 12 AWG wire such that the clamp arm **142** should be able to move to an open position where the outer diameter of 12 AWG wire can fit. As another example, if the blade-type electrical receptacle **10** is rated for 30 amps, then the wire terminal **130** should also be rated for at least 30 amps. The wire size, i.e., the bare conductor size, for 30 amps is 10 AWG wire such that the clamp arm **142** should be able to move to an open position where the outer diameter of 10 AWG wire can fit. As another example, if the blade-type electrical receptacle **10** is rated for 40 amps, then the wire terminal **130** should also be rated for at least 40 amps. The wire size, i.e., the bare conductor size, for 40 amps is 8 AWG wire such that the clamp arm **142** should be able to move to an open position where the outer diameter of 8 AWG wire can fit.

As noted, the spring member **140** is made of an electrically conductive resilient material with sufficient stiffness to flex when the plunger **150** pushes the spring member **140** from the closed position to the open position while applying a biasing force (i.e., a spring force) through the clamp member **146** to a wire between the clamp member **146** and the clamp brace **132**. As an example, the spring arm **140** can be made of metal, such as spring steel. The biasing force (or spring force) exerted by the spring arm **140** clamping a wire between the clamp member **146** and the clamp brace **132** should be sufficient to apply a constant and continuous force on the wire to electrically couple or connect the wire terminal **130** to the wire in various temperature and environmental conditions. The spring member **140** is configured so that it is normally biased toward the closed position, i.e., in the direction of arrow "A" which is away from the clamp brace **132**, as seen in FIG. **8**. In the spring member's **140** normal position without a conductor inserted into the elongated opening **144**, the clamp member **146** of the clamp arm **142** can contact the clamp brace **132**.

Turning to FIGS. **8**A, **8**B and **9**A-**9**D, another exemplary embodiment of a contact assembly **101** according to the present disclosure is shown. The contact assembly **101** is substantially similar to the contact assembly **100** such that like reference numerals are used to reference like components. The contact assembly **101** includes the contact member **110**, the wire terminal **130** and the plunger **50**. In this exemplary embodiment, the wire terminal **130** includes a wire manager **900**.

The wire terminal **130** is a mechanical clamping terminal that uses, for example, one or more springs that can deflect under a mechanical load applied by the plunger **150** and recover to its initial shape when the mechanical load is removed. The energy stored by the one or more springs should be sufficient to apply a constant and continuous force in the range of, for example, about 5 pound force to about 35 pound force, to mechanically secure one or more wires, e.g., wire **710** shown in FIG. **9**A, to the wire terminal **130**. The wire terminal **130** is made of an electrically conductive resilient material with sufficient stiffness to flex when a mechanical load is applied and return to its normal position when the mechanical load is removed. An example of such an electrically conductive resilient material is spring steel. In the exemplary configuration shown in FIGS. **8**A and **8**B, the wire terminal **130** includes a clamp brace **132**, a contact arm **134** and a clamp spring **136**. The clamp brace **132** is a fixed terminal body that may be a substantially planar shaped member or an arcuate shaped member secured to or integrally formed into the contact body **112** of the contact member **110** via the contact arm **134**. The clamp spring **136** includes an end portion **138**, a spring member **140** and a clamp arm **142**. The clamp arm **142** has an elongated opening **144** configured to receive a portion of the clamp brace **132** and a clamp member **146** that contacts a wire, e.g., wire **710** seen in FIG. **9**A, positioned within the elongated opening **144** between the clamp brace **132** and the clamp member **146** when the clamp spring **136** is in the closed position. The clamp arm **142** is movable relative to the clamp brace **132** between the closed position, seen in FIG. **8**A, and the open position, seen in FIG. **9**A.

In this exemplary embodiment, the clamp brace **132** has a wire manager **900** integrally or monolithically formed into the clamp brace **132**. In another embodiment, the wire manager **900** may be secured to the clamp brace **132** by, for example, a solder joint, a brazed joint or a welded joint. It is to be appreciated that the wire manager **900** may also be integrally or monolithically formed into the clamp spring **136**. It is also to be appreciated that the wire manager **900** may also be secured to the clamp spring **136** by, for example, a solder joint, a brazed joint or a welded joint. The wire manager **900** is provided to urge the wire, e.g., wire **700** or **710**, to be concentrated toward a center or middle of the clamp brace **132** and/or a center or middle of the clamp member **146**. Preferably, the wire manager **900** is provided to urge wire strands of stranded wire, e.g., stranded wire **710**, to be concentrated toward a center or middle the clamp brace **132** and/or a center or middle of the clamp member **146**. Concentrating the wire, e.g., wire strands of stranded wire **710**, toward a middle the clamp brace **132** and/or a middle of the clamp member **146** increases the force or pressure applied by the clamp member **146** of the clamp arm **142** of the clamp spring **136** to the wire. For example, concentrating the wire toward a middle the clamp brace **132** and/or a middle of the clamp member **146** can increase the force or pressure applied by the clamp member **146** by, for example, about 20 percent when compared to instances where the wire, e.g., wire **710**, is not concentrated wire toward a center or middle the clamp brace **132** and/or a center or middle of the clamp member **146**. This results in a higher wire retention force in the range of about 1 pound force and about 7 pound force that can be applied by the clamp spring **136** to hold the wire, e.g., the wire strands of the stranded wire **710**, against the clamp brace **132**. For example, in the example where the energy stored by the one or more springs should be sufficient to apply a constant and continuous force in the range of, for example, about 5 pound force to about 35 pound force, the higher wire retention force would be in the range of, for example, 6 pound force to about 42 pound force. In addition, the higher spring force or pressure on the wire also provides an improved electrical connection by lowering the contact resistance. Exemplary embodiments of the wire manager **900** are shown in FIGS. **43**-**47** and are described herein below. However, the present disclosure contemplates other wire manager embodiments where the wire manager urges a wire or wire strands toward a center or middle of a clamp brace and/or a center or middle of the clamp member.

As noted, the wire terminal **130** can connect to electrical conductors of different sizes. For example, if the blade-type electrical receptacle **10** is rated for 15 amps, then the wire

terminal **130** should also be configured and rated for at least 15 amps. The wire size, i.e., the bare conductor size, for 15 amps is 14 AWG wire such that the clamp arm **142** should be able to move to an open position where the outer diameter of 14 AWG wire can fit. As another example, if the blade-type electrical receptacle **10** is rated for 20 amps, then the wire terminal **130** should also be rated for at least 20 amps. The wire size, i.e., the bare conductor size, for 20 amps is 12 AWG wire such that the clamp arm **142** should be able to move to an open position where the outer diameter of 12 AWG wire can fit. As another example, if the blade-type electrical receptacle **10** is rated for 30 amps, then the wire terminal **130** should also be rated for at least 30 amps. The wire size, i.e., the bare conductor size, for 30 amps is 10 AWG wire such that the clamp arm **142** should be able to move to an open position where the outer diameter of 10 AWG wire can fit. As another example, if the blade-type electrical receptacle **10** is rated for 40 amps, then the wire terminal **130** should also be rated for at least 40 amps. The wire size, i.e., the bare conductor size, for 40 amps is 8 AWG wire such that the clamp arm **142** should be able to move to an open position where the outer diameter of 8 AWG wire can fit.

As noted, the spring member **140** is made of a resilient material with sufficient stiffness to flex when the plunger **150** pushes the spring member **140** from the closed position to the open position while applying a biasing force (i.e., a spring force) through the clamp member **146** to a wire between the clamp member **146** and the clamp brace **132**. As an example, the spring arm **140** can be made of metal, such as spring steel. The biasing force (or spring force) exerted by the spring arm **140** clamping a wire between the clamp member **146** and the clamp brace **132** should be sufficient to apply a constant and continuous force on the wire to electrically couple or connect the wire terminal **130** to the wire in various temperature and environmental conditions. The spring member **140** is configured so that it is normally biased toward the closed position, i.e., in the direction of arrow "A" which is away from the clamp brace **132**, as seen in FIG. **8**. In the spring member's **140** normal position without a conductor inserted into the elongated opening **144**, the clamp member **146** of the clamp arm **142** can contact the clamp brace **132**.

As described herein, the receptacle **10** uses contact assemblies **100** to terminate electrical conductors or wires within an electrical box. To connect wires within an electrical box to the receptacle **10**, an installer, e.g., an electrician, strips the insulation from the end of each wire. In this exemplary embodiment, the receptacle **10** has three contact assemblies **100** such that three wires can be connected to the receptacle **10**. However, it is also contemplated that each contact assembly could be configured to electrically connect more than one wire to the contact assembly **100**. The plungers **150** for each contact assembly **100** extending through the rear cover **70** are then pulled vertically relative to a longitudinal axis of the receptacle **10**, i.e., in the direction of arrow "B" seen in FIG. **8**, to cause the camming surface **152***a* of the notch **152** in the plunger **150** to ride along the spring member **140** applying a mechanical load on the spring member **140** causing the spring member to deflect in the direction of arrow "C" from the closed position toward the open position, seen in FIG. **9**. With the wire terminals **130** in the open position, the electrical wires are then inserted into the appropriate wire receiving aperture **74** in the rear cover **70** of the receptacle **10**. The wire receiving apertures **74** and wire guides **76** guide the bare end of the wires into the portion of the elongated opening **144** of the clamp spring **136** between clamp brace **132** and clamp member **146**. When the bare end of each wire is positioned between the clamp brace **132** and the clamp member **146**, the respective plunger **150** is then pushed back into the receptacle **10** removing the mechanical load applied by the plunger on the spring member **140** so that the energy stored by the spring member **140** moves the spring member **140** to the closed position securing or clamping the wire between the clamp brace **132** and the clamp member **146** completing an electrically conductive path between the wire and the contact member **110**.

