



- (51) **International Patent Classification:**
G02B 6/44 (2006.01) *H02G 3/06* (2006.01)
- (21) **International Application Number:**
PCT/EP2012/074612
- (22) **International Filing Date:**
6 December 2012 (06.12.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/579,396 22 December 2011 (22.12.2011) US
61/701,321 14 September 2012 (14.09.2012) US
- (71) **Applicants:** **TYCO ELECTRONICS RAYCHEM BVBA** [BE/BE]; Diestsesteenweg 692, B-3010 Kessel-Lo (BE). **TYCO ELECTRONICS UK LTD** [GB/GB]; Faraday Road, Dorcan, Swindon Wiltshire SN3 5HH (GB).
- (72) **Inventors:** **WAITE, Alistair J.**; 110 Coed Camlas, New Inn, Pontypool Gwent NP4 8RR (GB). **THUS, Danny, Ghislain**; Merelstraat 14, B-3520 Zonhoven (BE).
- (74) **Agent:** **HEINZ-SCHAEFER, Marion**; Tyco Electronics UK LTD, European Patent Department, Faraday Road, Dorcan, Swindon Wiltshire SN3 5HH (GB).

(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

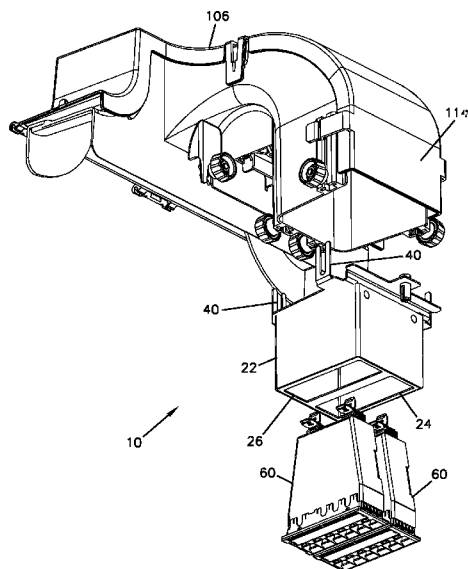
Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.1 7(H))*

[Continued on nextpage]

- (54) **Title:** OVERHEAD CABLE TERMINATION ARRANGEMENT

FIG. 8



(57) **Abstract:** A telecommunications apparatus (10, 210) includes a frame (20, 220) for mounting to a fiber optic cable trough (104, 106, 206). The frame (20, 220) includes a main body (22, 222) defining at least one opening (24, 26). The opening (24, 26) receives a connector module (60, 260). The frame (20, 220) includes a plurality of extensions (40, 240) extending transversely to the main body (22), wherein one or more extensions (40, 240) includes two parallel prongs (42) separated by a slot (44). Fasteners (34) mount the frame (20, 220) to slots (138) on a trough system element.

Published:

— with international search report (Art. 21(3))

OVERHEAD CABLE TERMINATION ARRANGEMENT

Technical Field

5 This disclosure relates to methods and devices for use in the telecommunications industry. More specifically, this disclosure relates to methods and devices for use in managing and organizing telecommunications cables and cable termination components.

Background of the Invention

10 In the telecommunications industry, effective management and organization of cables and associate cable termination components is necessary in light of the massive cabling schematics involved in providing telecommunication services. Telecommunication facilities, such as data centers or central offices, for example, often
15 have rows of equipment racks and/or equipment cabinets interconnected to cables routed overhead. The cabling schematics of such facilities involve dropping cables down from overhead troughs or ladders, for example, and terminating the cables to termination panels mounted on the racks or in the cabinets.

 Space to accommodate the increasing demand for telecommunication
20 services is limited. Improvements are needed in the methods and devices for managing and organizing the systems, cabling schematics, and components associated with providing telecommunication services.

Summary of the Invention

25 The present disclosure relates to an overhead cable management system including a cable termination device that mounts to an overhead cable pathway structure. The overhead cable pathway structure can include, for example, a U-shaped trough or a ladder-type structure. The overhead arrangement of the cable termination device allots more space on equipment racks or in equipment cabinets for telecommunication
30 equipment.

One embodiment of a cable termination device mounts to overhead cable management system with a quick connection device to mount cable terminations to the overhead troughing or other components. The quick connection device mounts connectors, adapters, modules or other equipment to the troughing or other components.

5 A telecommunications apparatus includes a frame for mounting to a cable trough. The frame includes a main body defining at least one opening. The opening receives a connector module. The frame includes a plurality of extensions extending transversely to the main body, wherein parallel prongs are defined separated by a slot. Fasteners mount the prongs of the frame to the slots on a trough system element.

10 A variety of examples of desirable product features or methods are set forth in part in the description that follows, and in part will be apparent from the description, or may be learned by practicing various aspects of the disclosure. The aspects of the disclosure may relate to individual features as well as combinations of features. It is to be understood that both the foregoing general description and the
15 following detailed description are explanatory only, and are not restrictive of the claimed invention.

Brief Description of the Drawings

20 FIG. 1 is a perspective view of one embodiment of a cable management system including a lateral cable trough and a cable exit trough;

FIG. 2 is a side view of the system of FIG. 1;

FIG. 3 is an exploded view of the system of FIG. 1;

FIG. 4 is a front view of a telecommunications system including multiple
25 embodiments of a cable termination device mounted to a cable trough in accordance with the principles disclosed;

FIG. 5 is a bottom perspective view of a cable exit trough including a cable termination device;

FIG. 6 is a side view of the device of FIG. 5;

30 FIG. 7 is a further side view of the device of FIG. 5;

FIG. 8 is an exploded perspective view of the device of FIG. 5;

FIG. 9 is an exploded view of the cable termination device;

FIG. 9A shows a threaded fastener in greater detail;

FIG. 10 is an alternative embodiment of a cable termination device mounted to a cable exit trough;

FIG. 11 is an exploded perspective view of the alternative embodiment of the cable termination device mounted to a cable exit trough shown in FIG. 10;

FIG. 12 is a top perspective view of the cable termination device of FIG. 5 mounted to a different lateral trough element;

FIG. 13 is an exploded perspective view of the device of FIG. 12;

FIG. 14 is a perspective view of the cable termination device of FIG. 10, shown mounted to an end of a lateral trough;

FIG. 15 is an exploded perspective view of the device shown in FIG. 14.

Detailed Description

FIGS. 1-4 illustrates one embodiment of an overhead cable management system 100 which includes a lateral trough 104 and a cable exit trough 106. The overhead cable management system 100 is designed to manage and organize cables and related components to increase capacity in limited telecommunication facility space. The overhead cable management system 100 of the present disclosure includes a cable termination device or apparatus 10 that mounts to an overhead cable pathway structure of the cable management system 100.

Cable exit trough 106 includes a main body 108, flanges 110, and a cover 112. A pivoting cover portion 113 allows for access to cable trough 104. Downspout portion 114 includes slots 138. Lateral trough 104 also includes slots 138. More details of cable exit troughs are shown in U.S. Patent No. 6,535,683, the disclosure of which is incorporated by reference. Cable exit troughs 106 allow cables to exit cable trough or lateral trough 104.

Referring to FIG. 4, in telecommunication facilities, such as data centers or central offices, for example, overhead cable pathway structures 120 are hung above racks 154, cabinets 156, and/or other equipment enclosures or framework. The overhead cable pathway structures 120 carry cables that interconnect to equipment mounted to on

the racks, for example. For the purposes of simplification, the remaining description refers to the structure in which the equipment mounts as a "rack"; however it is to be understood that the present disclosure applies similarly to the other equipment structures (e.g., cabinets, and other enclosures or framework). The "overhead" cable pathway structures are typically run "overhead", as racks commonly have a height equivalent or greater than the height of a technician. It is to be understood that "overhead" is not intended to be limiting to the height of the technician, but rather means that the cable pathway structures are located a distance from the floor, typically overhead, the more commonly above the structures to which the equipment is mounted (e.g. the rack or cabinet). In the illustrated embodiment FIG. 4, the overhead cable pathway structure includes a U-shaped channel or trough 104. In other embodiments, the overhead cable pathway structure can be a ladder-type structure. Other types of structures that carry cables overhead to and from racks or cabinets can be used in accordance with the principals disclosed.

In utilizing the space above equipment racks for the run of cables, it can be understood that the cable pathway structure provides a generally horizontal run for the cables. That is, the cable pathway structures are constructed such that the cables run more horizontally, rather than vertically, when carried by the cable pathway structure.

In conventional arrangements, cables carried by the overhead cable pathway structures are pulled down from the overhead structure and terminated to a termination panel mounted on the equipment racks. Termination panels are panels to which overhead cables are terminated and generally include a number of adapters or connectors. Jumper cables or patch cords are used to provide interconnections between the termination panel and the equipment mounted on the rack. The racks in conventional facility arrangements hold both the equipment and the termination panel to which the cables terminate, the termination panel occupying at least one of the limited number of unit spaces of the rack.

Referring still to FIG. 4, the overhead cable management system 100 of the present disclosure provides improvements upon spatial utilization of racks and facilities. That is, the overhead cable management system increases service capacity of a facility by providing cable terminations at a location other than the rack. Cable

terminations are instead provided in unoccupied space above the racks at apparatus 10, with cables 160 extending downwardly from terminations associated with apparatus 10. Valuable rack space can thereby be allocated for more equipment, as opposed to being constrained by the requirement of a termination panel on racks 154 or in cabinets 156.

5 Referring to FIGS. 5-9 and 9A, the cable termination apparatus 10 includes a frame 20 including a main body 22 defining at least one opening 24. In the illustrated embodiment, main body 22 includes a second opening 26. Each opening 24, 26 receives a telecommunications connection module 60. Each connection module 60 includes one or more connection locations 62 on the front and the rear for connecting to
10 cables. The front and rear connections can be copper, fiber, hybrid, or other. The connections can be the same or different, such as MPO on the rear, and single fiber on the front, or IDCs on the rear and RJ-45s on the front, in much the same way as rack mounted patch panels or modules. The modules/connections can be fiber adapter holders or RJ jack holders, for example. The modules 60 snap mount to frame 20.

15 Frame 20 of cable termination apparatus 10 includes extensions 40 which each include a pair of prongs 42 with a slot 44 defined there between. Threaded fasteners 34 thread into winged retaining pieces 36. The winged retaining pieces 36 are sized to fit within a slot 138 of exit trough 106 so as to mount prongs 42 of extensions 40 to exit trough 106. Prongs 42 mount outside of slots 138 in alignment with slots 38.

20 Each module 60 includes connection locations 62 on a front 64 and a back 66. A depth dimension D is created by module 60 for housing internal components and cabling. Main body 22 of frame 20 includes side walls 28 which define an interior for receiving module 60. A framework 32 mounts to side walls 28, and defines the prongs 42. Frame 20 includes a grounding lug 70 in order to provide a grounding location if
25 desired. Referring back to FIG. 4, the overhead cable management system 100 includes cabling in the lateral troughs 104 extending into exit troughs 106 to modules 60 in the cable termination apparatus 10. Cables 160 mounted to the front 64 of modules 60 extend downward to racks 154 or cabinets 156. Cables 160 can be copper, fiber, hybrid, or other. Similarly, the cables in the lateral trough 104 extending to modules 60 can be
30 copper, fiber, hybrid or other.

Referring back to FIG. 9, apparatus 10 is shown in exploded view. Frame 20 includes a first frame portion 72 and a second frame portion 74 fastened together which cooperate to define main body 22.

Referring now to FIGS. 10 and 11, an alternative cable termination apparatus 210 is shown. Cable termination apparatus 210 includes a frame 220 with a main body 222 having a plate shape with rear extensions 240 and a rear plate 244 extending directly from the plate portion 242. Modules 260 are in the form of RJ jack holders which snap fit into openings 24, 26.

Referring now to FIGS. 12 and 13, cable termination apparatus 10 is shown mounted to an alternative lateral trough element 206 including a downspout portion 208.

Referring now to FIGS. 14 and 15, cable termination apparatus 210 is shown mounted to an end of lateral trough 104.

