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Stener

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(54) **VEHICULAR MOUNTED RAIL SYSTEM**

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This patent is subject to a terminal disclaimer.

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(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation of application No. 18/152,109, filed on Jan. 9, 2023, now Pat. No. 11,951,951, which is a continuation of application No. 17/027,603, filed on Sep. 21, 2020, now Pat. No. 11,572,021, which is a continuation-in-part of application No. 16/779,288, filed on Jan. 31, 2020, now abandoned.

(51) **Int. Cl.**

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B60R 7/00	(2006.01)
B60R 7/06	(2006.01)
B60R 11/00	(2006.01)
F16M 11/20	(2006.01)
F16M 11/14	(2006.01)

(52) **U.S. Cl.**

CPC ***B60R 7/06*** (2013.01); ***B60R 11/00*** (2013.01); *B60R 2011/0005* (2013.01); *B60R 2011/0084* (2013.01); *B60R 2011/0089* (2013.01); *F16M 11/14* (2013.01); *F16M 11/2085* (2013.01); *F16M 13/02* (2013.01)

(58) **Field of Classification Search**

CPC ... B60R 7/06; B60R 11/00; B60R 2011/0005; B60R 2011/0089; B60R 2011/0084; F16M 13/02; F16M 11/2085; F16M 11/14

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

892,105	A	6/1908	White
1,536,985	A	5/1925	Swinford
1,945,332	A	6/1934	Robinson
D208,918	S	10/1967	Dole et al.
D225,204	S	11/1972	Kendrick
4,073,113	A	2/1978	Oudot et al.
D251,467	S	4/1979	Anderson
D271,312	S	11/1983	Renteria
D275,065	S	8/1984	Steiner
4,469,261	A	9/1984	Stapleton et al.
4,516,296	A	5/1985	Sherman

(Continued)

FOREIGN PATENT DOCUMENTS

CN	304763109.5	8/2018
TW	D183200	5/2017

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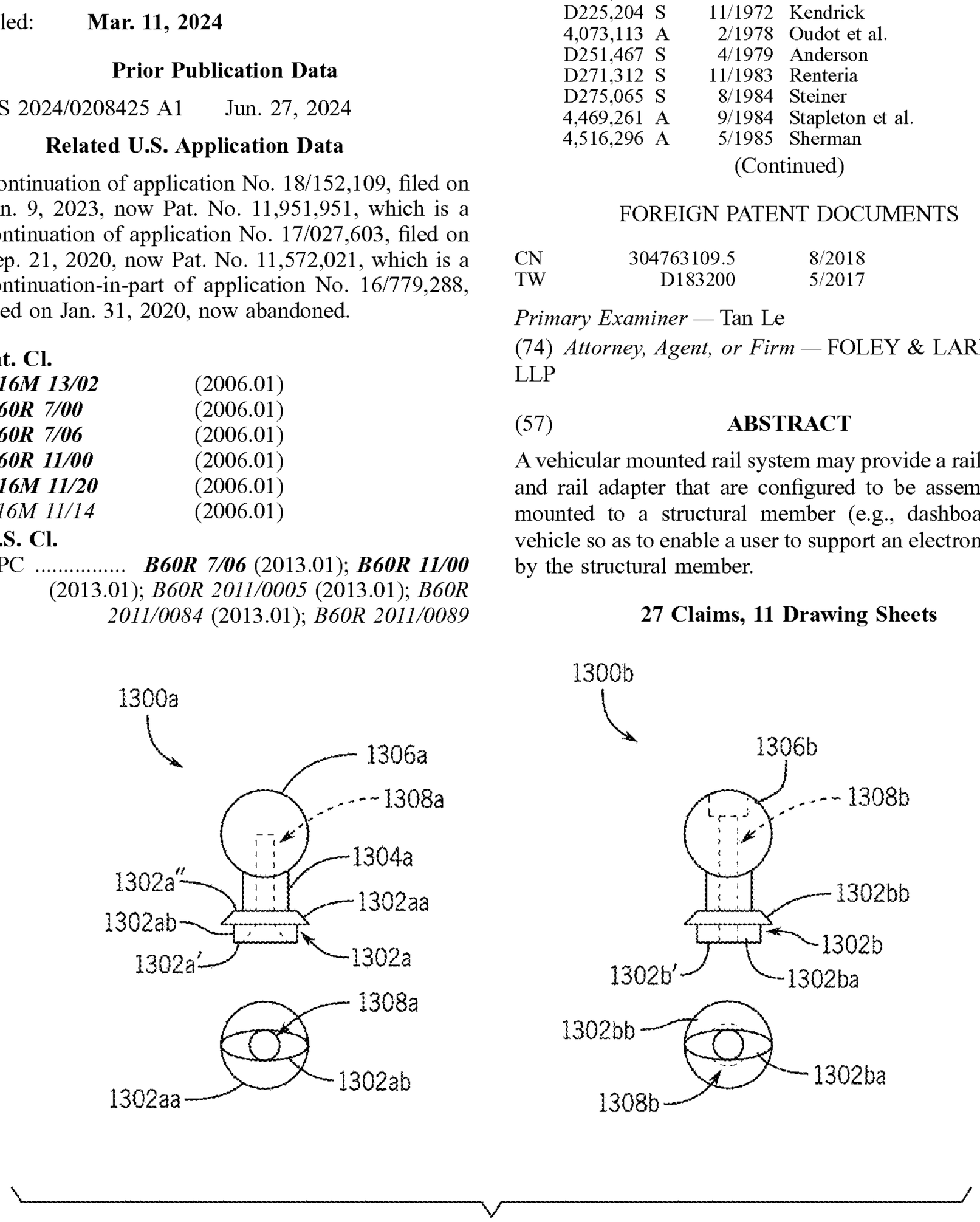
(57) **ABSTRACT**

A vehicular mounted rail system may provide a rail, base(s), and rail adapter that are configured to be assembled and mounted to a structural member (e.g., dashboard) of a vehicle so as to enable a user to support an electronic device by the structural member.