To remove the wires from the contact assembly **100**, the plungers **150** for each contact assembly **100** extending through the rear cover **70** are pulled vertically relative to a longitudinal axis of the receptacle **10** to cause the camming surface **152***a* of the notch **152** in the plunger **150** to ride along the spring member **140** applying a mechanical load on the spring member **140** causing the spring member to deflect from the closed position to the open position. With the wire terminals **130** in the open position, the electrical wires can be removed from the receptacle.

Referring now to FIGS. **10-16**, an exemplary embodiment of a blade-type electrical power cord connector is shown. In this exemplary embodiment, the blade-type connector **200** has a housing **210** and a plurality of contact assemblies **300** within the housing that are accessible from an exterior of the housing. The housing **210** has a main body **220**, a retainer **240** and a cover **260**. The retainer **240** is secured to a top side of the main body **220** using screw **242**. The cover **260** is secured to the top side of the main body **220** using screws **222** inserted through apertures in a face **224** in the main body **220** and through the main body **220**. The housing **210** is made of a suitably rigid, electrical insulating material, such as a plastic material, including injection molded thermoplastic, or a rubber material.

The main body **220** includes a plurality of chambers or cavities **226** seen in FIGS. **12** and **13**. Each cavity **226** is configured to receive and position a contact assembly **300** within the main body **220**. Each contact assembly **300** is configured to receive a conductor and to mate with a contact blade of a blade-type plug connector, such as a contact blade of the plug connector of FIG. **17**. The face **224** of the main body **220** has a plurality of blade-receiving slots **228** through which contact blades of a blade-type plug connector can be inserted in the usual manner into adjacent cavities **226** within the main body **220** and into a respective contact assembly **300**.

The cover **260** of the connector **200** may be hollow, partially hollow or solid. As shown in FIGS. **10** and **12**, the cover **260** includes a cable connector **262** at a top portion of the cover **260**. The cable connector **262** includes a fixed bracket **264** and a movable bracket **266** releasably secured to the fixed bracket **264** using screws **268**. In a central portion of the connector **262** is a cable receiving opening **270** that extends through the cover **260**. The cable receiving opening **270** permits an electrical power cord (not shown) to pass through the cover **260** so that electrical wires within the electrical power cord can be connected to the contact assemblies **300**.

Referring to FIGS. **12** and **14**, the retainer **240** is secured to the main body **220** using mechanical fasteners, such as screw **242**. The retainer **240** includes a plurality of wire receiving apertures **244**. Each wire receiving aperture **244** is positioned to align with a cavity **226** in the main body **220** so that a wire can pass through the retainer **240** into a contact assembly **300** resting within a cavity **226** in the main body **220**. The retainer **240** may also include a plurality of wire

guides **246** extending outwardly from surface **248** of the retainer, as shown. In the embodiment shown, one wire guide **246** corresponds to one wire receiving aperture **244**. Each wire guide **246** may have an arcuate like shape that corresponds to the shape of a wire being inserted into the wire receiving aperture **244**. The retainer **240** also includes a plurality of plunger openings **250**, seen in FIG. **14**. In the embodiment shown, one plunger opening **250** corresponds to one wire receiving aperture **244**. The plunger openings **250** permit a portion of a respective plunger **350** forming a portion of the contact assembly **300**, described below, to extend outside the main body **220**. The retainer **240** may also include a plurality of plunger guides **254** extending outwardly from surface **252** of the retainer, as shown in FIG. **12**. In the embodiment shown, one plunger guide **254** corresponds to one plunger opening **250**. The plunger guides **254** guide the plungers **350** as they are moved relative to the retainer **240**.

Referring to FIGS. **15** and **16**, another exemplary embodiment of a contact assembly **300** according to the present disclosure is shown. In this exemplary embodiment, the contact assembly **300** includes a contact member **310**, a wire terminal **330** and a plunger **350**. The contact member **310** is made of an electrically conductive material, such as brass, copper or aluminum. The wire terminal **330** is made of an electrically conductive resilient material with sufficient stiffness to flex when a mechanical load is applied to the material and return to its normal position when the mechanical load is removed. An example of an electrically conductive resilient material is spring steel. The plunger **350** is made of a suitable rigid electrical insulating material, such as plastic materials. An example of a plastic material is injection molded thermoplastic. The contact member **310** and wire terminal **330** can be formed as a unitary structure, or the contact member and wire terminal can be individual components secured together by, for example, a solder joint, a brazed joint, or a welded joint.

The contact member **310** includes a contact body **312** and a pair of flexible fingers **314** and **316** extending from the contact body **312**, as shown. The flexible fingers **314** and **316** form a female contact configured to engage a contact blade of a blade-type electrical power cord plug, such as a contact blade of the plug shown in FIG. **17**. The distal end of the flexible fingers **314** and **316** contact each other or are in close proximity to each other to form a gripping portion **318** between the fingers. The gripping portion **318** is capable of receiving a contact blade so as to electrically couple or connect the contact member **310** to the contact blade. Thus, each contact assembly **300** is adapted to engage one of a plurality of contact blades of a blade-type electrical power cord plug.

The wire terminal **330** is a mechanical clamping terminal that uses one or more springs that can deflect under a mechanical load applied by the plunger **350** and recover to their initial shape when the mechanical load is removed. The energy stored by the one or more springs should be sufficient to apply a constant and continuous force to mechanically secure one or more wires, e.g., wire **700** shown in FIG. **16**, to the wire terminal **330**.

In the exemplary configuration shown in FIGS. **15** and **16**, the wire terminal **330** includes a clamp brace **332** and a clamp spring **336**. The clamp brace **332** is a fixed terminal body that may be a substantially planar shaped member or an arcuate shaped member secured to or integrally formed into the contact body **312** of the contact member **310**. The clamp brace **332** also forms an electrically conductive path between the contact body **312** and the clamp brace **332**. The clamp spring **336** includes an end portion **338**, a spring member **340** and a clamp arm **342**. The end portion **338** can be a substantially planar shaped member or an arcuate shaped member that is configured to mate with the clamp brace **332** and is secured to the clamp brace by, for example, a solder joint, a brazed joint, or a welded joint. The spring member **340** has a lower lobe **340***a* and an upper lobe **340***b*. The lower lobe **340***a* and the upper lobe **340***b* are configured to interact with the plunger **350** so that vertical movement of the plunger relative to the spring member **340** is translated to the application of a mechanical load on the spring member **340** or the removal of the mechanical load on the spring member **340**. For example, the plunger **350** can be a rectangular shaped member having a notch **352** that is configured to receive the upper lobe **340***b* of the spring member **340**, as shown in FIG. **15**. The notch **352** has a camming surface **352***a* that rides along the spring member **340** when the plunger **350** is moved in the direction of arrow "E" applying a mechanical load on the spring member **340** causing the spring member **340** to deflect in the direction of arrow "F" toward the open position, seen in FIG. **16**. The clamp arm **342** extends from the upper lobe **340***b* of the spring member **340** toward the clamp brace **332**, as shown. The clamp arm **342** has an elongated opening **344** configured to receive a portion of the clamp brace **332** and a clamp member **346** that contacts a wire, e.g., wire **700** seen in FIG. **16**, positioned between the clamp brace **332** and the clamp member **346** when the clamp spring **336** is in the closed position, seen in FIG. **15**. The clamp arm **342** is movable relative to the clamp brace **332** between the closed position, seen in FIG. **15**, and the open position, seen in FIG. **16**.

Turning to FIGS. **15**A, **1513** and **16**A-**16**D, another exemplary embodiment of a contact assembly **301** according to the present disclosure is shown. The contact assembly **301** is substantially similar to the contact assembly **300** such that like reference numerals are used to reference like components. The contact assembly **301** includes the contact member **310**, the wire terminal **330** and the plunger **350**. In this exemplary embodiment, the wire terminal **130** includes a wire manager **900**.

The wire terminal **330** is a mechanical clamping terminal that uses, for example, one or more springs that can deflect under a mechanical load applied by the plunger **350** and recover to its initial shape when the mechanical load is removed. The energy stored by the one or more springs should be sufficient to apply a constant and continuous force in the range of, for example, about 5 pound force to about 35 pound force, to mechanically secure one or more wires, e.g., wire **710** shown in FIG. **16**A, to the wire terminal **330**. In this exemplary embodiment, the wire terminal **330** is made of an electrically conductive resilient material with sufficient stiffness to flex when a mechanical load is applied and return to its normal position when the mechanical load is removed. An example of such an electrically conductive resilient material is spring steel. In the exemplary configuration shown in FIGS. **15**A and **15**B, the wire terminal **330** includes the clamp brace **332**, the contact arm **334** and the clamp spring **336**. The clamp brace **332** is a fixed terminal body that may be a substantially planar shaped member or an arcuate shaped member secured to or integrally formed into the contact body **312** of the contact member **310**. The clamp spring **336** includes an end portion, the spring member **340** and the clamp arm **342**. The clamp arm **342** has the elongated opening **344** configured to receive a portion of the clamp brace **332** and the clamp member **346** that contacts a wire, e.g., the wire strands of stranded wire **710** seen in FIG. **16**A, positioned within the elongated opening **344** between

the clamp brace **332** and the clamp member **346** when the clamp spring **336** is in the closed position. The clamp arm **342** is movable relative to the clamp brace **332** between the closed position, seen in FIG. **15**A, and the open position, seen in FIG. **16**A.