The overhead pathway structures 120 of the present disclosure minimize the amount of rack space needed in a data center, central office, or other telecommunications facility. Alternatively, the devices allow for expansion and/or upgrade of systems and facilities having spatial constraints and can be added without having to add racks or cabinets. The devices are also easily incorporated and mounted to the various trough devices 104, 106, 206 shown with a quick connect coupling in the form of threaded fasteners 34. The present cable management system 100 does not increase costs by requiring replacement or upgrading of existing racks or existing overhead structures.

In addition, the present devices do not interfere with cooling pathways of existing systems. For example, in conventional methods, expanding the capacity of cabinets often requires the installation of additional termination panels within the cabinets. The added panels can block airflow needed to cool the electrical components inside the cabinet. Because the added panels or devices of the present system are mounted overhead, the panels or devices do not obstruct the airflow passages through the cabinet.

30

Parts List

10	Cable termination apparatus
20	Frame
22	Main body
24	Opening
26	Opening
28	Side walls
32	Framework
34	Threaded fasteners
36	Winged retaining pieces
40	Extensions
42	Prongs
44	Slot
60	Module
62	Connection locations
64	Front
66	Back
70	Grounding lug
72	First body portion
74	Second body portion
100	Cable management system
104	Lateral trough
106	Exit trough
108	Main body
110	Flanges
112	Cover
114	Downspout portion
120	Overhead pathway cable structures
138	Slots

154	Racks
156	Cabinets
160	Cables
206	Alternative lateral trough element
208	Downspout portion
210	Cable termination apparatus
220	Frame
222	Main body
240	Extensions
242	Plate portion
244	Rear plate
260	Module

CLAIMS:

1. A telecommunications apparatus (10, 210) comprising:
a frame (20, 220) for mounting to a fiber optic cable trough (104, 106, 206), the frame including:
a main body (22, 222) defining an opening (24, 26);
a plurality of extensions (40, 240) extending transversely to the main body (22, 222), each extension (40, 240) including a slot (44).
2. The apparatus of claim 1, further comprising a telecommunications module (60, 260) mounted to the main body (22, 222) within the opening (24, 26).
3. The apparatus of claims 1 and 2, further comprising:
a U-shaped fiber optic trough element (104, 106, 206), wherein the trough element includes external slots (138), and further comprising fasteners (34) which mount the extensions (40, 240) to the slots (44), wherein the extensions (40, 240) extend parallel to the slots (44).
4. The apparatus of claims 1-3, wherein the frame (20, 220) includes a grounding lug (70).
5. The apparatus of claims 1-4, wherein the extension (40, 240) includes two parallel prongs (42) separated by the slot (44)
6. The apparatus of claims 1-5, wherein the extensions (40, 240) are positioned on three sides of main body (22, 222).
7. The apparatus of claims 1-6, wherein four extensions (40, 240) are provided.

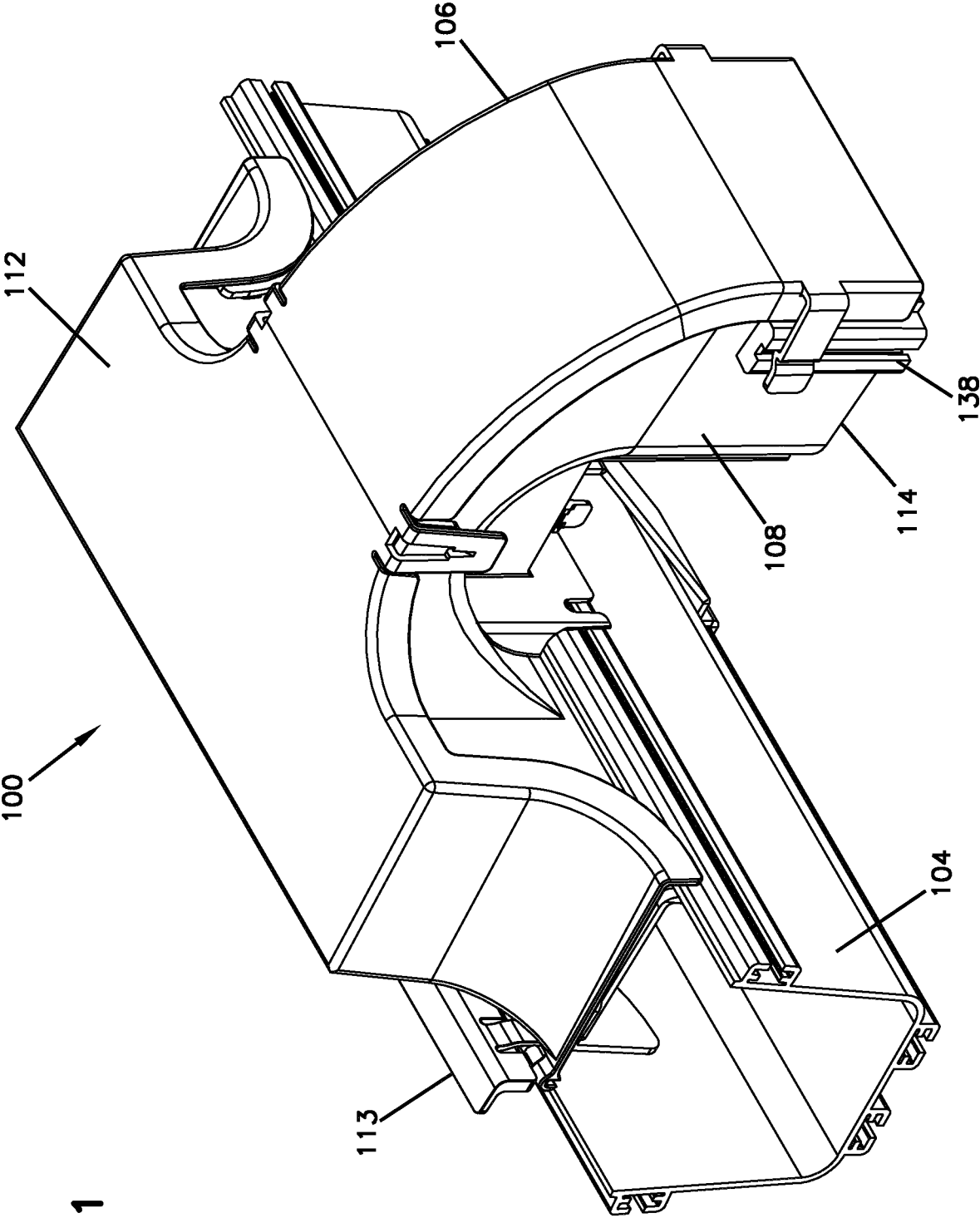
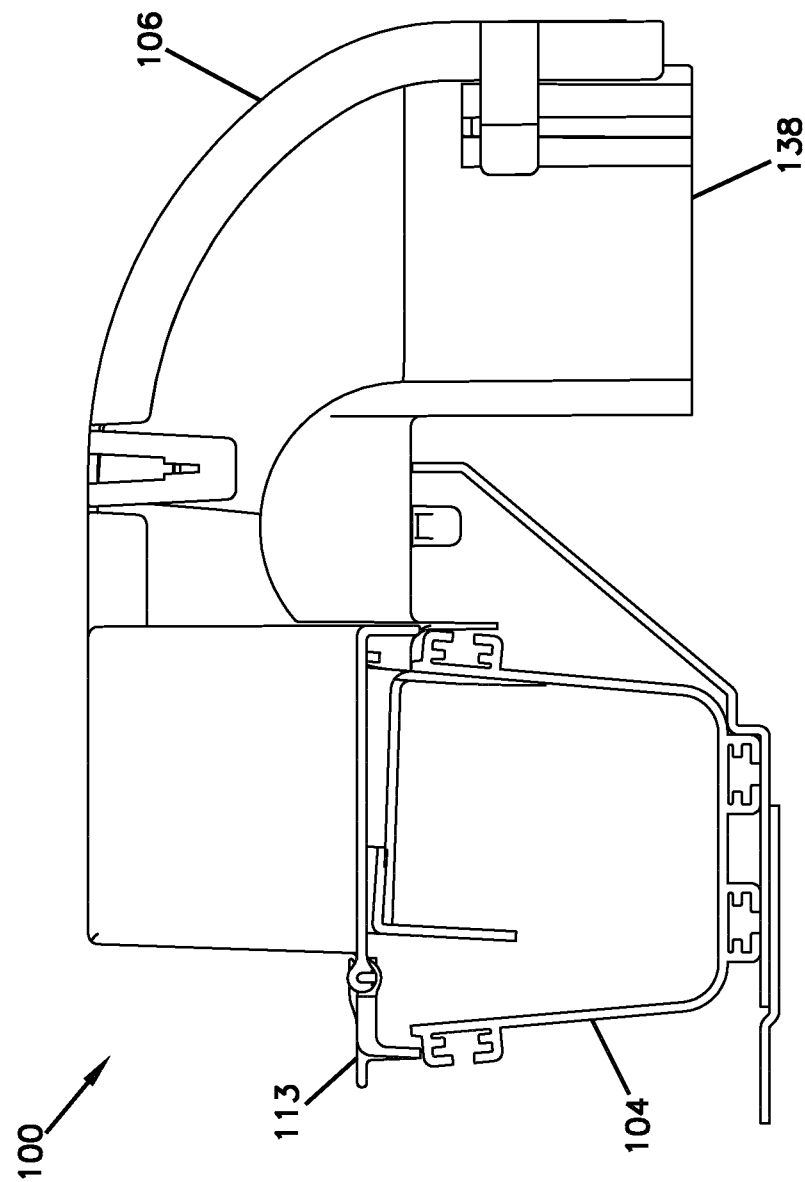