27 Claims, 11 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

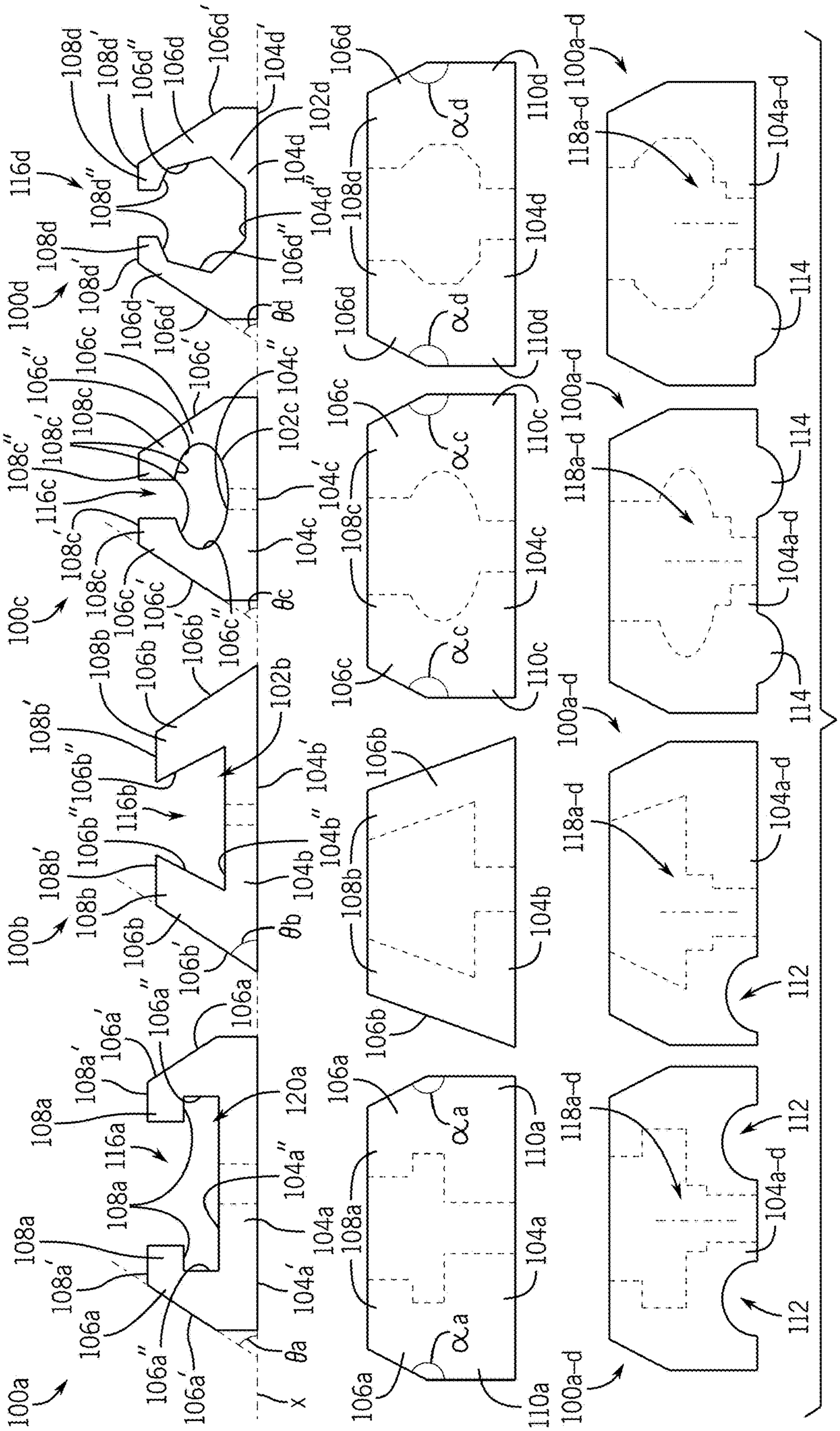
D282,759	S	2/1986	Weissberg
4,596,406	A	6/1986	Van Vleet et al.
D290,719	S	7/1987	Holloway
D291,785	S	9/1987	Rahme
4,708,554	A	11/1987	Howard
4,948,313	A	8/1990	Zankovich
D317,331	S	6/1991	Holloway
D317,950	S	7/1991	Tse
5,154,385	A	10/1992	Lindberg et al.
5,231,785	A	8/1993	Roberts
5,271,586	A	12/1993	Schmidt
5,279,711	A	1/1994	Frankeny et al.
5,305,700	A	4/1994	Strong et al.
5,395,131	A	3/1995	Herrick
D357,400	S	4/1995	Sachs
D360,571	S	7/1995	Perry
D373,761	S	9/1996	Yu
D374,165	S	10/1996	Marshall
D375,065	S	10/1996	Duvernay et al.
D375,765	S	11/1996	Kawasaki
D376,780	S	12/1996	McCoy
D378,302	S	3/1997	Kin-Man Tse
D390,709	S	2/1998	Moore
5,786,807	A	7/1998	Couch et al.
D399,847	S	10/1998	Seifert
D401,496	S	11/1998	Lambert et al.
5,839,744	A	11/1998	Marks
5,855,342	A	1/1999	Hawkins et al.
5,890,726	A	4/1999	McCoy et al.
5,893,744	A	4/1999	Wang
D409,182	S	5/1999	Tyler
5,927,041	A	7/1999	Sedlmeier et al.
D414,761	S	10/1999	Oikawa et al.
5,984,243	A	11/1999	Pfaller et al.
D440,845	S	4/2001	Lackey
D443,566	S	6/2001	Peterson
6,305,650	B1	10/2001	Hawkins et al.
D455,199	S	4/2002	Lenart et al.
6,446,915	B1	9/2002	Ismert
6,494,415	B1	12/2002	Roth
D506,916	S	7/2005	Sale, Jr.
D510,696	S	10/2005	Sale, Jr.
7,025,315	B2	4/2006	Carnevali
D521,314	S	5/2006	Ball
7,070,374	B2	7/2006	Womack et al.
D526,939	S	8/2006	Profitt et al.
D534,061	S	12/2006	Sakai
7,261,256	B2	8/2007	Pattie et al.
D551,937	S	10/2007	Krumpe et al.
D554,137	S	10/2007	Richter
7,320,450	B2	1/2008	Carnevali
7,324,050	B2	1/2008	Chung et al.
D567,060	S	4/2008	Busalt et al.
7,401,995	B2	7/2008	Senakiewich, II
7,441,731	B2	10/2008	Smart et al.
7,448,822	B2	11/2008	Nebeker et al.
D587,713	S	3/2009	Sutton
D592,487	S	5/2009	Tedesco et al.
D594,735	S	6/2009	Hofer
D599,829	S	9/2009	Jorgensen et al.
7,604,444	B2	10/2009	Wu
D607,381	S	1/2010	Lekkas
7,757,424	B2	7/2010	Follmar
7,774,973	B2	8/2010	Carnevali
7,849,630	B2	12/2010	Carnevali
8,100,600	B2	1/2012	Blum
D657,783	S	4/2012	Mo
D658,184	S	4/2012	Chang et al.
D658,478	S	5/2012	Wall
D673,443	S	1/2013	Elrod
D674,681	S	1/2013	Gorman
D686,622	S	7/2013	Rey et al.
8,497,760	B2	7/2013	Whalen et al.
D691,027	S	10/2013	Rainer
D698,357	S	1/2014	Mainville et al.
D699,176	S	2/2014	Salomon et al.
D703,998	S	5/2014	Funnell et al.
D718,298	S	11/2014	Aspinall et al.
D720,199	S	12/2014	Clements et al.
D722,815	S	2/2015	Fuller et al.
8,944,399	B2	2/2015	Sutherland et al.
D723,559	S	3/2015	Hein et al.
D732,519	S	6/2015	Aspinall et al.
D732,932	S	6/2015	Ng et al.
D733,116	S	6/2015	Aspinall et al.
D735,722	S	8/2015	Amann
D736,595	S	8/2015	Moore et al.
D740,589	S	10/2015	Ng
D741,689	S	10/2015	Metzler
D748,640	S	2/2016	Hart
D749,405	S	2/2016	White
D750,951	S	3/2016	Fuller et al.
D752,976	S	4/2016	Koffel et al.
D753,983	S	4/2016	Toye
D754,527	S	4/2016	Green et al.
9,303,792	B2	4/2016	Heims et al.
D758,834	S	6/2016	Tally
D759,465	S	6/2016	Reed
D760,066	S	6/2016	Krenek
D761,094	S	7/2016	Hooten
D764,597	S	8/2016	Kujawski et al.
D772,689	S	11/2016	Zimmer
9,494,400	B1	11/2016	Allemann et al.
9,506,600	B1	11/2016	Li
D776,091	S	1/2017	Spio
9,574,589	B2	2/2017	Knutson et al.
D780,480	S	3/2017	Prince et al.
D789,177	S	6/2017	Carnevali
D790,325	S	6/2017	Gupta
D790,545	S	6/2017	Dannenberg et al.
9,671,060	B1	6/2017	Cifers
9,683,590	B2	6/2017	Zhang et al.
D792,418	S	7/2017	Stener
9,717,329	B2	8/2017	Hazzard et al.
D799,067	S	10/2017	Forsberg
D799,690	S	10/2017	Kawamura et al.
D807,152	S	1/2018	Hansen
D808,243	S	1/2018	Clements et al.
9,863,576	B1	1/2018	Cifers
9,879,819	B1	1/2018	Cifers
D810,008	S	2/2018	Mollison et al.
D810,076	S	2/2018	Lee et al.
D812,056	S	3/2018	Guermeur
9,923,511	B2	3/2018	Xie
D816,373	S	5/2018	Schwandt et al.
D818,349	S	5/2018	White
10,027,273	B2	7/2018	West et al.
D824,749	S	8/2018	Wright et al.
D828,482	S	9/2018	Alldredge et al.
D834,020	S	11/2018	Pascucci
D839,216	S	1/2019	Kim et al.
D843,199	S	3/2019	Stener
10,273,694	B2	4/2019	Wright et al.
D848,671	S	5/2019	Neuhaus et al.
D849,502	S	5/2019	Lucic, III
D860,198	S	9/2019	Engwall et al.
D860,522	S	9/2019	Zhan
D862,213	S *	10/2019	Stener D8/380
D865,502	S *	11/2019	Stener D8/380
D868,010	S	11/2019	Bard et al.
D879,671	S	3/2020	Siegel
D884,661	S	5/2020	Kim et al.
11,572,021	B2	2/2023	Stener
11,635,155	B2	4/2023	Carnevali
11,702,842	B2	7/2023	Ball et al.
11,951,951	B2 *	4/2024	Stener B60R 7/06
2001/0045725	A1	11/2001	McCoy et al.
2002/0166936	A1	11/2002	Carnevali
2004/0251388	A1	12/2004	Williams
2005/0045779	A1	3/2005	Nan
2005/0092876	A1	5/2005	Carnevali
2005/0104327	A1	5/2005	Irgens et al.
2006/0000957	A1	1/2006	Carnevali
2006/0279067	A1	12/2006	Irgens et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2007/0120036	A1	5/2007	Olle et al.
2008/0115344	A1	5/2008	Carnevali
2008/0272574	A1	11/2008	Stuart
2009/0026730	A1	1/2009	Frantz
2009/0079164	A1	3/2009	Columbia
2009/0253521	A1	10/2009	Arden et al.
2010/0276558	A1	11/2010	Faust et al.
2012/0045276	A1	2/2012	Carnevali
2013/0248668	A1	9/2013	Lu et al.
2015/0030386	A1	1/2015	Carnevali
2018/0306233	A1	10/2018	Burton
2018/0345476	A1	12/2018	Carnevali
2018/0347749	A1	12/2018	Carnevali
2018/0363842	A1	12/2018	Carnevali