In this exemplary embodiment, the clamp brace **332** has a wire manager **900** integrally or monolithically formed into the clamp brace **332**. In another embodiment, the wire manager **900** may be secured to the clamp brace **332** by, for example, a solder joint, a brazed joint or a welded joint. It is to be appreciated that the wire manager **900** may also be integrally or monolithically formed into the clamp spring **336**. It is also to be appreciated that the wire manager **900** may also be secured to the clamp spring **336** by, for example, a solder joint, a brazed joint or a welded joint. The wire manager **900** is provided to urge the wire, e.g., wire **700** or the wire strands of stranded wire **710**, to be concentrated toward a center or middle of the clamp brace **332** and/or a center or middle of the clamp member **346**. Preferably, the wire manager **900** is provided to urge wire strands of stranded wire, e.g., stranded wire **710**, to be concentrated toward a center or middle the clamp brace **332** and/or a center or middle of the clamp member **346**. Concentrating the wire, e.g., wire strands of stranded wire **710**, toward a middle the clamp brace **332** and/or a middle of the clamp member **346** increases the force or pressure applied by the clamp member **346** of the clamp arm **342** of the clamp spring **336** to the wire. For example, concentrating the wire toward a middle the clamp brace **332** and/or a middle of the clamp member **346** can increase the force or pressure applied by the clamp member **346** by, for example, about 20 percent when compared to instances where the wire, e.g., wire **710**, is not concentrated wire toward a center or middle the clamp brace **332** and/or a center or middle of the clamp member **346**. This results in a higher wire retention force in the range of, for example, about 1 pound force and about 7 pound force that can be applied by the clamp spring **336** to hold the wire, e.g., the wire strands of the stranded wire **710** against the clamp brace **332**. For example, in the example where the energy stored by the one or more springs should be sufficient to apply a constant and continuous force in the range of, for example, about 5 pound force to about 35 pound force, the higher wire retention force would be in the range of, for example, 6 pound force to about 42 pound force. In addition, the higher spring force or pressure on the wire also provides an improved electrical connection by lowering the contact resistance. Exemplary embodiments of the wire manager **900** are shown in FIGS. **43-47** and are described herein below. However, the present disclosure contemplates other wire manager embodiments where the wire manager urges a wire or wire strands toward a center or middle of a clamp brace and/or a center or middle of the clamp member.

As noted, the wire terminal **330** can connect to electrical conductors of different sizes. For example, if the blade-type connector **200** is rated for 15 amps, then the wire terminal **330** should also be configured and rated for at least 15 amps. The wire size, i.e., the bare conductor size, for 15 amps is 14 AWG wire such that the clamp arm **342** should be able to move to an open position where the outer diameter of 14 AWG wire can fit. As another example, if the blade-type connector **200** is rated for 20 amps, then the wire terminal **330** should also be rated for at least 20 amps. The wire size, i.e., the bare conductor size, for 20 amps is 12 AWG wire such that the clamp arm **342** should be able to move to an open position where the outer diameter of 12 AWG wire can fit. As another example, if the blade-type connector **200** is rated for 30 amps, then the wire terminal **330** should also be rated for at least 30 amps. The wire size, i.e., the bare conductor size, for 30 amps is 10 AWG wire such that the clamp arm **342** should be able to move to an open position where the outer diameter of 10 AWG wire can fit. As another example, if the blade-type connector **200** is rated for 40 amps, then the wire terminal **330** should also be rated for at least 40 amps. The wire size, i.e., the bare conductor size, for 40 amps is 8 AWG wire such that the clamp arm **342** should be able to move to an open position where the outer diameter of 8 AWG wire can fit.

As noted, the spring member **340** is made of an electrically conductive resilient material with sufficient stiffness to flex when the plunger **350** pushes the spring member **340** from the closed position to the open position while applying a biasing force (i.e., a spring force) to the clamp member **346** to secure or clamp a wire between the clamp member **346** and the clamp brace **332**. As an example, the spring arm **340** can be made of metal, such as spring steel. The biasing force (or spring force) exerted by the spring arm **340** clamping a wire between the clamp member **346** and the clamp brace **332** should be sufficient to apply a constant and continuous force on the wire to electrically couple or connect the wire terminal **330** to the wire in various temperature and environmental conditions. The spring member **340** is configured so that it is normally biased toward the closed position, i.e., in the direction of arrow "D" which is away from the clamp brace **332**, as seen in FIG. **15**. In the spring member's **340** normal position without a conductor inserted into the elongated opening **344**, the clamp member **346** of the clamp arm **342** can contact the clamp brace **332**.

As described herein, the connector **200** uses the contact assemblies **300** to terminate electrical wires within the connector. To connect wires within the connector **200**, an installer, e.g., an electrician, passes a wire cable through the cable receiving opening **270** in cover **260**. The insulation at the end of each wire within the cable is then striped. In this exemplary embodiment, the connector **200** has three contact assemblies **300** such that three wires within the wire cable can be connected to the connector. The portion of the plungers **350** for each contact assembly **300** extending through the retainer **240** are then pulled vertically relative to a longitudinal axis of the connector **200**, i.e., in the direction of arrow "E" seen in FIG. **15**, to cause the camming surface **352***a* of the notch **352** in the plunger **350** to ride along the spring member **340** applying a mechanical load on the spring member **340**. Applying a mechanical load to the spring member **340** in such a manner causes the spring member **340** to deflect in the direction of arrow "F" (i.e., from the closed position toward the open position), seen in FIG. **16**. With the wire terminals **330** in the open position, the electrical wires are then inserted into the appropriate wire receiving aperture **244** in the retainer **240** of the connector **200**. The wire receiving apertures **244** and wire guides **246** guide the bare end of the wires into the portion of the elongated opening **344** of the clamp spring **336** between clamp brace **332** and clamp member **346**. When the bare end of each wire is positioned between the clamp brace **332** and the clamp member **346**, the respective plunger **350** is then pushed back toward the main body **220** removing the mechanical load applied by the plunger **350** on the spring member **340** so that the energy stored by the spring member **340** biases the spring member **340** toward the closed position securing the wire between the clamp brace **332** and the clamp member **346**, and completing an electrically conductive path between the wire and the contact member **310**. To remove the wires from the contact assembly **300**, the plungers **350** for each contact assembly **300** extending through the

retainer **240** are pulled vertically relative to a longitudinal axis of the connector **200** to cause the camming surface **352***a* of the notch **352** in the plunger **350** to ride along the spring member **340** applying a mechanical load on the spring member **340** causing the spring member **340** to deflect from the closed position to the open position. With the wire terminals **330** in the open position, the electrical wires can be removed from the connector **200**.

Referring now to FIGS. **17-22**, an exemplary embodiment of a blade-type electrical power cord plug is shown. In this exemplary embodiment, the blade-type plug **400** has a housing **410** and a plurality of contact assemblies **500** within the housing **410** and extending at least partially from an exterior of the housing **410**. As seen in FIG. **18**, the housing **410** has a main body **420**, a bottom cover **440**, a retainer **460** and a top cover **480**. The retainer **460** is secured to a top side of the main body **420** using screw **462**. The bottom cover **440** is secured to the top cover **480** by passing screws **442** through a face **444** and apertures **446** in the bottom cover **440**, through corresponding apertures **422** in the main body **420** and through corresponding apertures **464** in the retainer **460**. The screws **442** are then secured to corresponding mounting holes (not shown) in the top cover **480**. The housing **410** is made of a suitably rigid, electrical insulating material, such as a plastic material, or a rubber material. An example of a plastic material is injection molded thermoplastic.

The main body **420** includes a plurality of chambers or cavities **424** seen in FIGS. **18** and **19**. Each cavity **424** is configured to receive and position a contact assembly **500** within the main body **420**. Each contact assembly **500** is configured to receive a conductor and to mate with a female contact of a blade-type connector, such as the female contacts of FIG. **8** or **15**. The face **444** of the bottom cover **440** has a plurality of blade-receiving slots **448** through which contact blades **514** of the contact assemblies **500** can be inserted so that the contact blades extend outside the housing **410**.

The bottom cover **440** when secured to the top cover **480** helps hold the contact assemblies **500** within the main body **420**. The top cover **480** of the connector **400** may be hollow, partially hollow or solid. As shown in FIGS. **17** and **18**, the cover **480** includes a cable connector **482** at a top portion of the cover **480**. The cable connector **482** includes a fixed bracket **484** and a movable bracket **486** releasably secured to the fixed bracket using screws **488**. In a central portion of the connector **482** is a cable receiving opening **490** that extends through the cover **480**. The cable receiving opening **490** permits an electrical power cord (not shown) to pass through the cover **480** so that electrical wires within the electrical power cord can be connected to the contact assemblies **500**.