FIG. 1

FIG. 2



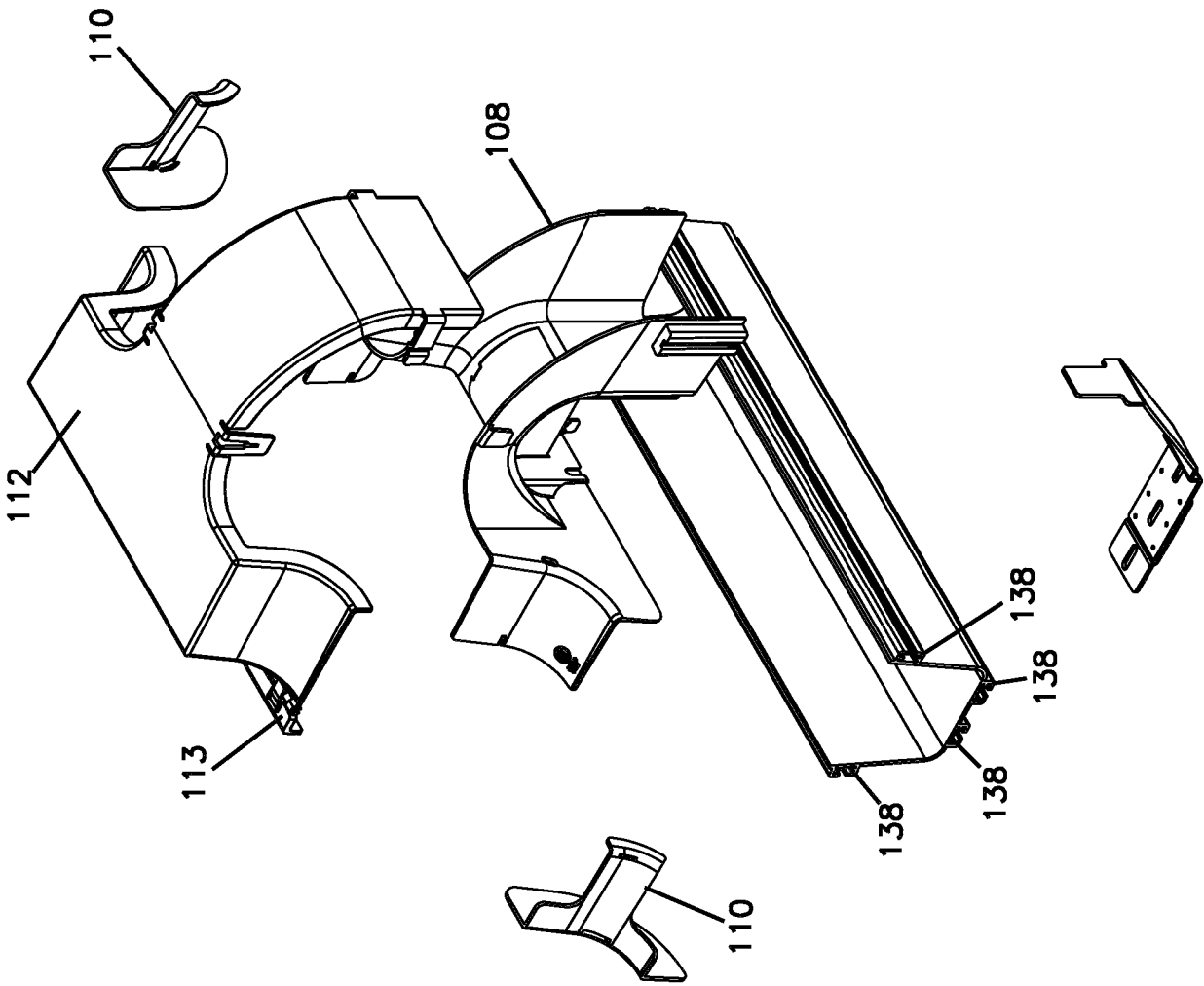
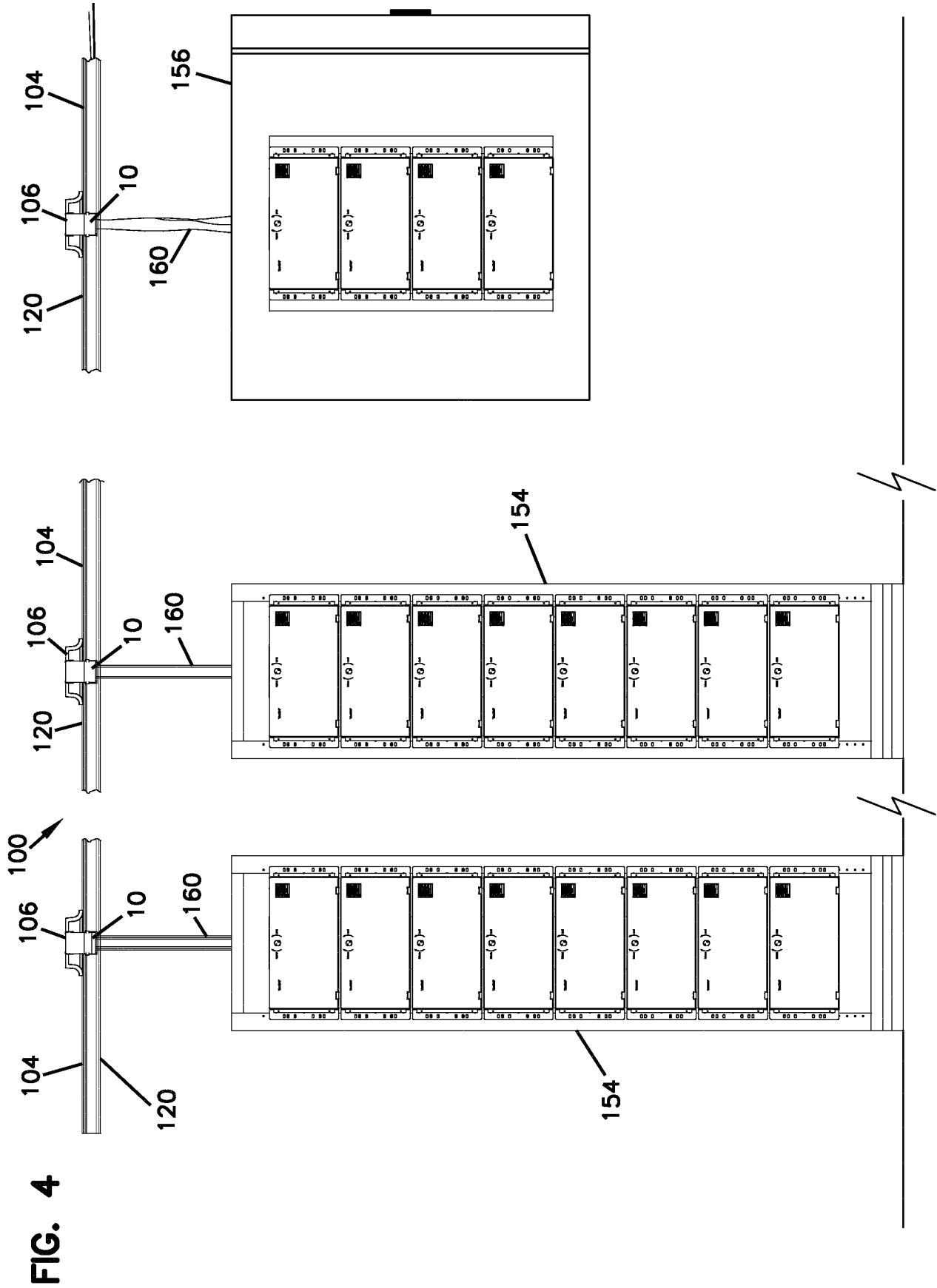