* cited by examiner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100d
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102c
102d
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104a'
104a''
104a–d
104b
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104c
104c'
104c''
104d
104d'
104d''
106a
106a'
106a''
106b
106b'
106b''
106c
106c'
106c''
106d
106d'
106d''
108a
108a'
108b
108b'
108c
108c'
108d
108d'
108d''
110a
110c
110d
112
114
116b
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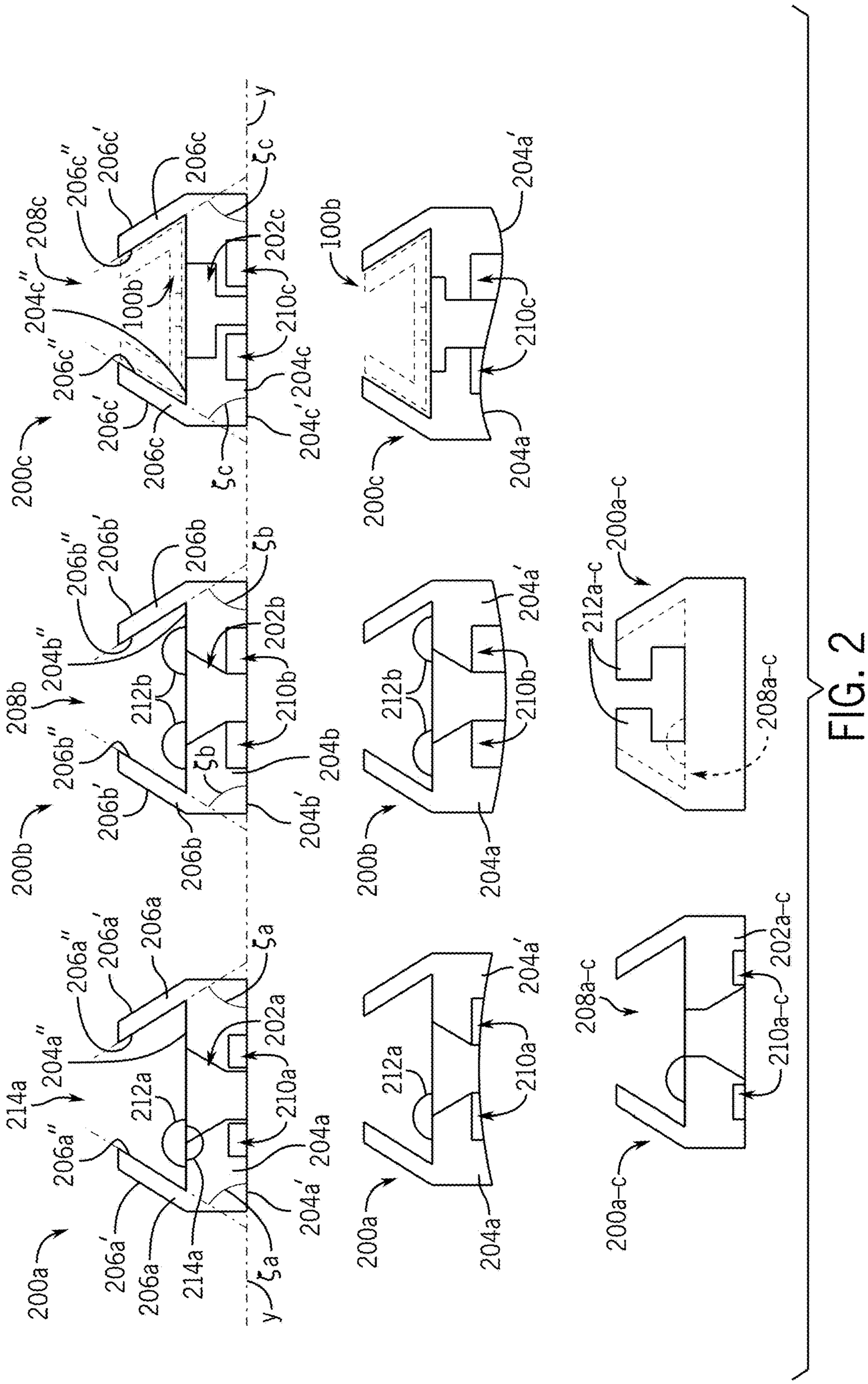
116d
118a–d
120a
αa
αc
αd
θa
θb
θc
θd
X