Referring to FIGS. **18** and **20**, the retainer **460** is secured to the main body **420** using mechanical fasteners, such as screw **462**. The retainer **460** includes a plurality of wire receiving apertures **466**. Each wire receiving aperture **466** is positioned to align with a cavity **424** in the main body **420** so that a wire can pass through the retainer **460** into a contact assembly **500** resting within a cavity **424** in the main body **420**. The retainer **460** may also include a plurality of wire guides **468** extending outwardly from surface **470** of the retainer **460**, as shown. In the embodiment shown, one wire guide **468** corresponds to one wire receiving aperture **466**. Each wire guide **468** may have an arcuate like shape that corresponds to the shape of a wire being inserted into the wire receiving aperture **466**. The retainer **460** also includes a plurality of plunger openings **472**. In the embodiment shown, one plunger opening **472** corresponds to one wire receiving aperture **466**. The plunger openings **472** permit a portion of a respective plunger **550** forming a portion of the contact assembly **500** described below, to extend outside the main body **420** and into the top cover **480**.

Referring now to FIGS. **21** and **22**, another exemplary embodiment of a contact assembly **500** according to the present disclosure is shown. In this exemplary embodiment, the contact assembly **500** includes a contact member **510**, a wire terminal **530** and a plunger **550**. The contact member **510** is made of an electrically conductive material, such as brass, copper or aluminum. The wire terminal **530** is made of an electrically conductive resilient material with sufficient stiffness to flex when a mechanical load is applied and return to its normal position when the mechanical load is removed. An example of an electrically conductive resilient material is spring steel. The plunger **550** is made of a rigid electrical insulating material, such as a plastic material. An example of a plastic material is injection molded thermoplastic. The contact member **510** and wire terminal **530** can be formed as a unitary structure, or the contact member **510** and wire terminal **530** can be individual components secured together by, for example, a solder joint, a brazed joint, or a welded joint.

The contact member **510** includes a contact body **512** and a blade **514** extending from the contact body **512**, as shown. The blade **514** is non-circular in shape and may be, for example, substantially flat in shape, arcuate in shape, L-shape or U-shape. The blade **514** forms a male contact configured to engage a female contact of a blade-type receptacle or a blade-type electrical power cord connector. The wire terminal **530** is a mechanical clamping terminal that uses one or more springs that can deflect under a mechanical load applied by the plunger **550** and recover to their initial shape when the mechanical load is removed. The energy stored by the one or more springs should be sufficient to apply a constant and continuous force to mechanically secure one or more wires, e.g., wire **700** shown in FIG. **22**, to the wire terminal **530**.

In the exemplary configuration shown in FIGS. **21** and **22**, the wire terminal **530** includes a clamp brace **532** and a clamp spring **536**. The clamp brace **532** is a fixed terminal body that may be a substantially planar shaped member or an arcuate shaped member secured to or integrally formed into the contact body **512** of the contact member **510**. The clamp brace **532** also provides an electrically conductive path between the contact body **512** and the clamp brace **532**. The clamp spring **536** includes an end portion, a spring member **540** and a clamp arm **542**. The end portion can be a substantially planar shaped member or an arcuate shaped member that is configured to mate with the clamp brace **532** and is secured to the clamp brace **532** by, for example, a solder joint, a brazed joint, or a welded joint. The spring member **540** has a lower lobe **540***a* and an upper lobe **540***b*. The lower lobe **540***a* and the upper lobe **540***b* are configured to interact with the plunger **550** so that vertical movement of the plunger **550** relative to the spring member **540** is translated to the application of a mechanical load on the spring member **540** or the removal of the mechanical load on the spring member **540**. For example, the plunger **550** can be a rectangular shaped member having a notch **552** that is configured to receive the upper lobe **540***b* of the spring member **540**, as shown in FIG. **21**. The notch **552** has a camming surface **552***a* that rides along the spring member **540** when the plunger **550** is moved in the direction of arrow "H" applying a load on the spring member **540** causing the spring member **540** to deflect in the direction of arrow "I" toward the open position, seen in FIG. **22**. The clamp arm

542 extends from the upper lobe 540*b* of the spring member 540 toward the clamp brace 532, as shown. The clamp arm 542 has an elongated opening 544 configured to receive a portion of the clamp brace 532 and a clamp member 546 that contacts a wire, e.g., wire 700 seen in FIG. 22, positioned between the clamp brace 532 and the clamp member 546 when the clamp spring 536 is in the closed position. The clamp arm 542 is movable relative to the clamp brace 532 between the closed position, seen in FIG. 21, and the open position, seen in FIG. 22.

Turning to FIGS. 21A, 21B and 22A-22D, another exemplary embodiment of a contact assembly 501 according to the present disclosure is shown. The contact assembly 501 is substantially similar to the contact assembly 500 such that like reference numerals are used to reference like components. The contact assembly 501 includes the contact member 510, the wire terminal 530 and the plunger 550. In this exemplary embodiment, the wire terminal 530 includes a wire manager 900.

The wire terminal 530 is a mechanical clamping terminal that uses, for example, one or more springs that can deflect under a mechanical load applied by the plunger 550 and recover to its initial shape when the mechanical load is removed. The energy stored by the one or more springs should be sufficient to apply a constant and continuous force in the range of, for example, about 5 pound force to about 35 pound force, to mechanically secure one or more wires, e.g., wire 710 shown in FIG. 22A, to the wire terminal 530. In this exemplary embodiment, the wire terminal 530 is made of an electrically conductive resilient material with sufficient stiffness to flex when a mechanical load is applied and return to its normal position when the mechanical load is removed. An example of such an electrically conductive resilient material is spring steel.

In the exemplary configuration shown in FIGS. 21A and 21B, the wire terminal 530 includes the clamp brace 532 and a clamp spring 536. The clamp brace 532 is a fixed terminal body that may be a substantially planar shaped member or an arcuate shaped member secured to or integrally formed into the contact body 512 of the contact member 510. The clamp spring 536 includes an end portion, the spring member 540 and the clamp arm 542. The clamp arm 542 has an elongated opening 544 configured to receive a portion of the clamp brace 532 and the clamp member 546 that contacts a wire, e.g., wire 710 seen in FIG. 22A, positioned within the elongated opening 544 between the clamp brace 532 and the clamp member 546 when the clamp spring 536 is in the closed position. The clamp arm 542 is movable relative to the clamp brace 532 between the closed position, seen in FIG. 21A, and the open position, seen in FIG. 22A.

In this exemplary embodiment, the clamp brace 532 has a wire manager 900 integrally or monolithically formed into the clamp brace 532. In another embodiment, the wire manager 900 may be secured to the clamp brace 532 by, for example, a solder joint, a brazed joint or a welded joint. It is to be appreciated that the wire manager 900 may also be integrally or monolithically formed into the clamp spring 536. It is also to be appreciated that the wire manager 900 may also be secured to the clamp spring 536 by, for example, a solder joint, a brazed joint or a welded joint. The wire manager 900 is provided to urge the wire, e.g., wire 700 or the wire strands of the stranded wire 710, to be concentrated toward a center or middle of the clamp brace 532 and/or a center or middle of the clamp member 546. Preferably, the wire manager 900 is provided to urge wire strands of stranded wire, e.g., stranded wire 710, to be concentrated toward a center or middle the clamp brace 532 and/or a center or middle of the clamp member 546. Concentrating the wire, e.g., wire strands of stranded wire 710, toward a middle the clamp brace 532 and/or a middle of the clamp member 546 increases the force or pressure applied by the clamp member 546 of the clamp arm 542 of the clamp spring 536 to the wire. For example, concentrating the wire toward a middle the clamp brace 532 and/or a middle of the clamp member 546 can increase the force or pressure applied by the clamp member 546 by, for example, about 20 percent when compared to instances where the wire, e.g., wire 710, is not concentrated wire toward a center or middle the clamp brace 532 and/or a center or middle of the clamp member 546. This results in a higher wire retention force in the range of, for example, about 1 pound force and about 7 pound force that can be applied by the clamp spring 536 to hold the wire, e.g., the wire strands of the stranded wire 710 against the clamp brace 532. For example, in the example where the energy stored by the one or more springs should be sufficient to apply a constant and continuous force in the range of, for example, about 5 pound force to about 35 pound force, the higher wire retention force would be in the range of, for example, 6 pound force to about 42 pound force. In addition, the higher spring force or pressure on the wire also provides an improved electrical connection by lowering the contact resistance. Exemplary embodiments of the wire manager 900 are shown in FIGS. 43-47 and are described herein below. However, the present disclosure contemplates other wire manager embodiments where the wire manager 900 urges a wire or wire strands toward a center or middle of a clamp brace and/or a center or middle of the clamp member.

As noted, the wire terminal 530 can connect to electrical conductors of different sizes. For example, if the plug 400 is rated for 15 amps, then the wire terminal 530 should also be configured and rated for at least 15 amps. The wire size, i.e., the bare conductor size, for 15 amps is 14 AWG wire such that the clamp arm 542 should be able to move to an open position where the outer diameter of 14 AWG wire can fit. As another example, if the plug 400 is rated for 20 amps, then the wire terminal 530 should also be rated for at least 20 amps. The wire size, i.e., the bare conductor size, for 20 amps is 12 AWG wire such that the clamp arm 542 should be able to move to an open position where the outer diameter of 12 AWG wire can fit. As another example, if the plug 400 is rated for 30 amps, then the wire terminal 530 should also be rated for at least 30 amps. The wire size, i.e., the bare conductor size, for 30 amps is 10 AWG wire such that the clamp arm 542 should be able to move to an open position where the outer diameter of 10 AWG wire can fit. As another example, if the plug 400 is rated for 40 amps, then the wire terminal 530 should also be rated for at least 40 amps. The wire size, i.e., the bare conductor size, for 40 amps is 8 AWG wire such that the clamp arm 542 should be able to move to an open position where the outer diameter of 8 AWG wire can fit.