FIG. 3



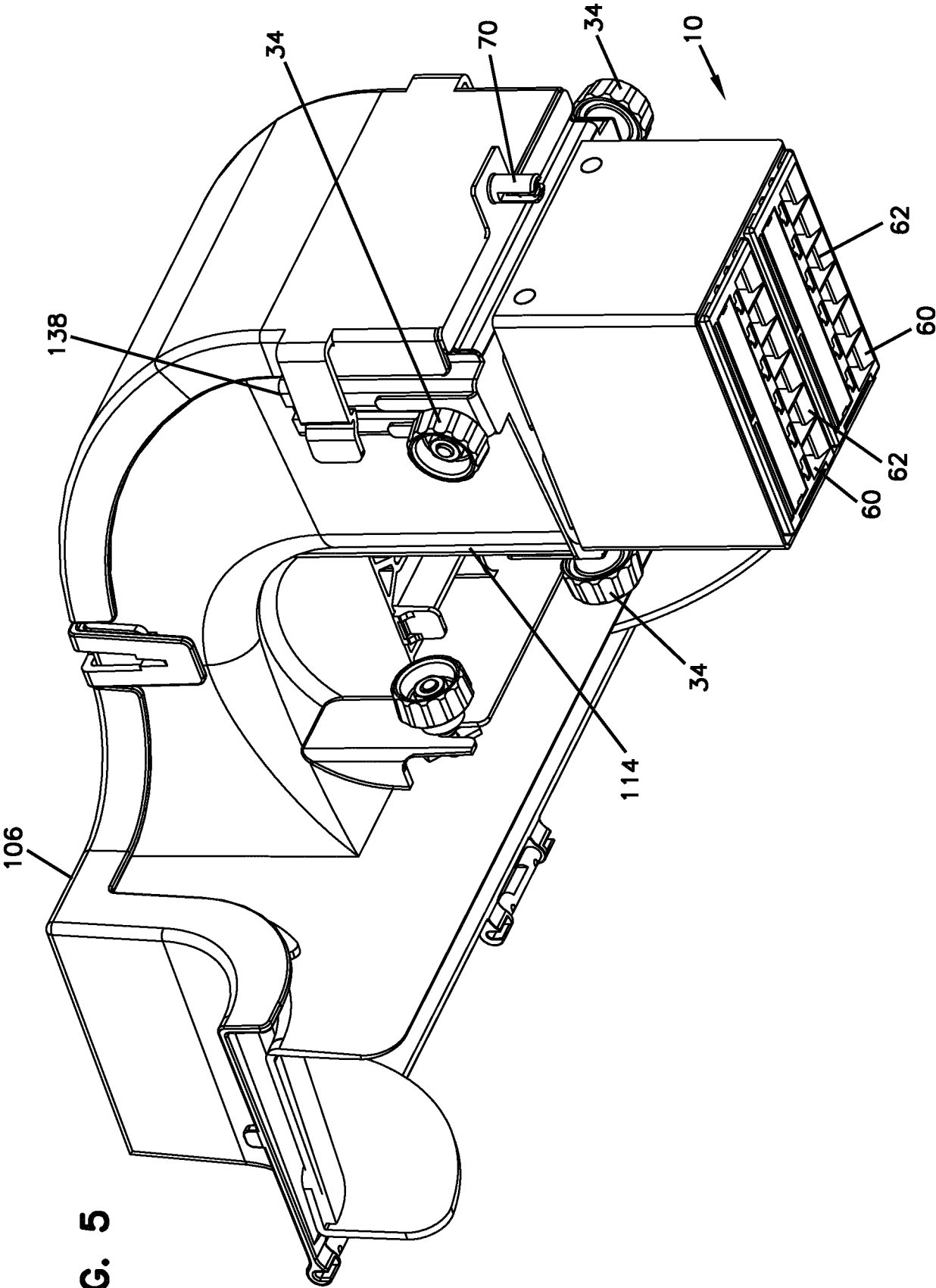


FIG. 5

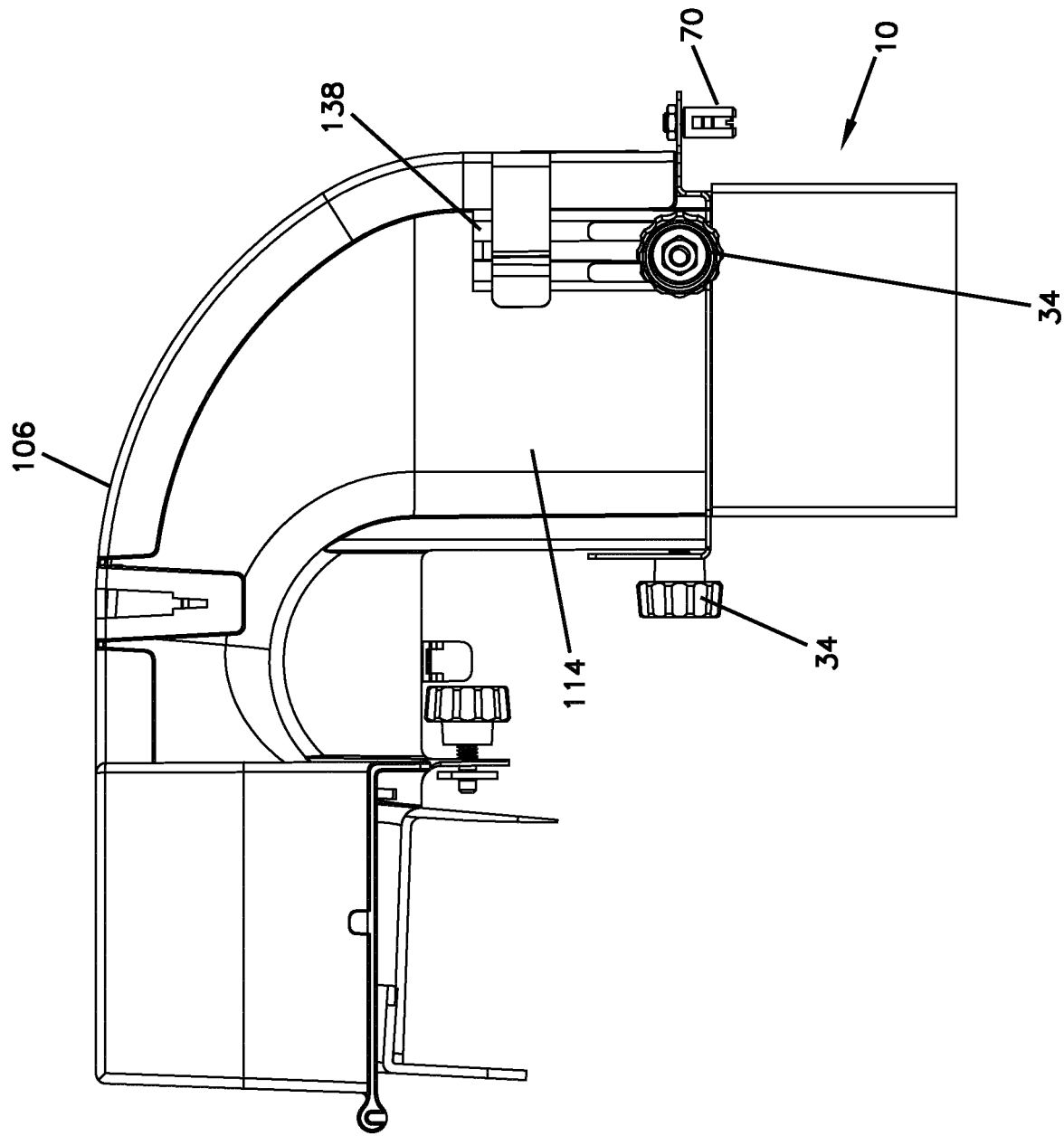


FIG. 6

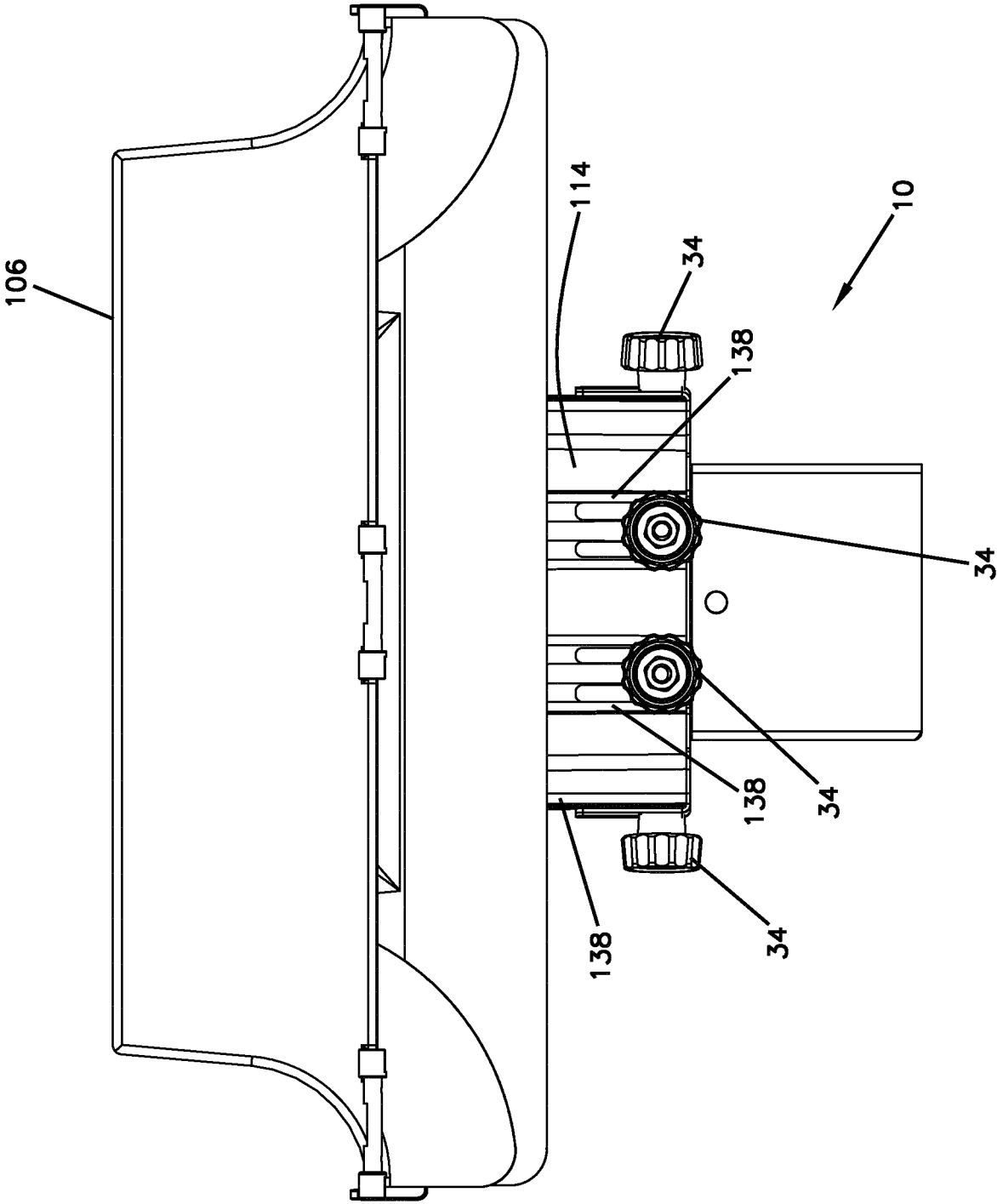
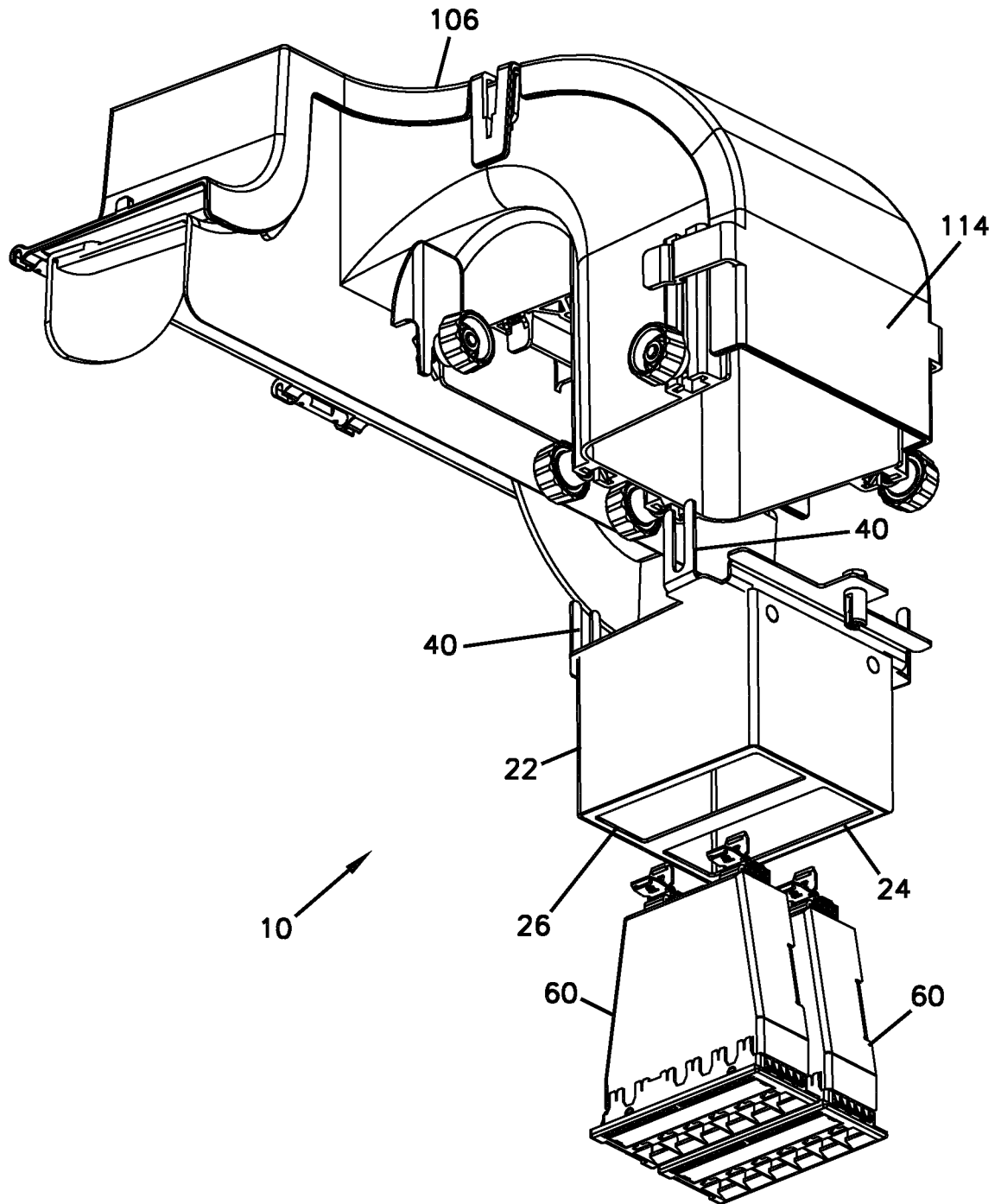


FIG. 7

FIG. 8



9/21

FIG. 9

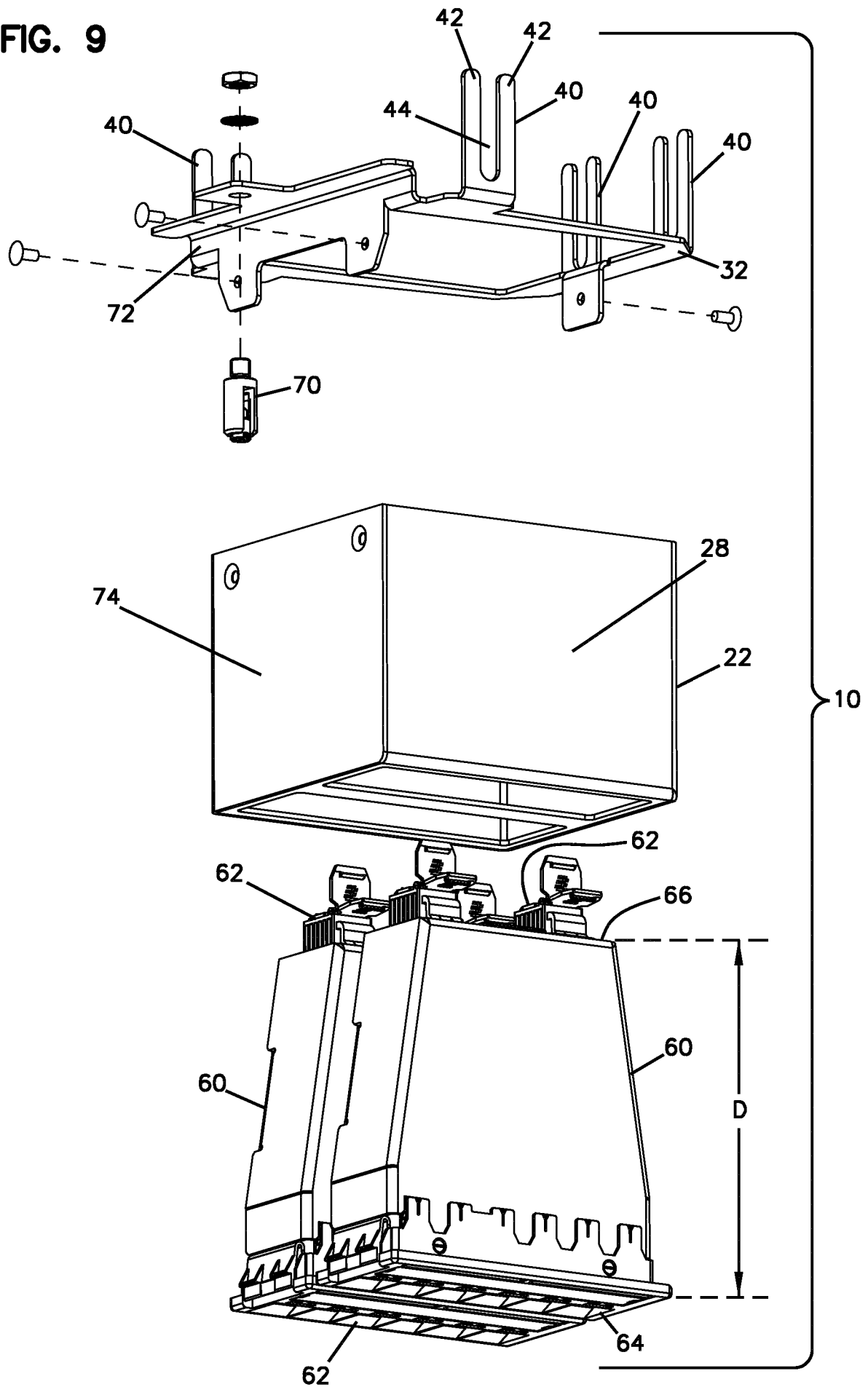
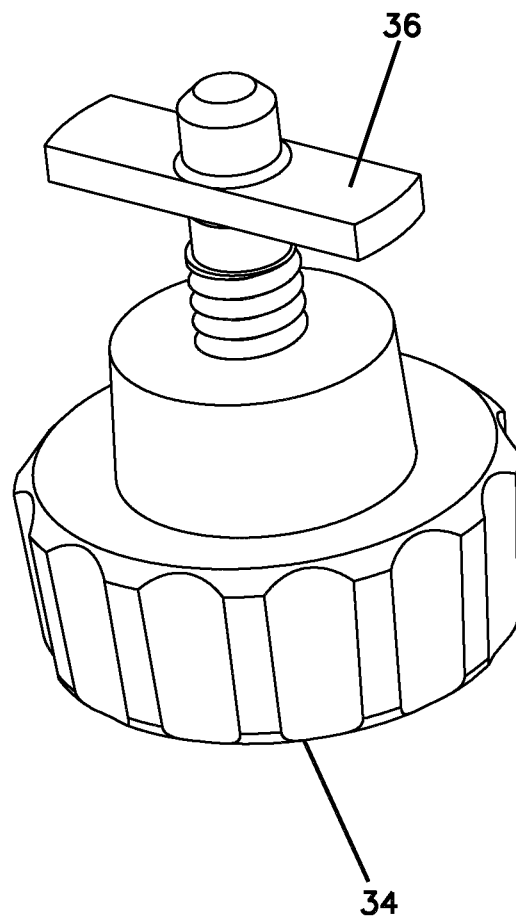