FIG. 1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206c''
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ζc
y
202c
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204a'
200b
208b
204b''
206b''
206b'
206b
ζb
202b
210b
212b
204b'
204b
200a
214a
204a''
206a''
206a'
206a
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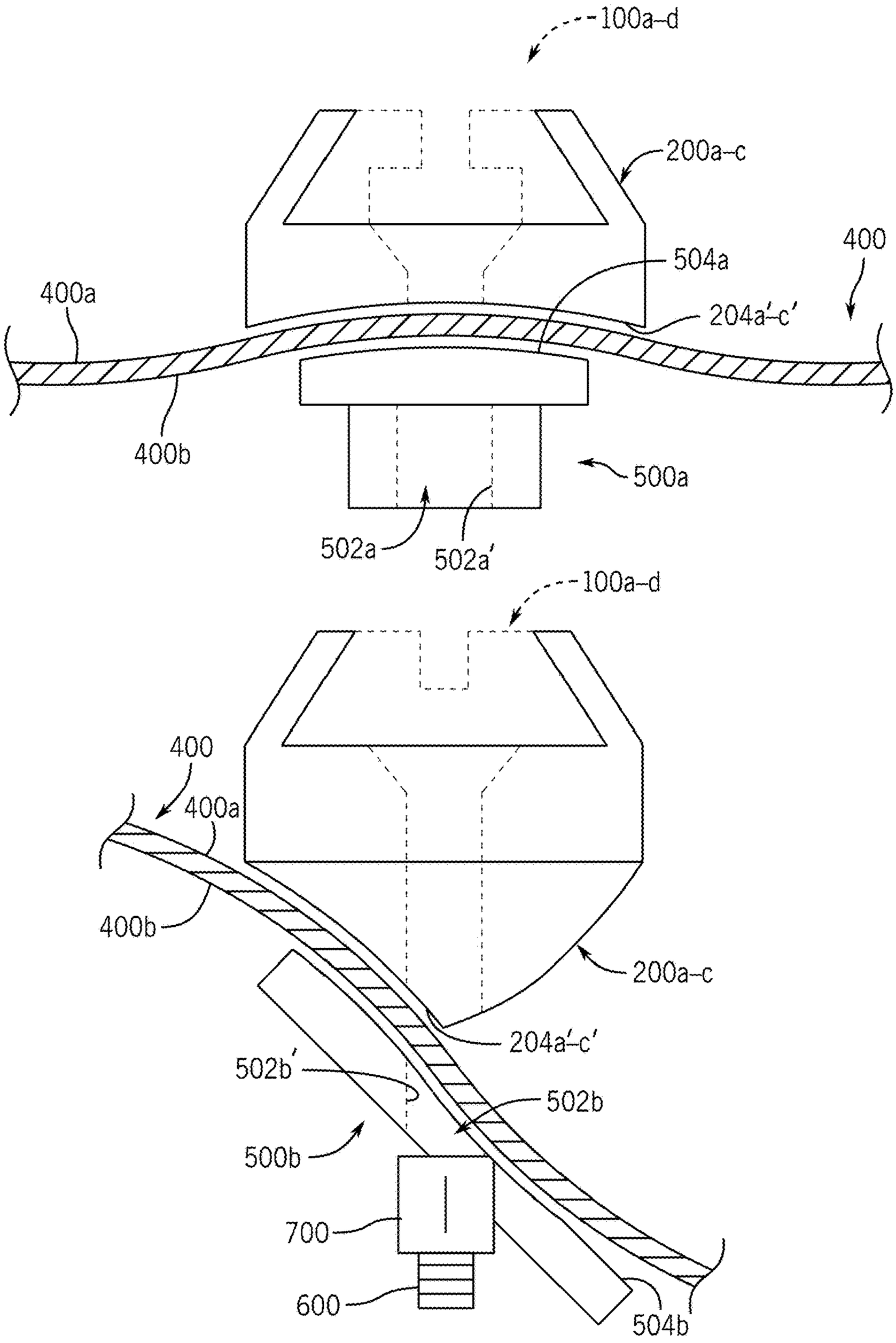
212a–c
200a–c
202a–c
210a–c

FIG. 2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200a-c
504a
400
400a
204a'-c'
400b
500a
502a
502a'
100a-d
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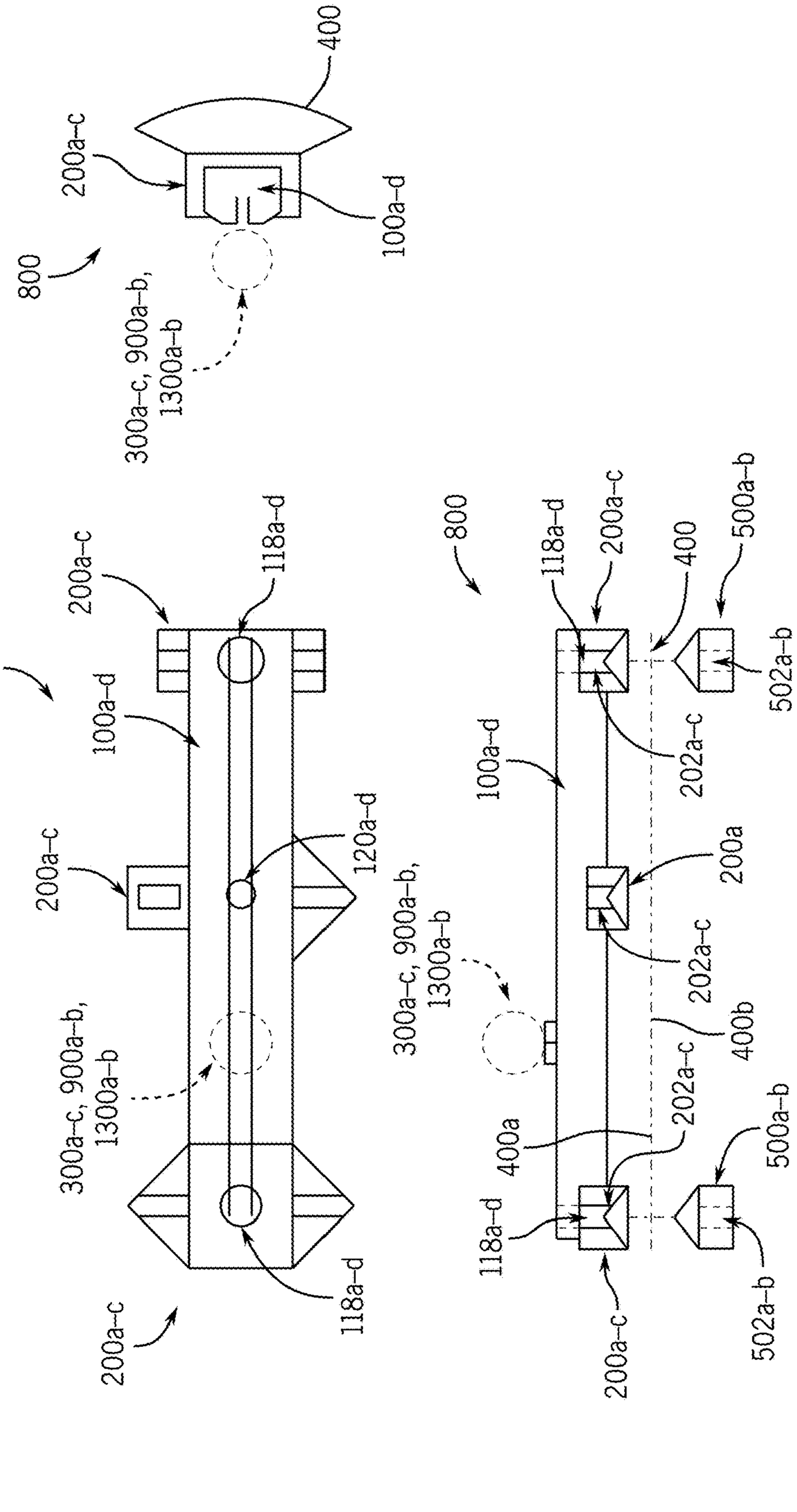
400b
200a-c
204a'-c'
502b'
502b
500b
700
600
504b