As noted, the spring member 540 is made of an electrically conductive resilient material with sufficient stiffness to flex when the plunger 550 pushes the spring member 540 from the closed position to the open position while applying a biasing force (i.e., a spring force) to the clamp member 546 to secure or clamp a wire between the clamp member 546 and the clamp brace 532. As an example, the spring arm 540 can be made of metal, such as spring steel. The biasing force exerted by the spring arm 540 clamping a wire between the clamp member 546 and the clamp brace 532 should be sufficient to apply a constant and continuous force on the wire to electrically couple or connect the wire terminal 530 to the wire in various temperature and environmental con-

ditions. The spring member **540** is configured so that it is normally biased toward the closed position, i.e., in the direction of arrow "G" which is away from the clamp brace **532**, as seen in FIG. **21**. In the spring member's **540** normal position without a conductor inserted into the elongated opening **544**, the clamp member **546** of the clamp arm **542** can contact the clamp brace **532**.

As described herein, the plug **400** uses the contact assemblies **500** to terminate electrical wires within the blade-type plug. To connect wires within the plug **400**, an installer passes a wire cable through the cable receiving opening **490** in cover **480**. The insulation at the end of each wire within the cable is then striped. In this exemplary embodiment, the plug **400** has three contact assemblies **500** such that three wires within the wire cable can be connected to the plug **400**. The portion of the plunger **550** for each contact assembly **500** extending through the retainer **460** are then pulled vertically relative to a longitudinal axis of the plug **400**, i.e., in the direction of arrow "H" seen in FIGS. **21** and **22**, to cause the camming surface **552***a* of the notch **552** in the plunger **550** to ride along the spring member **540** applying a mechanical load to the spring member **540**. Applying such mechanical load to the spring member **540** causes the spring member **540** to deflect in the direction of arrow "I" (i.e., from the closed position toward the open position). With the wire terminals **530** in the open position, the electrical wires are then inserted into the appropriate wire receiving aperture **466** in the retainer **460**. The wire receiving apertures **466** and wire guides **468** guide the bare end of the wires into the portion of the elongated opening **544** of the clamp spring **536** between clamp brace **532** and clamp member **546**. When the bare end of each wire is positioned between the clamp brace **532** and the clamp member **546**, the respective plunger **550** is then pushed back toward the main body **420** removing the mechanical load applied by the plunger **550** on the spring member **540** so that the energy stored by the spring member biases the spring member to the closed position securing the wire between the clamp brace **532** and the clamp member **546**, and completing an electrically conductive path between the wire and the contact member **510**. To remove the wires from the contact assembly **500**, the plungers **550** for each contact assembly **500** extending through the retainer **460** are pulled vertically relative to a longitudinal axis of the plug **400** to cause the camming surface **552***a* of the notch **552** in the plunger **550** to ride along the spring member **540** applying a mechanical load on the spring member **540** causing the spring member **540** to deflect from the closed position toward the open position. With the wire terminals **530** in the open position, the electrical wires can be removed from the plug **400**.

Referring now to FIGS. **23-26**, an exemplary embodiment of a non-locking blade type electrical receptacle is shown. In this exemplary embodiment, the receptacle **600** has a housing **620** and a plurality of contact assemblies, which are similar to the contact assemblies **100**, described herein and shown in FIGS. **8** and **9**, within the housing that are accessible from an exterior of the housing. The housing **620** has a main body **630**, a front cover **650** and a rear cover **670**. The front cover **650** is secured to one side of the main body **630** and the rear cover **670** is secured to the other side of the main body. The housing **620** is made of a suitable electrical insulating material, such as plastic, including injection molded thermoplastic, and is configured to fit within an electrical box.

The main body **630** includes a plurality of chambers or cavities **632**, seen in FIG. **26**. Each cavity **632** is configured to receive and position a contact assembly **100** within the main body **630**, as shown in FIG. **26**. Each contact assembly **100** is configured to receive a wire, such as wire **700**, and to mate with a contact blade of a conventional plug connector as described above.

As shown in FIG. **23**, the front cover **650** of the receptacle **600** includes a face **652** having a plurality of blade-receiving slots **654** through which contact blades (e.g., hot, neutral and ground contact blades) of a plug connector can be inserted in the usual manner into adjacent cavities **632** within the main body **630**. The front cover **650** has one or more mounting straps **656** that are secured to an exterior surface of the front cover **650** using, for example, mechanical fasteners or adhesives. The mounting straps **656** are used to secure the receptacle **600** to an electrical box via apertures **658** as is known. The mounting straps **656** may also be connected to electrical ground via a contact assembly **100** within the main body **630**. The front cover **650** can be secured to the main body **630** using mechanical fasteners, adhesives or welds such as sonic welds.

Referring to FIGS. **24** and **25**, the rear cover **670** can be secured to the main body **630** using mechanical fasteners, such as screws **672**, adhesives or welds such as sonic welds. The rear cover **670** includes a plurality of wire receiving apertures **674**. Each wire receiving aperture **674** is positioned to align with a cavity **632** in the main body **630** so that a wire can pass through the rear cover **670** into a contact assembly **100** resting within a cavity **632** in the main body **630**. The rear cover **670** may also include a plurality of wire guides **76** extending outwardly from an exterior surface **678** of the rear cover **670**, as shown. In the embodiment shown, one wire guide **676** corresponds to one wire receiving aperture **674**. Each wire guide **676** has an arcuate shape that corresponds to the round shape of a wire being inserted into the wire receiving aperture **674**. The rear cover **670** also includes a plurality of plunger openings **680**, seen in FIG. **25**, that permits a portion of a plunger **150**, forming a portion of the contact assembly **100** described above, to extend outside the housing **620**.

Referring now to FIGS. **27-30**, an exemplary embodiment of a switch is shown. In this exemplary embodiment, the switch **720** has a housing **740** and a plurality of contact assemblies, which are similar to the contact assemblies **100**, described herein and shown in FIGS. **8** and **9**, within the housing **740** that are accessible from an exterior of the housing **740**. However, in this embodiment, the contact assemblies **100** would not include the contact member **110** and contact arm **134**, as seen in FIGS. **31** and **32**. Instead the clamp brace **132** would connect to respective switch contacts and/or ground connections within the housing **740**.

Another exemplary embodiment of a contact assembly **103** according to the present disclosure that may be used with the switch **720** is shown in FIGS. **31**A, **31**B and **32**A-**32**D. The contact assembly **103** is substantially similar to the contact assembly **100** such that like reference numerals are used to reference like components. The contact assembly **103** includes the wire terminal **130** and the plunger **150**. However, in this embodiment, the contact assemblies **103** would not include the contact member **110** and contact arm **134**. Instead, the clamp brace **132** would connect to respective switch contacts and/or ground connections within the housing **740** of the switch **720**. In addition, the wire terminal **130** would include the wire manager **900**. As described above, the clamp brace **132** has the wire manager **900** integrally or monolithically formed into the clamp brace **132**. However, the wire manager **900** may be secured to the clamp brace **132** by, for example, a solder joint, a brazed joint or a welded joint. It is to be appreciated that the wire

manager **900** may also be integrally or monolithically formed into the clamp spring **136**. It is also to be appreciated that the wire manager **900** may also be secured to the clamp spring **136** by, for example, a solder joint, a brazed joint or a welded joint. The wire manager **900** is provided to cause the wire, e.g., wire **700** or the wire strands of the stranded wire **710**, to be concentrated toward a center or middle of the clamp brace **132** and/or a center or middle of the clamp member **146**. Preferably, the wire manager **900** is provided to cause wire strands of stranded wire, e.g., stranded wire **710**, to be concentrated toward a center or middle the clamp brace **132** and/or a center or middle of the clamp member **146**. Concentrating the wire, e.g., wire strands of stranded wire **710**, toward a middle the clamp brace **132** and/or a middle of the clamp member **146** increases the force or pressure applied by the clamp member **146** of the clamp arm **142** of the clamp spring **136** to the wire. For example, concentrating the wire toward a middle the clamp brace **132** and/or a middle of the clamp member **146** can increase the force or pressure applied by the clamp member **146** by, for example, about 20 percent when compared to instances where the wire, e.g., wire **710**, is not concentrated wire toward a center or middle the clamp brace **132** and/or a center or middle of the clamp member **146**. This results in a higher retention force in the range of, for example, about 1 pound force and about 7 pound force that can be applied by the clamp spring **136** to hold the wire, e.g., the wire strands of the stranded wire **710**, to the wire terminal **130**. For example, in the example where the energy stored by the one or more springs should be sufficient to apply a constant and continuous force in the range of, for example, about 5 pound force to about 35 pound force, the higher wire retention force would be in the range of, for example, 6 pound force to about 42 pound force. In addition, the higher spring force or pressure on the wire provides an improved electrical connection by lowering the contact resistance. Exemplary embodiments of the wire manager **900** are shown in FIGS. **43-47** and described herein below. However, the present disclosure contemplates other wire manager embodiments where the wire manager urges a wire or wire strands toward a center or middle of a clamp brace and/or a center or middle of the clamp member.