FIG. 9A



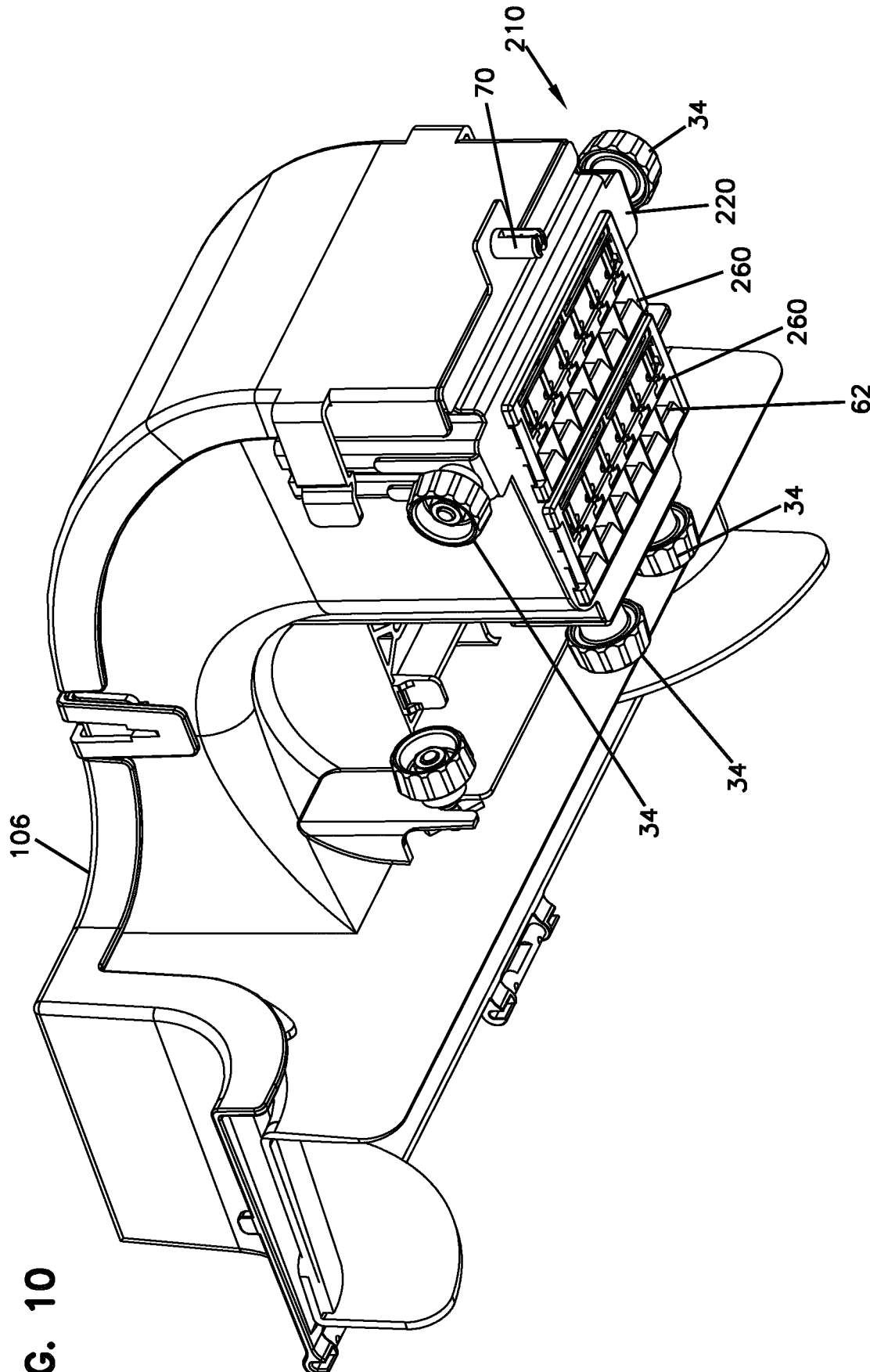
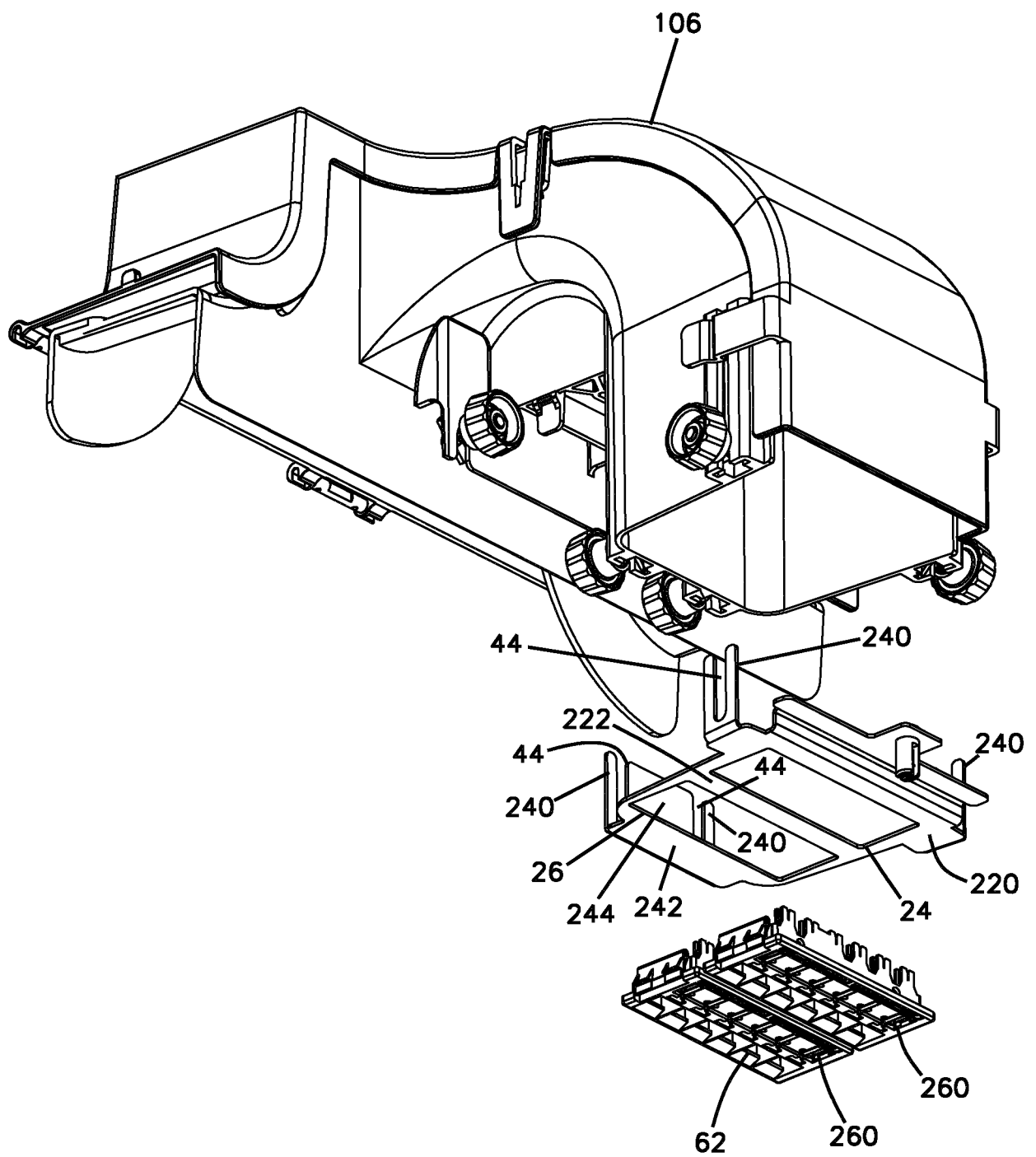