FIG. 3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100a–d
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120a–d
502a–b
202a–c
500a–b
400a
400b

FIG. 4

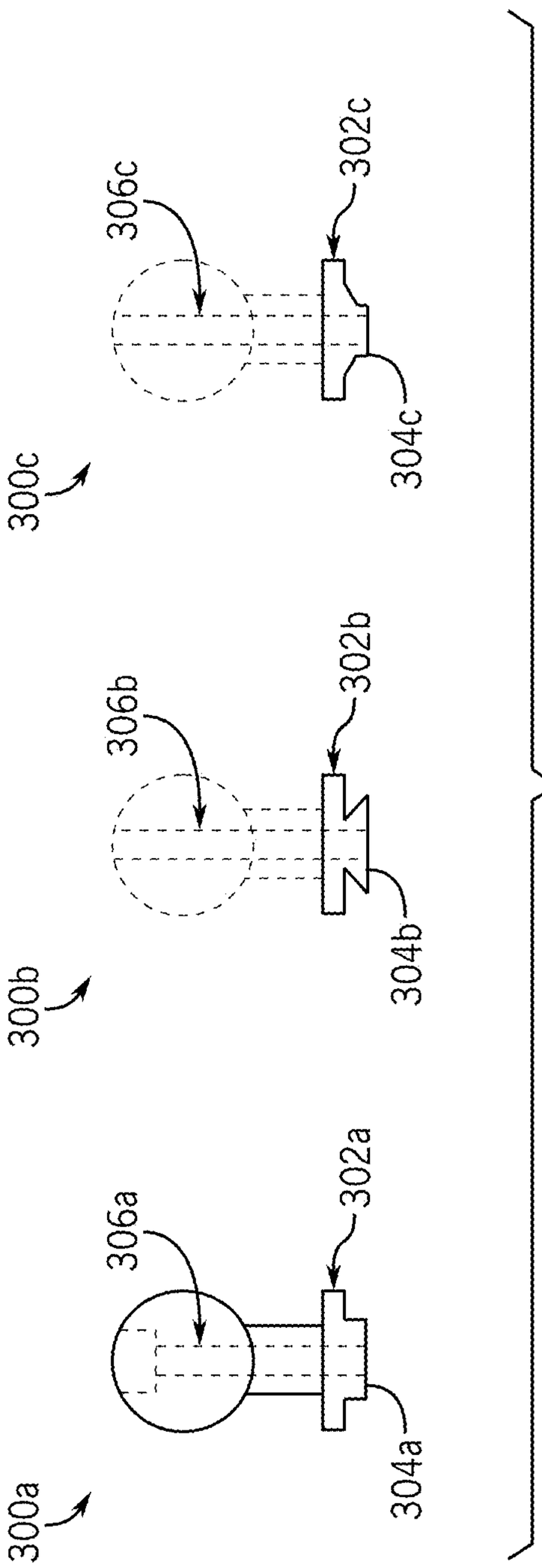
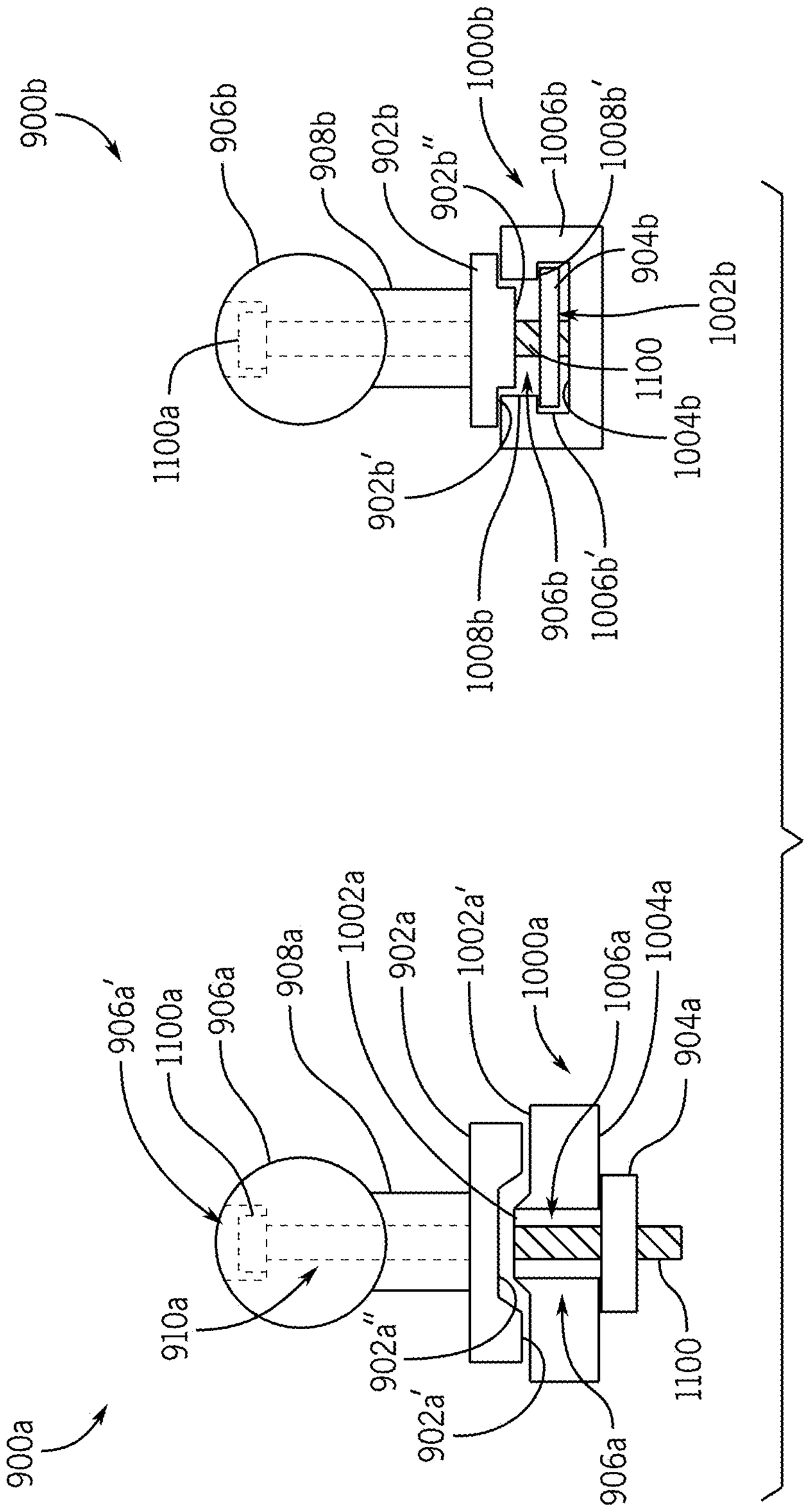