The housing **740** has a main body **750**, a front cover **770** and a rear cover **790**. The front cover **770** is secured to one side of the main body **750** and the rear cover **790** is secured to the other side of the main body **750**. The housing **740** is made of a suitable electrical insulating material, such as plastic, including injection molded thermoplastic, and is configured to fit within an electrical box. The main body **750** includes a plurality of chambers or cavities **752**, seen in **30**. Each cavity **752** is configured to receive and position a contact assembly **100** within the main body **750**, as shown in FIG. **30**. Each contact assembly **100** is configured to receive a wire, such as wire **700**, and to mate with a contact blade of a conventional plug connector as described above.

As shown in FIG. **27**, the front cover **770** of the switch **720** includes a face **772** with a switch arm aperture **774** through which a conventional switch arm of a toggle switch can pass. The front cover **770** has one or more mounting straps **776** that are secured to an exterior surface of the front cover using, for example, mechanical fasteners or adhesives. The mounting straps **776** are used to secure the switch **720** to an electrical box via apertures **778** as is known. The mounting straps **776** may also be connected to electrical ground via a contact assembly **100** within the main body **750**. The front cover **770** can be secured to the main body **750** using mechanical fasteners, adhesives or welds such as sonic welds.

Referring to FIGS. **28** and **29**, the rear cover **790** can be secured to the main body **750** using mechanical fasteners, adhesives or welds such as sonic welds. The rear cover **790** includes a plurality of wire receiving apertures **792**. Each wire receiving aperture **792** is positioned to align with a cavity **752** in the main body **750** so that a wire can pass through the rear cover **790** into a contact assembly **100** resting within a cavity **752** in the main body **750**. The rear cover **790** may also include a plurality of wire guides **794** extending outwardly from an exterior surface **796** of the rear cover, as shown. In the embodiment shown, one wire guide **794** corresponds to one wire receiving aperture **792**. Each wire guide **794** has an arcuate shape that corresponds to the round shape of a wire being inserted into the wire receiving aperture **792**. The rear cover **790** also includes a plurality of plunger openings **798**, seen in FIG. **29**, that permits a portion of a plunger **150**, forming a portion of the contact assembly **100** described above, to extend outside the housing **740**.

Referring now to FIGS. **33-37**, an exemplary embodiment of an electrical male flanged inlet having screwless connection terminals according to the present disclosure is shown. In this exemplary embodiment, the male flanged inlet **800** has a housing **802** and a plug assembly **804**. The housing **802** may be a circular housing having a flange **806** at one end of the housing. The housing **802** is configured to be mounted into an opening in a structure, such as a wall, and the flange **806** is provided to prevent the housing **802** from passing through a properly created opening in the structure. The flange **806** may include mounting holes **808** that can be used to secure the flange **806** to the structure. The housing **802** is preferably made of a suitably rigid, electrical insulating material, such as a plastic material, or a rubber material. An example of a plastic material is injection molded thermoplastic. However, the housing **802** may be made of a metallic material.

The plug assembly **804** is mounted within the housing **802** and secured to the housing using, for example, fasteners **810**. The plug assembly **804** may be similar to the blade-type plug **400** described above. For example, the plug assembly **804** may include a main body **812**, a cover **814**, a retainer **816** and a plurality of contact assemblies **501** positioned within the main body **812** and extending at least partially from an exterior of the cover **814**. As seen in FIG. **35**, the retainer **816** is secured to a top side of the main body **812** using screw **818**. The cover **814** is secured to the housing **802** by passing screws **810** through a face **820** and apertures **822** in the cover **814**, through corresponding apertures **824** in the main body **812**, and through corresponding apertures **826** in the retainer **816**. The screws **810** are then secured to corresponding mounting holes (not shown) within the housing **802**.

The main body **812** includes a plurality of chambers or cavities **828**, seen in FIGS. **35** and **36**. Each cavity **828** is configured to receive and position a contact assembly **501** within the main body **812**. Each contact assembly **501** is configured to receive a conductor and to mate with a female contact of a blade-type connector, such as the female contacts of FIG. **8** or **15**. The face **820** of the cover **814** has a plurality of blade-receiving slots **830** through which contact blades **514** of the contact assemblies **501** can be inserted so that the contact blades **514** extend outside the cover **814**. The cover **814** when secured to the housing **802** helps hold the contact assemblies **501** within the main body **812**.

Referring to FIGS. **35** and **37**, the retainer **816** is secured to the main body **812** using mechanical fasteners, such as

screw **818**. The retainer **816** includes a plurality of wire receiving apertures **832**. Each wire receiving aperture **832** is positioned to align with a cavity **828** in the main body **812** so that a wire can pass through the retainer **816** into a contact assembly **501** resting within the cavity **828** in the main body **812**. The retainer **816** may also include a plurality of wire guides **834** extending outwardly from surface **836** of the retainer, as shown. In the embodiment shown, one wire guide **834** corresponds to one wire receiving aperture **832**. Each wire guide **834** may have an arcuate like shape that corresponds to the shape of a wire being inserted into the wire receiving aperture **832**. The retainer **816** also includes a plurality of plunger openings **838**. In the embodiment shown, one plunger opening **838** corresponds to one wire receiving aperture **832**. The plunger openings **838** permit a portion of a respective plunger **550** forming a portion of the contact assembly **501**, described herein, to extend outside the main body **812** during installation. The contact assembly **501** is shown in FIGS. **21**A, **21**B and **22**A-**22**D and described above, and generally includes the contact member **510**, the wire terminal **530** and the plunger **550**. The wire terminal **530** includes the wire manager **900**.

Referring now to FIGS. **38-42**, an exemplary embodiment of an electrical female flanged receptacle having screwless connection terminals according to the present disclosure is shown. In this exemplary embodiment, the female flanged receptacle **850** has a housing **852** and a cord connector assembly **854**. The housing **852** may be a circular housing having a flange **856** at one end of the housing. The housing **852** is configured to be mounted into an opening in a structure, such as a wall, and the flange **856** is provided to prevent the housing **852** from passing through a properly created opening in the structure. The flange **856** may include mounting holes **858** that can be used to secure the flange **856** to the structure. The housing **852** is made of a suitably rigid, electrical insulating material, such as a plastic material, including injection molded thermoplastic, or a rubber material. However, the housing **802** may be made of a metallic material.

The cord connector assembly **854** is mounted within the housing **852** and secured to the housing **852** using, for example, fasteners **860**. The cord connector assembly **854** may be similar to the blade-type power cord connector **200** described above. For example, the cord connector assembly **844** may include a main body **862**, a retainer **864** and plurality of contact assemblies **301** within the main body **862** and are at least partially accessible from an exterior of the main body **862**. The retainer **864** is secured to a top side of the main body **862** using fastener **866**. The main body **862** is secured to housing **852** using the fasteners **860** inserted through apertures **868** in a face **870** in the main body **862** and through the main body **862**.

The main body **862** includes a plurality of chambers or cavities **872** seen in FIGS. **40** and **41**. Each cavity **872** is configured to receive and position a contact assembly **301** within the main body **862**. Each contact assembly **301** is configured to receive a conductor and to mate with a contact blade of a blade-type plug connector, such as a contact blade of the plug connector of FIG. **17**. The face **870** of the main body **862** has a plurality of blade-receiving slots **874** through which contact blades of a blade-type plug connector can be inserted in the usual manner into adjacent cavities **872** within the main body **862** and into a respective contact assembly **301**.

The retainer **864** is secured to the main body **862** using mechanical fasteners, such as screw **866**. The retainer **864** includes a plurality of wire receiving apertures **876**. Each wire receiving aperture **876** is positioned to align with a cavity **872** in the main body **862** so that a wire can pass through the retainer **864** into a contact assembly **301** resting within a cavity **872** in the main body **862**. The retainer **864** may also include a plurality of wire guides **878** extending outwardly from surface **880** of the retainer, as shown. In the embodiment shown, one wire guide **878** corresponds to one wire receiving aperture **876**. Each wire guide **878** may have an arcuate like shape that corresponds to the shape of a wire being inserted into the wire receiving aperture **876**. The retainer **864** also includes a plurality of plunger openings **882**, seen in FIG. **42**. In the embodiment shown, one plunger opening **882** corresponds to one wire receiving aperture **876**. The plunger openings **882** permit a portion of a respective plunger **350** forming a portion of the contact assembly **301**, described herein, to extend outside the main body **862**. The contact assembly **301** is shown in FIGS. **15**A, **15**B and **16**A-**16**D and described above, and generally includes the contact member **310**, the wire terminal **330** and the plunger **350**. The wire terminal **530** includes the wire manager **900**. The retainer **864** may also include a plurality of plunger guides **884** extending outwardly from surface **886** of the retainer **864**, as shown in FIG. **40**. In the embodiment shown, one plunger guide **884** corresponds to one plunger opening **882**. The plunger guides **884** guide the plungers **350** as they are moved relative to the retainer **864**.