FIG. 10

FIG. 11



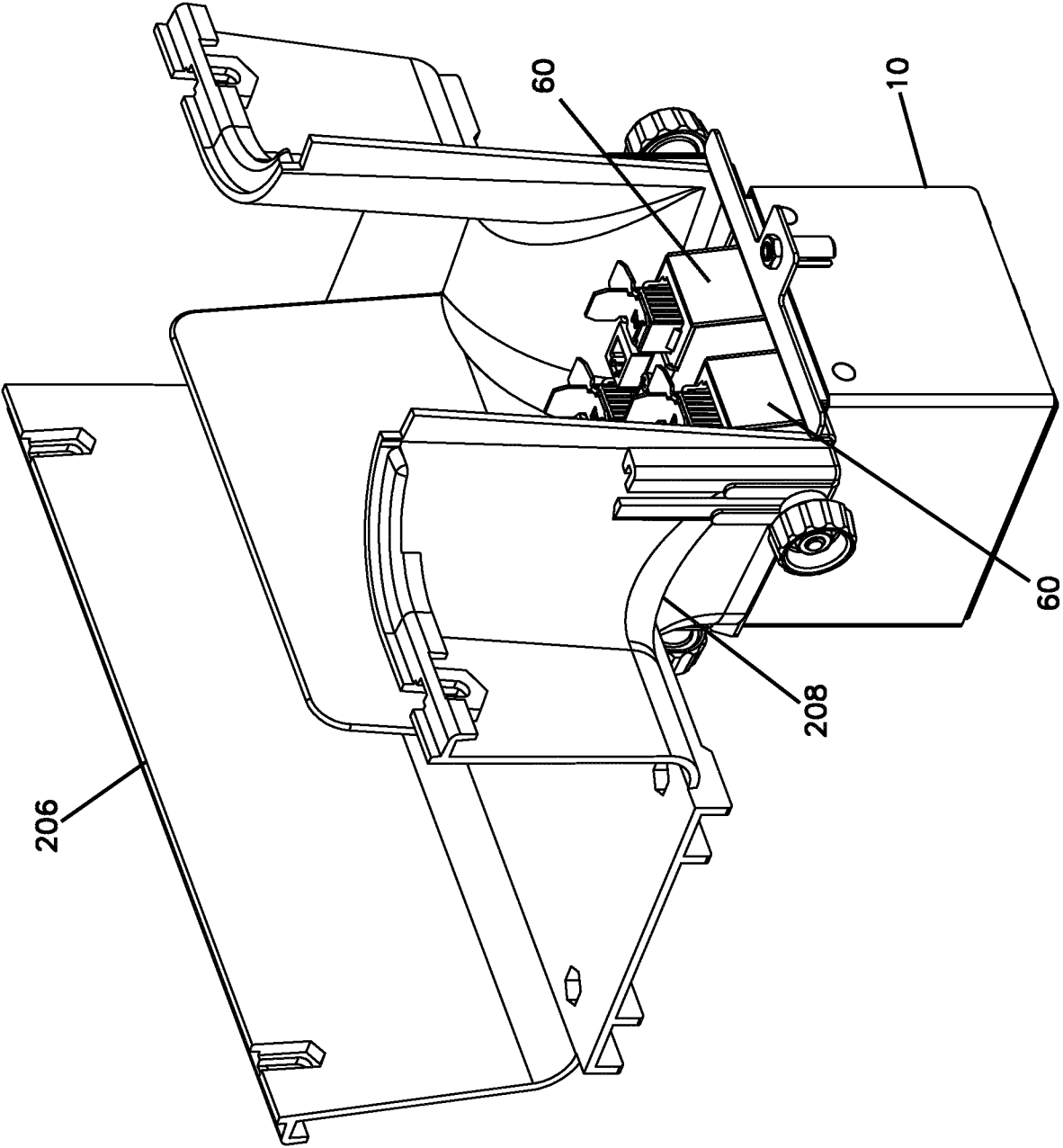


FIG. 12

FIG. 13

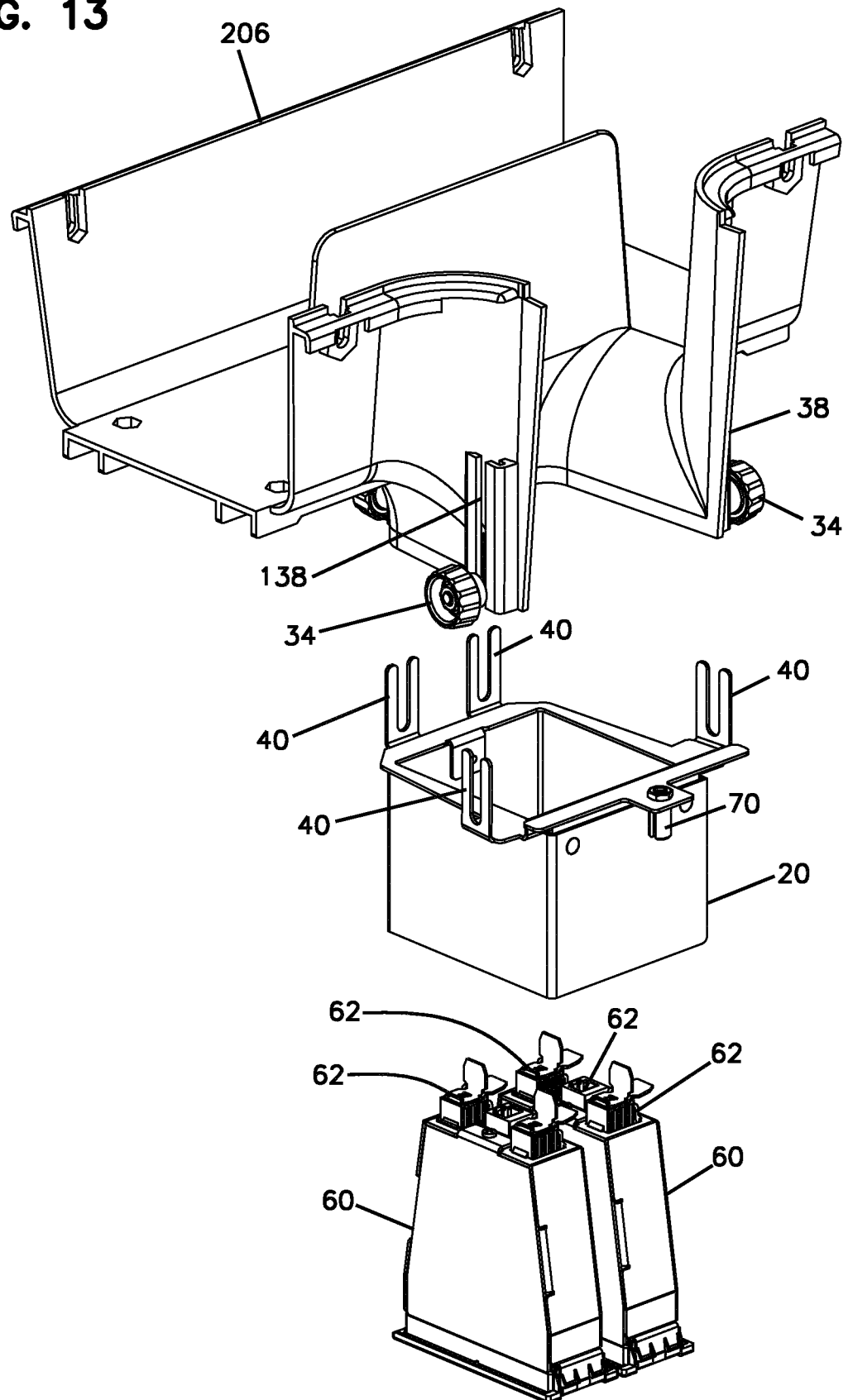
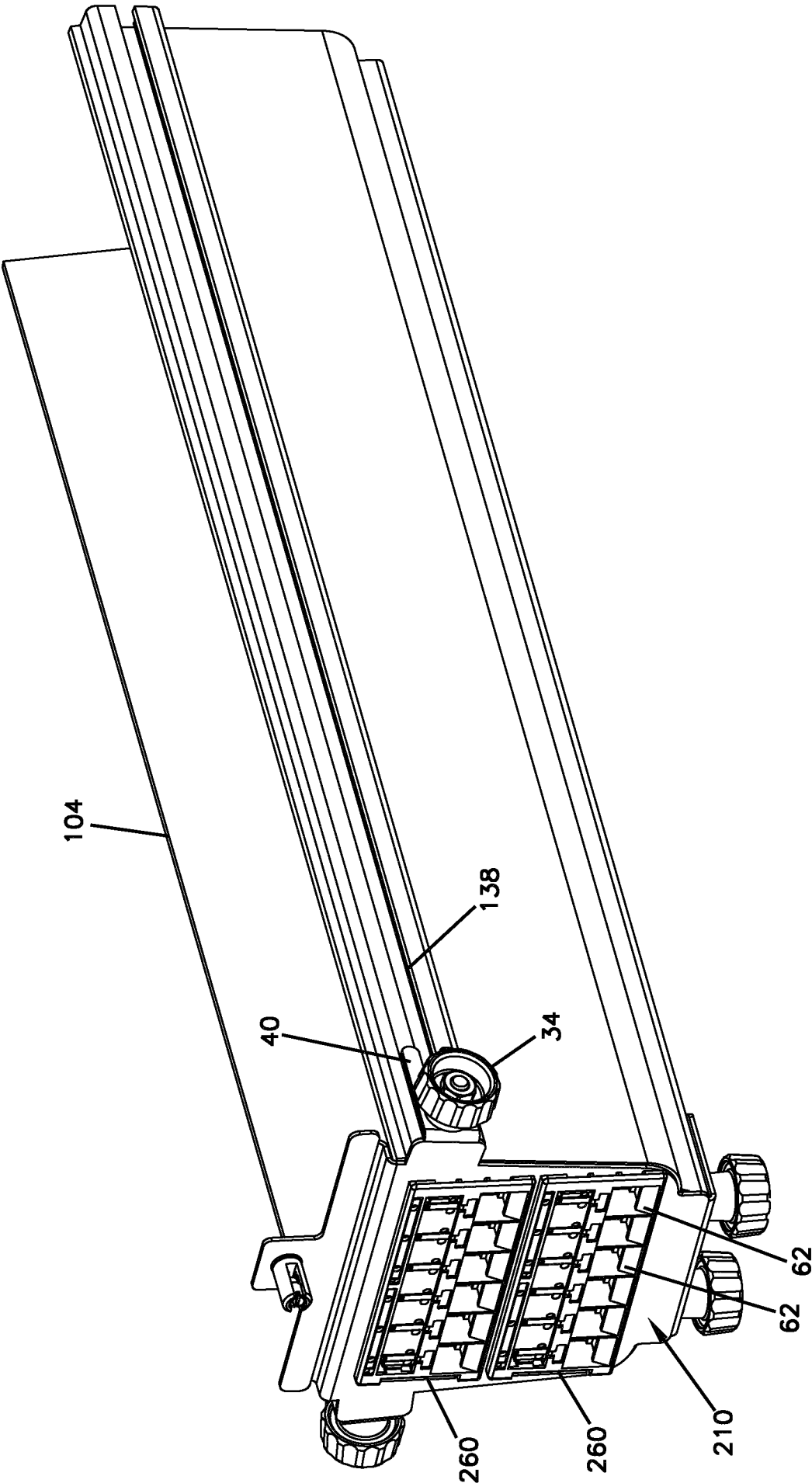
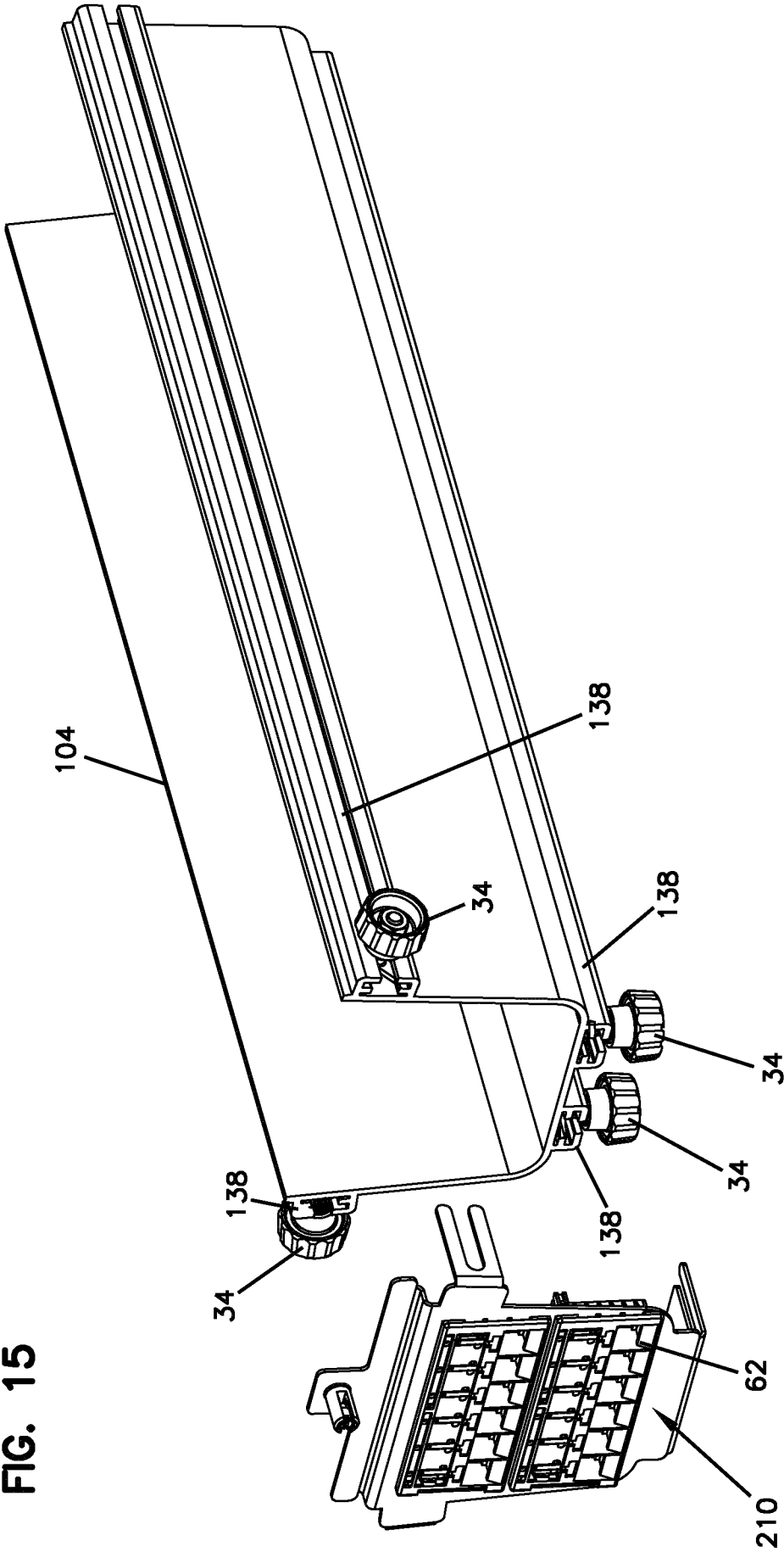