FIG. 5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908b
902b
902b''
1000b
1006b
1008b'
904b
1002b
1100
1004b
1100a
902b'
1008b
906b
1006b'
900a
906a'
1100a
906a
908a
1002a
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904a
910a
902a''
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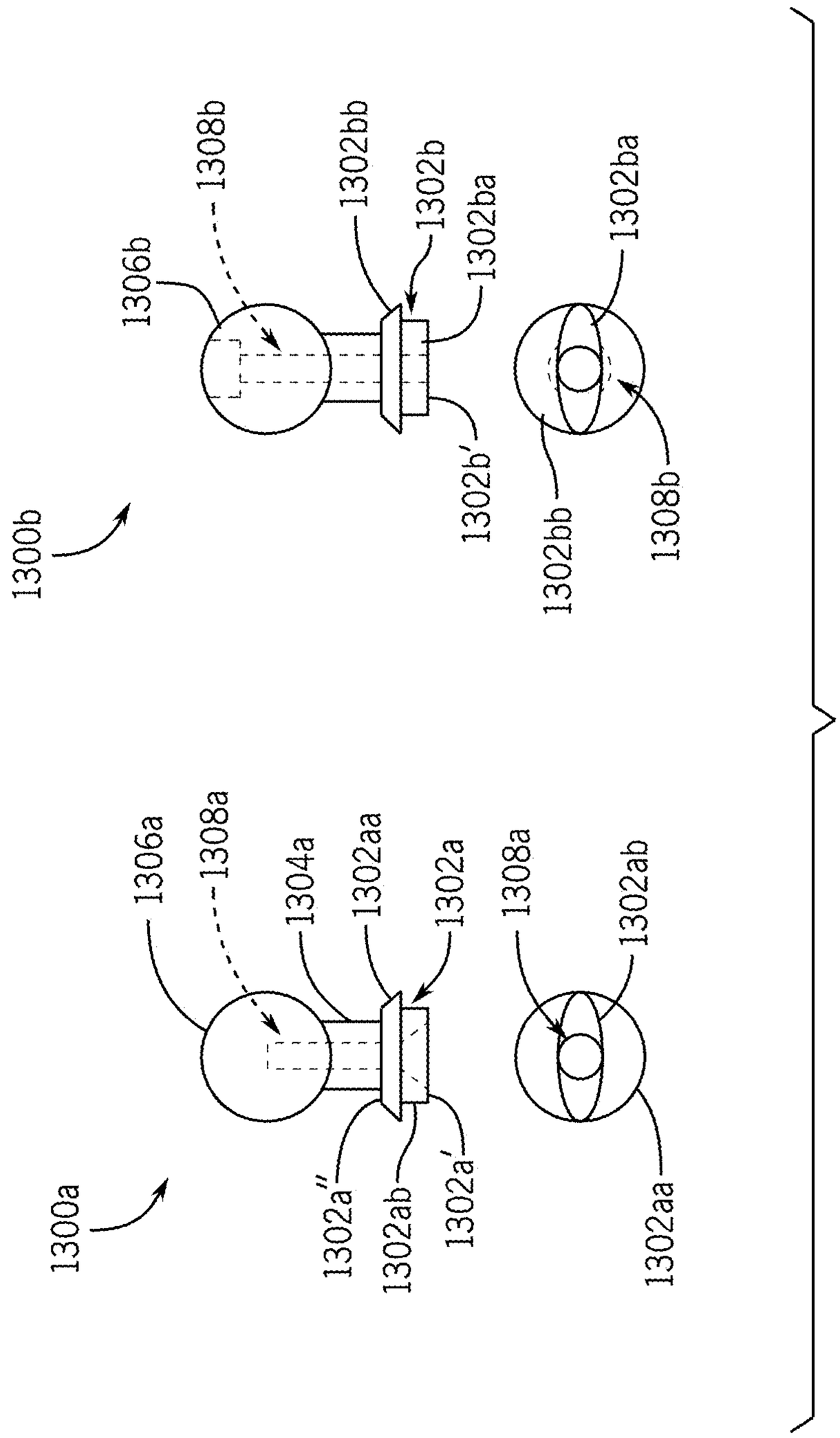
906a
1100

FIG. 6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1302a''
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1302b'
1302ba
1302b
1302bb
1308b