As noted above, non-limiting and exemplary embodiments of the wire manager **900** are shown in FIGS. **43-47**. However, the present disclosure contemplates other wire manager embodiments where the wire manager urges a wire or wire strands to concentrate toward a center or middle of a clamp brace and/or a center or middle of the clamp member. In the exemplary wire manager embodiments shown, the wire manager **900** may be integral or monolithically formed into the clamp brace **132**, **332**, **532** or the clamp member **146**, **346**, **546**, or the wire manager **900** may be secured to the clamp brace **132**, **332**, **532** or the clamp member **146**, **346**, **546**. Each wire manager **900** may be used with the wire terminals **130**, **330**, **530** described herein.

In the exemplary embodiment shown in FIG. **43**, the wire manager **900** is a V-shape like structure formed with a pair of wedges **802** and **804** joined by a rounded valley **806**. The wedges **802** and **804** may be symmetrically shaped wedges or asymmetrically shaped wedges. In the embodiment shown, the wedges **802** and **804** are symmetrically shaped wedges having a height "H" and a width "W." Preferably, the height "H" is in the range of, for example, about 0.05" and about 0.15", and the width "W" is in the range of, for example, about 0.1" and about 0.2". The wire manager **900** may extend along an entire width "W**2**" of the of the clamp brace **132**, **332**, **532**, or the wire manager **900** may extend along a portion of the width "W**2**" of the of the clamp brace **132**, **332**, **532**. In the embodiment shown, the wire manager **900** extends along the entire width "W**2**" of the of the clamp brace **132**, **332**, **532**, with the rounded valley **806** positioned at or in close proximity to a center line "C" of the clamp brace **132**, **332**, **532**. The wire manager **900** is also positioned on the clamp brace **132**, **332**, **532**, so that the wire manager **900** does not interfere with the clamp member **146**, **346**, **546** contacting the exposed conductor of the wire, e.g., the strands of the stranded wire **710**. For example, the wire manager **900** may be positioned so that the wire manager **900** is in close proximity to a contact line "C**2**," seen in FIG. **8**A, were a distal end **146***a*, **346***a*, **546***a* of the clamp member **146**, **346**, **546** would contact the clamp brace **132**, **332**, **532** when the clamp brace is in the closed position and no wire is inserted into the elongated opening **144**, **344**, **544** of the

wire terminal **130**, **330**, **530**. In addition, a contact area **811** of the clamp brace **132**, **332**, **532** may include a textured surface **813** that is provided to grip the exposed wire strands or wire, e.g., the exposed wire strands of stranded wire **710**, to improve the wire retention force applied to the exposed wire strands by the clamp member **146**, **346**, **546**. The contact area **811** is at least a portion of the clamp brace **132**, **332**, **532** where the clamp member **146**, **346**, **546** would contact the clamp brace **132**, **332**, **532** when the clamp brace is in the closed position and no wire is inserted into the elongated opening **144**, **344**, **544** of the wire terminal **130**, **330**, **530**. In the embodiment of FIG. **43**, the textured surface **813** is striations.

In the exemplary embodiment shown in FIG. **44**, the wire manager **900** is also a V-shape like structure formed with a pair of wedges **802** and **804**. However, in the embodiment of FIG. **44**, the wedges **802** and **804** are joined at their narrow end forming a sharp valley **806**, as shown. The wedges **802** and **804** may be symmetrically shaped wedges or asymmetrically shaped wedges. In the embodiment shown, the wedges **802** and **804** are symmetrically shaped wedges having a height "H" and a width "W." As a non-limiting example, the height "H" may be in the range of, for example, about 0.05" and about 0.15", and the width "W" may be in the range of, for example, about 0.1" and about 0.2". The wire manager **900** may extend along an entire width "W**2**" of the of the clamp brace **132**, **332**, **532**, or the wire manager **900** may extend along a portion of the width "W**2**" of the of the clamp brace **132**, **332**, **532**. In the embodiment shown, the wire manager **900** extends along the entire width "W**2**" of the of the clamp brace **132**, **332**, **532**, with the sharp valley **806** positioned at or in close proximity to the center line "C" of the clamp brace **132**, **332**, **532**. The wire manager **900** is also positioned on the clamp brace **132**, **332**, **532**, so that the wire manager **900** does not interfere with the clamp member **146**, **346**, **546** contacting the exposed conductor of the wire, e.g., the strands of the wire **710**. For example, the wire manager **900** may be positioned so that the wire manager **900** is in close proximity to the contact line "C**2**," shown in FIG. **8**A, were the distal end **146***a*, **346***a*, **546***a* of the clamp member **146**, **346**, **546** would contact the clamp brace **132**, **332**, **532** when the clamp brace is in the closed position and no wire is inserted into the elongated opening **144**, **344**, **544** of the wire terminal **130**, **330**, **530**. In addition, a contact area **811** of the clamp brace **132**, **332**, **532** may include the textured surface **813** that is provided to grip the exposed wire strands or wire, e.g., the exposed wire strands of stranded wire **710**, to improve the wire retention force applied to the exposed wire strands by the clamp member **146**, **346**, **546**. The contact area **811** is at least a portion of the clamp brace **132**, **332**, **532** where the clamp member **146**, **346**, **546** would contact the clamp brace **132**, **332**, **532** when the clamp brace is in the closed position and no wire is inserted into the elongated opening **144**, **344**, **544** of the wire terminal **130**, **330**, **530**. In the embodiment of FIG. **44**, the textured surface **813** is knurling.

In the exemplary embodiment shown in FIG. **45**, the wire manager **900** is also a V-shape like structure formed with a pair of wedges **802** and **804**. However, in the embodiment of FIG. **45**, the wedges **802** and **804** are spaced apart so that a portion of the clamp brace **132**, **332**, **532** forms the valley **806**, as shown. The wedges **802** and **804** may be symmetrically shaped wedges or asymmetrically shaped wedges. In the embodiment shown, the wedges **802** and **804** are symmetrically shaped wedges having a height "H" and a width "W." As a non-limiting example, the height "H" may be in the range of, for example, about 0.05" and about 0.15", and the width "W" may be in the range of, for example, about 0.1" and about 0.2". The wire manager **900** may extend along an entire width "W**2**" of the of the clamp brace **132**, **332**, **532**, or the wire manager **900** may extend along a portion of the width "W**2**" of the of the clamp brace **132**, **332**, **532**. In the embodiment shown, the wire manager **900** extends along a portion of the width "W**2**" of the of the clamp brace **132**, **332**, **532**, with the portion of the clamp brace forming the valley **806**. Preferably, the valley **806** is positioned at or in close proximity to a center or middle of the clamp brace **132**, **332**, **532**. The wire manager **900** is also positioned on the clamp brace **132**, **332**, **532** so that the wire manager **900** does not interfere with the clamp member **146**, **346**, **546** contacting the exposed conductor of the wire, e.g., the strands of the wire **710**. For example, the wire manager **900** may be positioned so that the wire manager **900** is in close proximity to the contact line "C**2**," shown in FIG. **8**A, where the distal end **146***a*, **346***a*, **546***a* of the clamp member **146**, **346**, **546** would contact the clamp brace **132**, **332**, **532** when the clamp brace is in the closed position and no wire is inserted into the elongated opening **144**, **344**, **544** of the wire terminal **130**, **330**, **530**. In addition, a contact area **811** of the clamp brace **132**, **332**, **532** may include the textured surface **813** that is provided to grip the exposed wire strands or wire, e.g., the exposed wire strands of stranded wire **710**, to improve the wire retention force applied to the exposed wire strands by the clamp member **146**, **346**, **546**. The contact area **811** is at least a portion of the clamp brace **132**, **332**, **532** where the clamp member **146**, **346**, **546** would contact the clamp brace **132**, **332**, **532** when the clamp brace is in the closed position and no wire is inserted into the elongated opening **144**, **344**, **544** of the wire terminal **130**, **330**, **530**. In the embodiment of FIG. **45**, the textured surface **813** is narrow grooves.

In the exemplary embodiment shown in FIG. **46**, the wire manager **900** is a U-shape like structure formed with a pair of side walls **814** and **816**, and a bottom wall **818** joined to the side walls **814** and **816** and forming a wire receiving opening or channel **820**. In the embodiment shown, the side walls **814** and **816** and bottom wall have a height "H**2**," a width "W**2**," and a length "L." As a non-limiting example, the height "H**2**" may be in the range of, for example, about 0.05" and about 0.15", the width "W**2**" may be in the range of, for example, about 0.1" and about 0.2", and the length "L" may be in the range of about 0.1" and about 0.3". The wire manager **900** is positioned on the clamp brace **132**, **332**, **532** so that the wire receiving opening **820** extends in a direction that is substantially parallel to a longitudinal axis of the clamp brace **132**, **332**, **532**, as shown. The wire manager **900** is also positioned on the clamp brace **132**, **332**, **532**, so that the wire manager **900** does not interfere with the clamp member **146**, **346**, **546** contacting the exposed conductor of the wire, e.g., the strands of the wire **710**. For example, the wire manager **900** may be positioned so that the wire manager **900** is in close proximity to the contact line "C**2**," shown in FIG. **8**A, where a distal end **146***a*, **346***a*, **546***a* of the clamp member **146**, **346**, **546** would contact the clamp brace **132**, **332**, **532** when the clamp brace is in the closed position and no wire is inserted into the elongated opening **144**, **344**, **544** of the wire terminal **130**, **330**, **530**. In addition, the contact area **811** of the clamp brace **132**, **332**, **532** may include the textured surface **813** that is provided to grip the exposed wire strands or wire, e.g., the exposed wire strands of stranded wire **710**, to improve the wire retention force applied to the exposed wire strands by the clamp member **146**, **346**, **546**. In this embodiment, the contact area is at least a portion of the clamp brace **132**, **332**, **532** where

the exposed conductors of, for example, the stranded wire **710**, would contact the clamp brace **132**, **332**, **532** when the clamp brace is in the closed position. As described above, the textured surface may be, for example, striations, knurling and/or small grooves on the surface of the clamp brace **132**, **332**, **532**.