FIG. 14





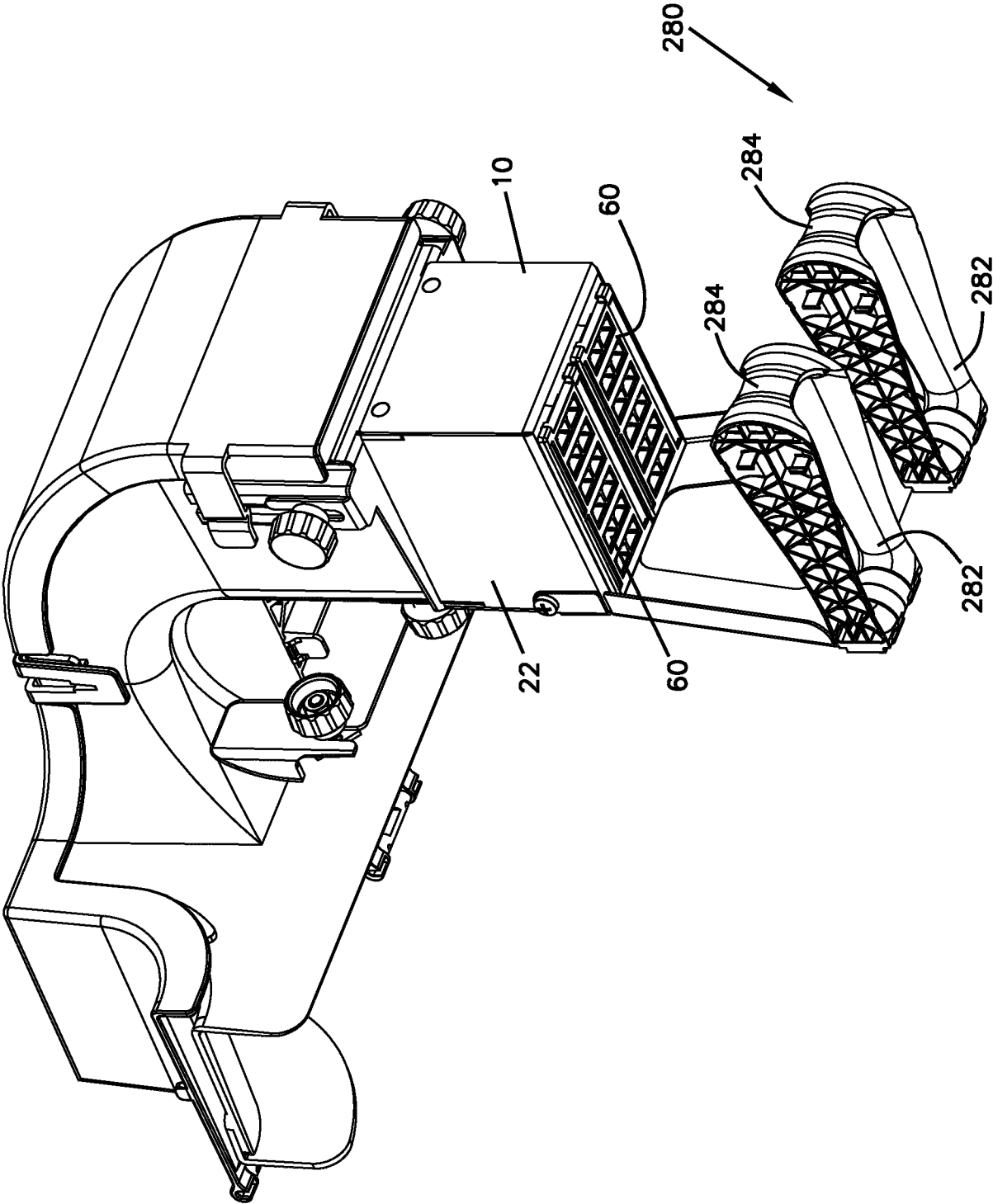


FIG. 16

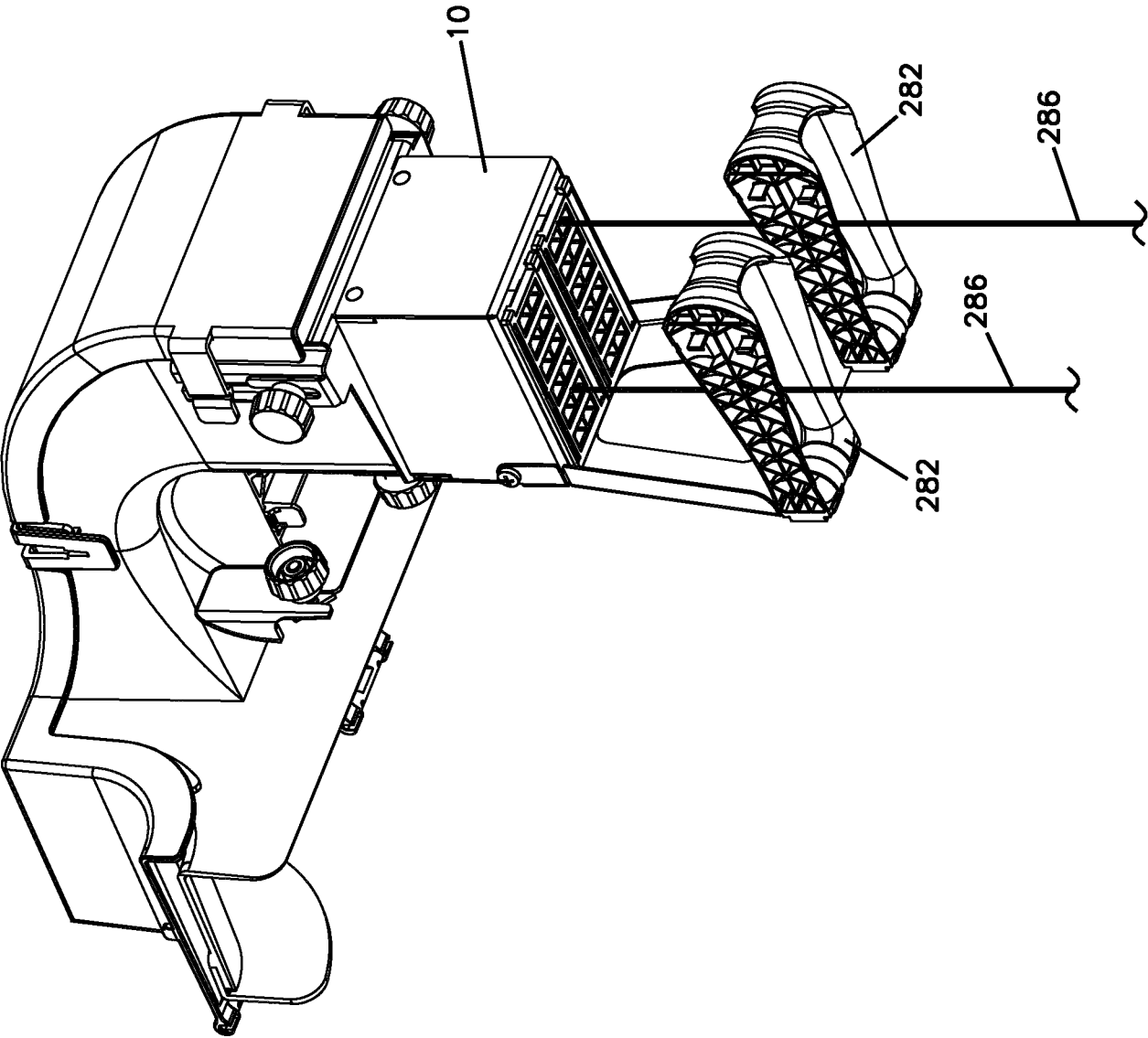


FIG. 17

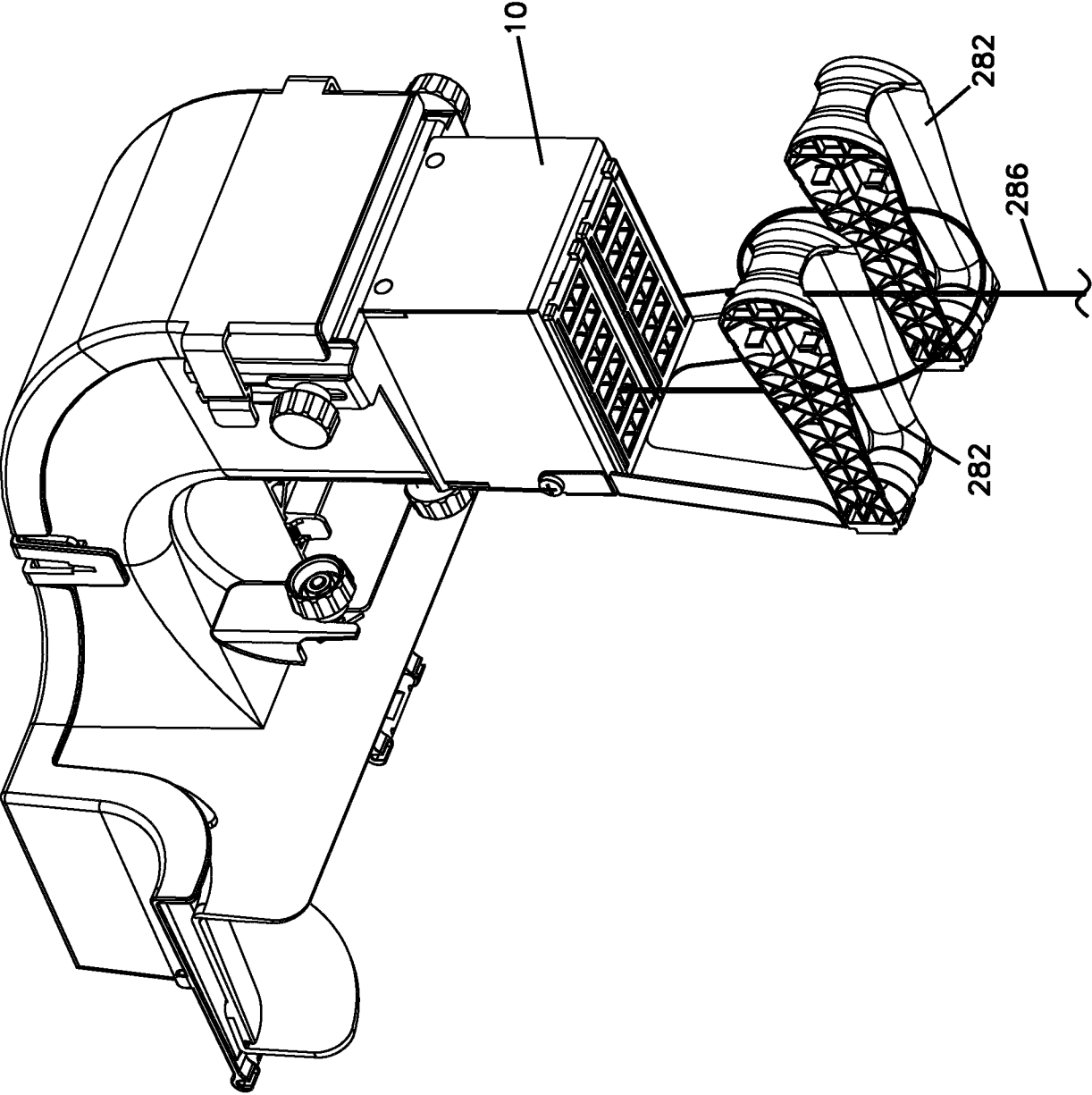
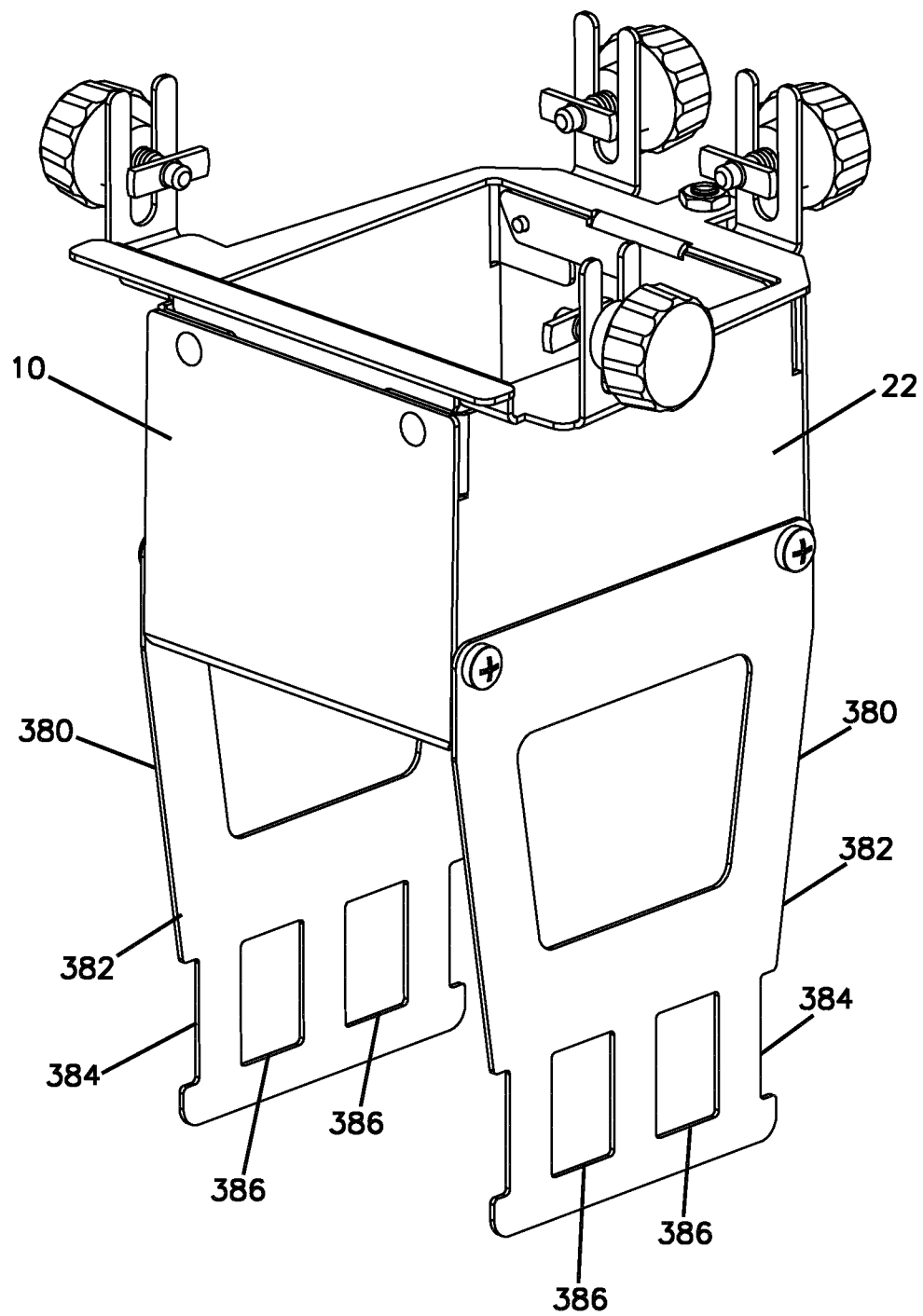


FIG. 18

FIG. 19

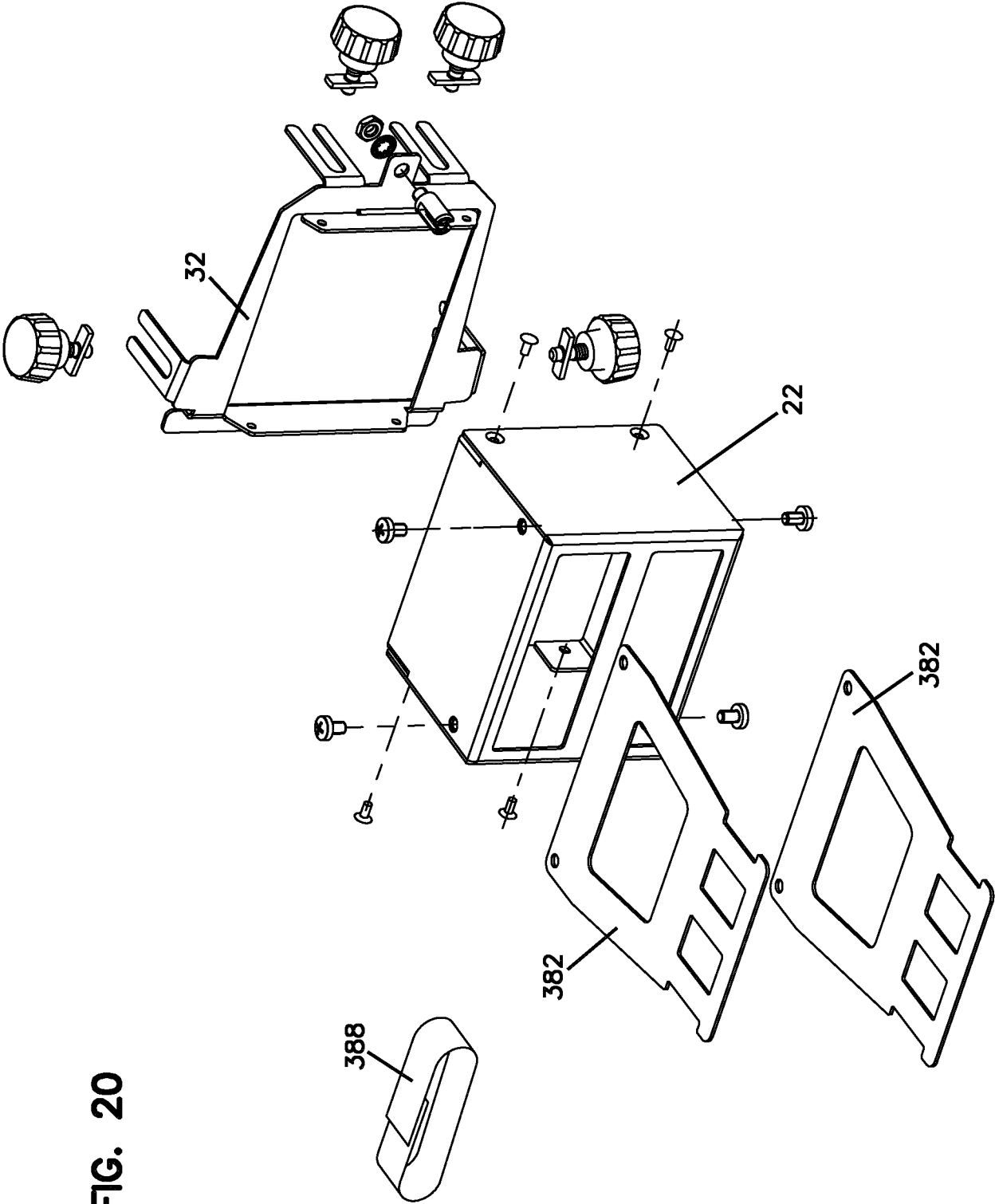


FIG. 20

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/074612

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G02B6/44 H02G3/06
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G02B H02G H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/006317 AI (HRUBY KEVIN L [US] ET AL) 14 January 2010 (2010-01-14) figures 6,7,9 -----	1-7
X	US 2011/074117 AI (CAVENEY JACK E [US] ET AL) 31 March 2011 (2011-03-31) figures 13b, 13c paragraph [0119] ; figure 34 -----	1,3-5
X	US 2011/116758 AI (COBURN HUTCH [US] ET AL) 19 May 2011 (2011-05-19) paragraphs [0027] - [0030] ; figures 4,5 -----	1-5
X	US 5 142 606 A (CARNEY WILLIAM V [US] ET AL) 25 August 1992 (1992-08-25) figure 10 ----- -/-	1-4,6,7



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

23 January 2013

Date of mailing of the international search report

30/01/2013

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040,
 Fax: (+31-70) 340-3016

Authorized officer

Ci arrocca, Marco

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/074612

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/086273 A1 (RECTOR III JACK BROWN [US]) 8 April 2010 (2010-04-08) figure 4 -----	1,2
X	US 2005/233647 A1 (DENOVIH SAM [US] ET AL) 20 October 2005 (2005-10-20) paragraphs [0050], [0051]; figures 5,6 -----	1,2
X	US 2007/196071 A1 (LAURSEN ERIK [US] ET AL) 23 August 2007 (2007-08-23) figures 1,11 -----	1,2
X	US 2005/041947 A1 (BARKER JED M [US] ET AL) 24 February 2005 (2005-02-24) figure 3 -----	1,2
X	US 5 724 467 A (VANDENENDEN JOHN P [CA] ET AL) 3 March 1998 (1998-03-03) column 3, lines 3-18; figures 1,2 -----	1,2