FIG. 7

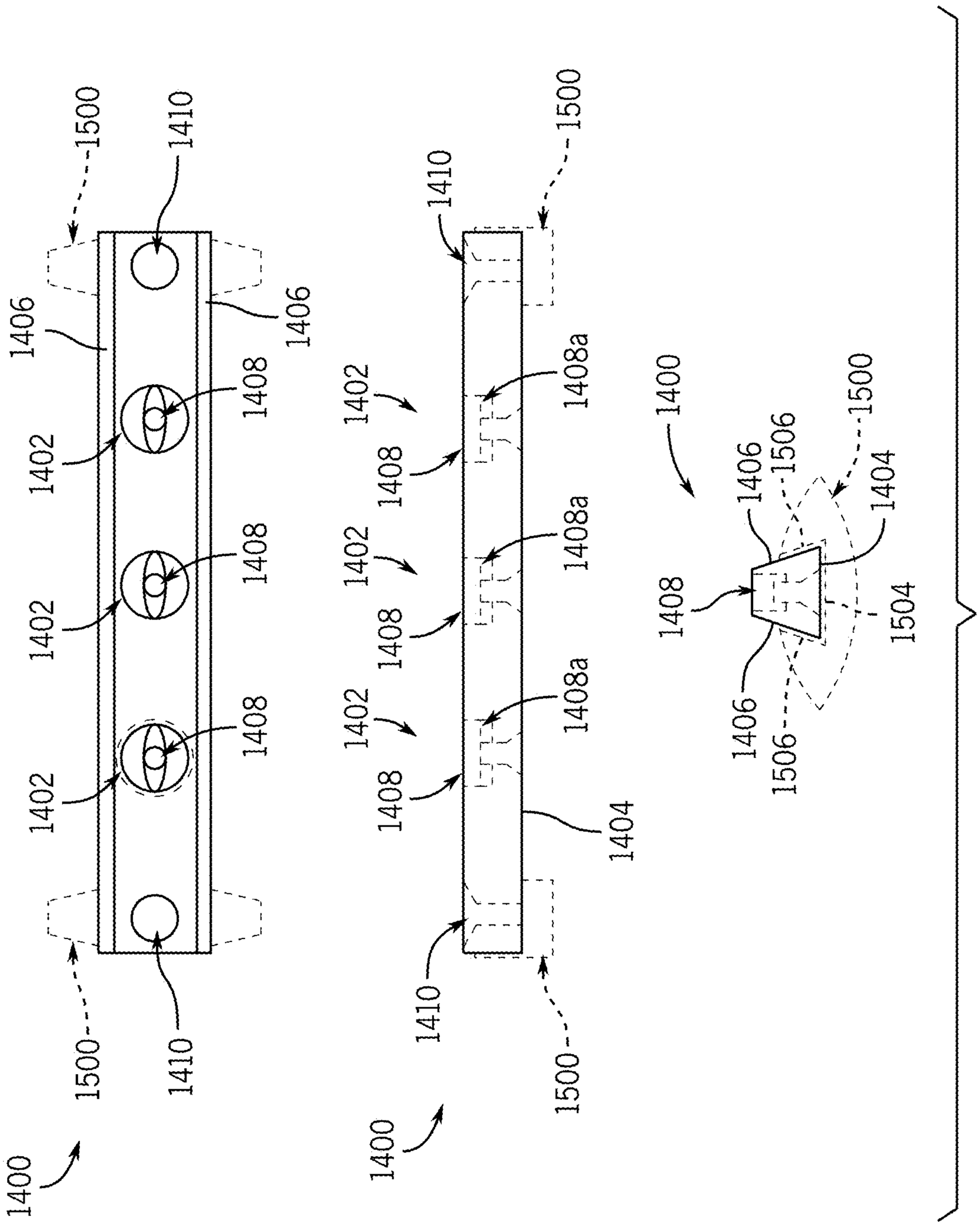
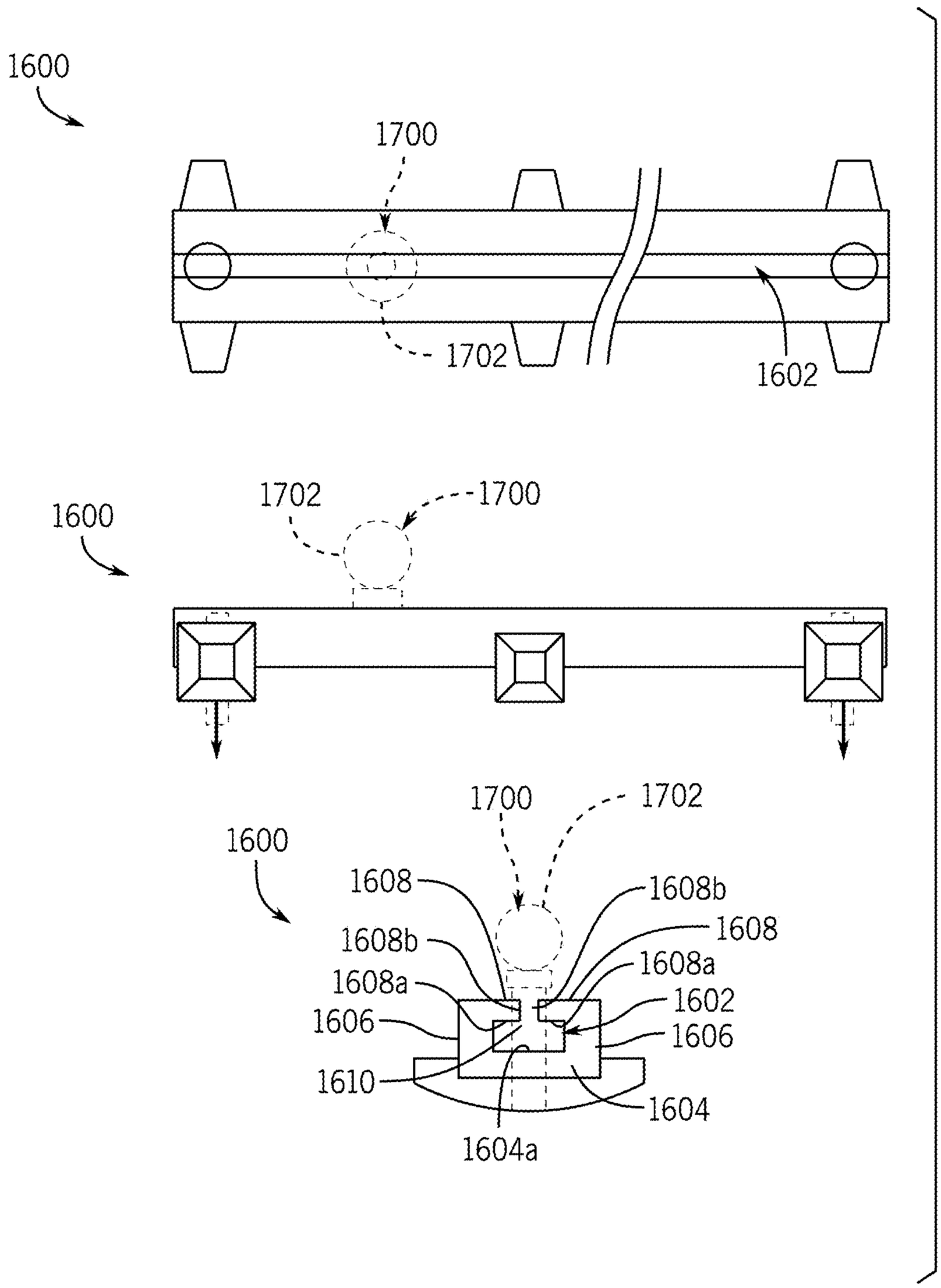


FIG. 8


1600
1700
1702
1602
1600
1702
1700
1600
1700
1702
1608
1608b
1608a
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1604a
1608b
1608
1608a
1602
1606
1604