In the exemplary embodiment shown in FIG. **47**, the wire manager **900** is an arcuate shape or C-shaped like structure having a wire receiving opening **820**. In the embodiment shown, the sides **814** and **816** and bottom have a height "H**3**," a width "W**3**," and a length "L**2**." As a non-limiting example, the height "H**3**" may be in the range of, for example, about 0.05" and about 0.15", the width "W**3**" may be in the range of, for example, about 0.1" and about 0.2", and the length "L**2**" may be in the range of, for example about 0.1" and about 0.3". In this exemplary embodiment, the wire manager **900** is positioned on the clamp member **146**, **346**, **546** of the clamp spring **136**, **336**, **536**, so that the wire receiving opening **820** extends in a direction that is substantially parallel to a longitudinal axis of the clamp member **146**, **346**, **546**, as shown. It is noted that the wedges **802** and **804**, and the U-shaped wire managers **900** described above, and any other suitable wire managers may be substituted for the arcuate shape or C-shaped like structure on the clamp member **146**, **346**, **546**. In addition, the contact area **811** of the clamp brace **132**, **332**, **532** may include the textured surface **813** that is provided to grip the exposed wire strands or wire, e.g., the exposed wire strands of stranded wire **710**, to improve the wire retention force applied to the exposed conductors of the wire, e.g., stranded wire **710** or wire **700**, by the clamp member **146**, **346**, **546**. In this embodiment, the contact area is at least a portion of the clamp brace **132**, **332**, **532** where the exposed conductors of, for example the stranded wire **710**, would contact the clamp brace **132**, **332**, **532** when the clamp brace is in the closed position. As described above, the textured surface may be, for example, striations, knurling and/or small grooves on the surface of the clamp brace **132**, **332**, **532**.

While exemplary embodiments have been chosen to illustrate the invention, it will be understood by those skilled in the art that various changes, modifications, additions, and substitutions are possible, without departing from the scope and spirit of the invention.

What is claimed is:

1. An electrical wiring device comprising:

a housing having a plurality of wire receiving apertures and a plurality of plunger openings; and

a plurality of contact assemblies positioned within the housing so that each of the plurality of contact assemblies is accessible from one of the plurality of wire receiving apertures and one of the plurality of plunger openings;

wherein each of the plurality of the contact assemblies includes:

a wire terminal including a clamp brace secured to a clamp spring and a wire manager, the clamp spring being movable relative to the clamp brace between a closed position where a wire can be clamped between the clamp spring and the clamp brace and an open position where a wire can be inserted through one of the plurality of wire receiving apertures and between the clamp spring and the clamp brace, the wire manager being positioned on the clamp brace or the clamp spring and configured to urge the wire between the clamp spring and the clamp brace toward a center of the clamp brace or the clamp spring such that the wire is concentrated in the center of the clamp brace or the clamp spring as the wire is clamped; and

a plunger positioned within the housing and extending at least partially through one of the plurality of plunger openings, the plunger being interactive with the clamp spring such that movement of the plunger in a first direction causes the plunger to apply a mechanical load to the clamp spring to cause the clamp spring to move from the closed position to the open position and movement of the plunger in a second direction that is opposite the first direction removes the mechanical load from the clamp spring so that to the clamp spring moves from the open position to the closed position.

2. The electrical wiring device according to claim **1**, wherein the wire manager comprises a first wedge joined to a second wedge such that a rounded valley or a sharp valley is formed between the first wedge and the second wedge.

3. The electrical wiring device according to claim **1**, wherein the wire manager comprises a first wedge, a second wedge and a valley between the first wedge and the second wedge, the valley being a portion of the clamp brace.

4. The electrical wiring device receptacle according to claim **1**, wherein the wire manager comprises a first wall, a second wall and a bottom wall joined between the first wall and the second wall so that an opening is formed between the first wall and the second wall, the bottom wall being integrally formed into or attached to the clamp brace.

5. The electrical wiring device according to claim **1**, wherein the wire terminal includes a clamp member configured to contact the wire positioned between the clamp spring and the clamp brace to clamp the wire between the clamp spring and the clamp brace, and wherein the wire manager extends from the clamp member.

6. The electrical wiring device according to claim **1**, wherein the plunger is made of a non-conductive material.

7. The electrical wiring device according to claim **1**, wherein the movement of the plunger in the second direction is opposite the movement of the plunger in the first direction.

8. The electrical wiring device according to claim **1**, wherein the movement of the plunger in the first direction and the second direction is parallel to the clamp brace.

9. A screwless contact assembly for use in electrical wiring devices, the screwless contact assembly comprising:

a wire terminal including a clamp brace secured to a clamp spring and a wire manager, the clamp spring being movable relative to the clamp brace between a closed position where a wire can be clamped between the clamp spring and the clamp brace and an open position where a wire can be inserted between the clamp spring and the clamp brace, the wire manager being positioned on the clamp brace or the clamp spring and configured to urge the wire between the clamp spring and the clamp brace toward a center of the clamp brace or the clamp spring such that the wire is concentrated in the center of the clamp brace or the clamp spring as the wire is clamped; and

a plunger that is interactive with the clamp spring such that movement of the plunger in a first direction causes the plunger to apply a mechanical load to the clamp spring to cause the clamp spring to move from the closed position to the open position and movement of the plunger in a second direction that is opposite the first direction removes the mechanical load from the clamp spring so that to the clamp spring moves from the open position to the closed position.

10. The screwless contact assembly according to claim 9, wherein the wire manager comprises a first wedge joined to a second wedge such that a rounded valley or a sharp valley is formed between the first wedge and the second wedge.

11. The screwless contact assembly according to claim 9, wherein the wire manager comprises a first wedge, a second wedge and a valley between the first wedge and the second wedge, the valley being a portion of the clamp brace.

12. The screwless contact assembly according to claim 9, wherein the wire manager comprises a first wall, a second wall and a bottom wall joined between the first wall and the second wall so that an opening is formed between the first wall and the second wall, the bottom wall being integrally formed into or attached to the clamp brace.

13. The screwless contact assembly according to claim 9, wherein the wire terminal includes a clamp member configured to contact the wire positioned between the clamp spring and the clamp brace to clamp the wire between the clamp spring and the clamp brace, and wherein the wire manager extends from the clamp member.

14. An electrical wiring device comprising:

a housing having at least one cavity, at least one wire receiving aperture and at least one plunger opening; and

at least one contact assembly positioned in the at least one cavity of the housing such that the at least one contact assembly is accessible from the at least one wire receiving aperture and the at least one plunger opening;

wherein the at least one contact assembly includes:

a wire terminal including a clamp brace secured to a clamp spring and a wire manager, the clamp spring being movable relative to the clamp brace between a closed position where a wire can be clamped between the clamp spring and the clamp brace and an open position where the wire can be inserted through the at least one wire receiving aperture in the housing and between the clamp spring and the clamp brace, the wire manager being positioned on the clamp brace or the clamp spring and configured to urge the wire between the clamp spring and the clamp brace toward a center of the clamp brace or the clamp spring such that the wire is concentrated in the center of the clamp brace or the clamp spring as the wire is clamped; and

a plunger positioned within the at least one cavity and extending at least partially through the at least one plunger opening in the housing, the plunger being interactive with the clamp spring such that movement of the plunger in a first direction causes the plunger to apply a mechanical load to the clamp spring to cause the clamp spring to move from the closed position to the open position and movement of the plunger in a second direction that is opposite the first direction removes the mechanical load from the clamp spring so that to the clamp spring moves from the open position to the closed position.

15. The electrical wiring device according to claim 14, wherein the wire manager comprises a first wedge joined to a second wedge such that a rounded valley or a sharp valley is formed between the first wedge and the second wedge.

16. The electrical wiring device according to claim 14, wherein the wire manager comprises a first wedge, a second wedge and a valley between the first wedge and the second wedge, the valley being a portion of the clamp brace.

17. The electrical wiring device according to claim 14, wherein the wire manager comprises a first wall, a second wall and a bottom wall joined between the first wall and the second wall so that an opening is formed between the first wall and the second wall, the bottom wall being integrally formed into or attached to the clamp brace.

18. The electrical wiring device according to claim 14, wherein the wire terminal includes a clamp member configured to contact the wire positioned between the clamp spring and the clamp brace to clamp the wire between the clamp spring and the clamp brace, and wherein the wire manager extends from the clamp member.

19. The electrical wiring device according to claim 14, wherein the plunger is made of a non-conductive material.

20. The electrical wiring device according to claim 14, wherein the movement of the plunger in the first direction and the second direction is parallel to the clamp brace.

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