X	US 2008/237408 A1 (MCCLELLAN JEFFREY R [US] ET AL) 2 October 2008 (2008-10-02) paragraph [0016]; figure 1 -----	1
A	GB 2 467 443 A (PEMSA PEQUENO MATERIAL ELECTRI [ES]) 4 August 2010 (2010-08-04) page 7, lines 25-29; figure 1 -----	4

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/074612

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
US 2010006317	AI	14-01-2010	CN	101690251	A	31-03-2010
			EP	2165552	AI	24-03-2010
			US	2010006317	AI	14- 01-2010
			WO	2009009218	AI	15- 01-2009

US 2011074117	AI	31-03-2011	AT	535978	T	15-12-2011
			EP	2297829	AI	23-03-2011
			US	2011074117	AI	31-03-2011
			WO	2009142885	AI	26-11-2009

US 2011116758	AI	19-05-2011	CN	101584095	A	18-11 -2009
			EP	2127049	AI	02-12 -2009
			JP	2010517077	A	20-05 -2010
			TW	200844518	A	16-11 -2008
			US	2008175554	AI	24-07 -2008
			US	2009067803	AI	12-03 -2009
			US	2011116758	AI	19-05 -2011
			WO	2008089192	AI	24-07 -2008

US 5142606	A	25-08-1992	NONE			

US 2010086273	AI	08-04-2010	NONE			

US 2005233647	AI	20-10-2005	AU	2005238880	AI	10-11-2005
			CA	2562008	AI	10-11-2005
			CN	1969213	A	23-05-2007
			EP	1735650	AI	27-12-2006
			JP	2007533158	A	15-11-2007
			US	2005233647	AI	20-10-2005
			WO	2005106555	AI	10-11-2005

US 2007196071	AI	23-08-2007	NONE			

US 2005041947	AI	24-02-2005	AT	442742	T	15-09 -2009
			CN	1400860	A	05-03 -2003
			CN	1816263	A	09-08 -2006
			EP	1280363	A2	29-01 -2003
			JP	4174256	B2	29-10 -2008
			JP	2003158384	A	30-05 -2003
			US	2003022552	AI	30-01 -2003
			US	2005041947	AI	24-02 -2005
			US	2005215112	AI	29-09 -2005
			US	2006063421	AI	23-03 -2006
			US	2006134972	AI	22-06 -2006
			US	2006154513	AI	13-07 -2006

US 5724467	A	03-03 -1998	CA	2186314	AI	12-04-1997
			US	5724467	A	03-03-1998

US 2008237408	AI	02-10 -2008	NONE			

GB 2467443	A	04-08 -2010	ES	1069695	U	01-05-2009
			FR	2941820	AI	06-08-2010
			GB	2467443	A	04-08-2010