FIG. 9

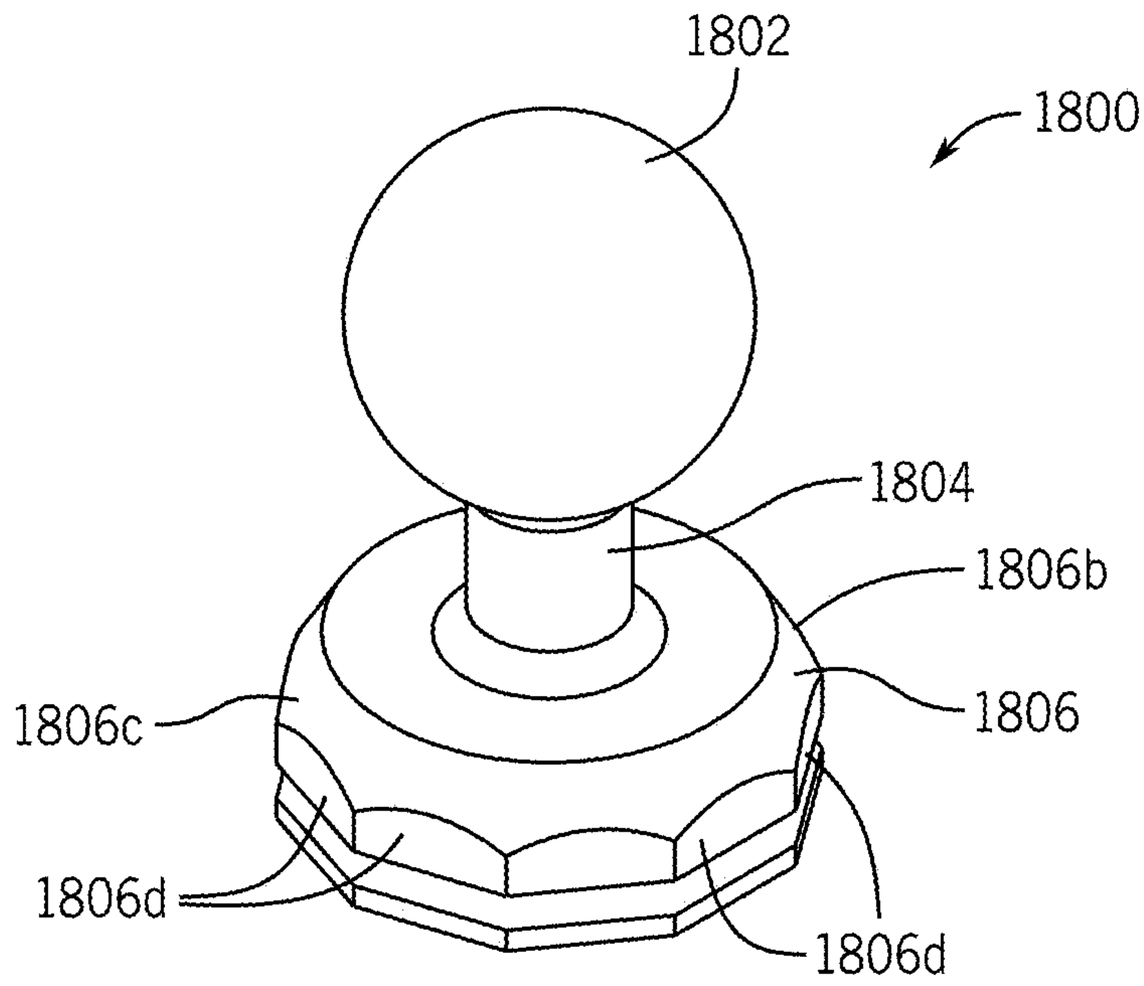

FIG. 10

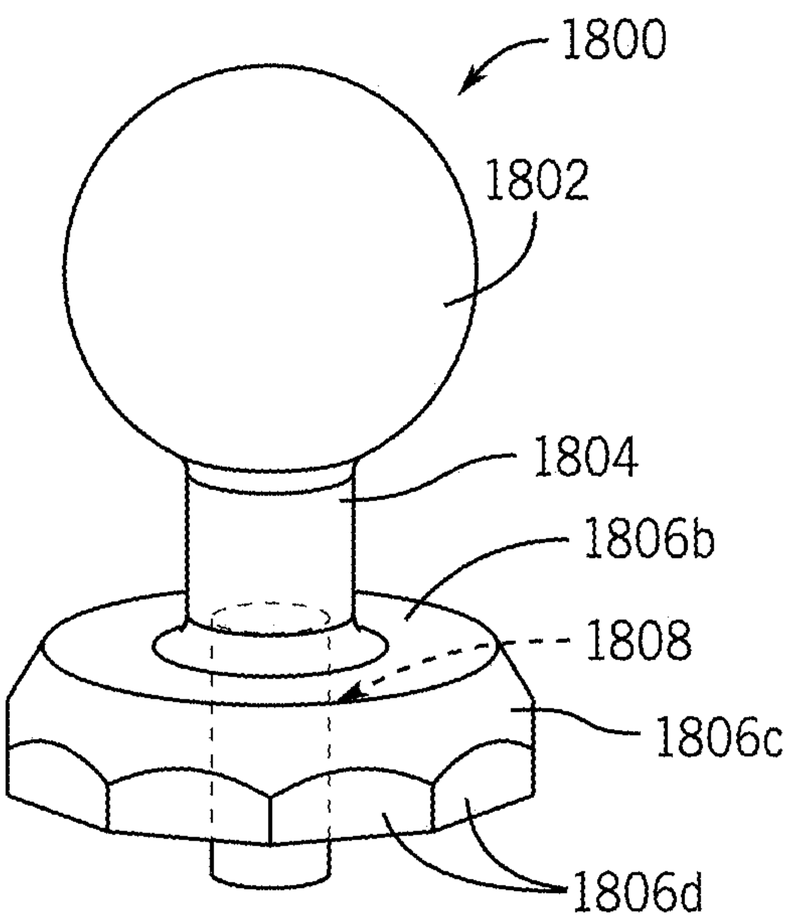

FIG. 11

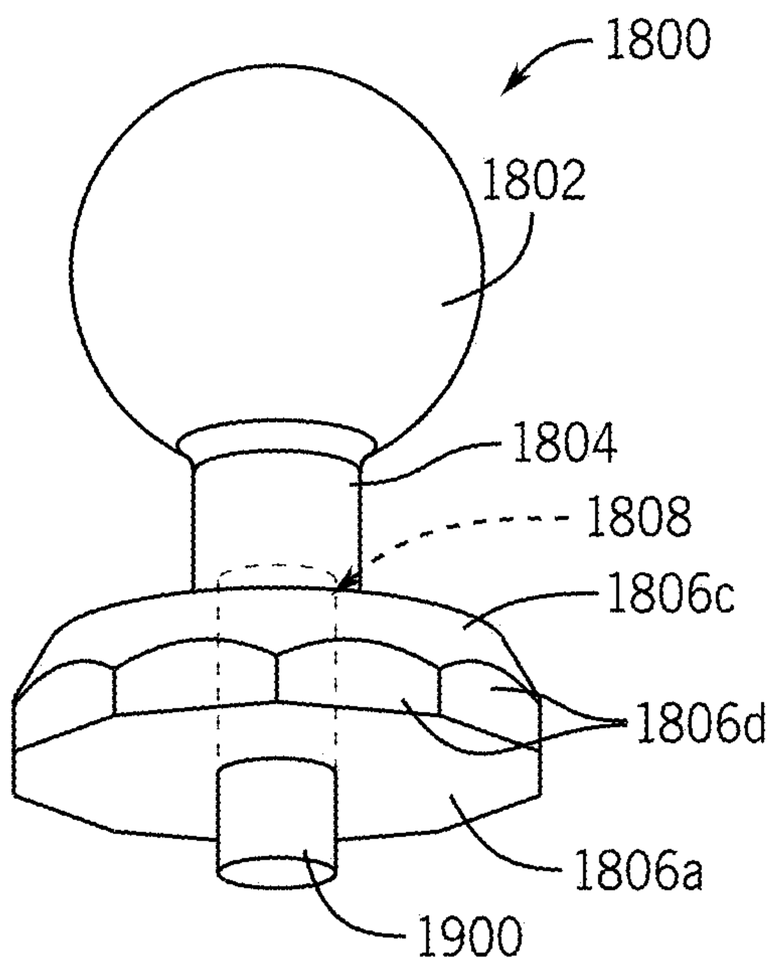

FIG. 12

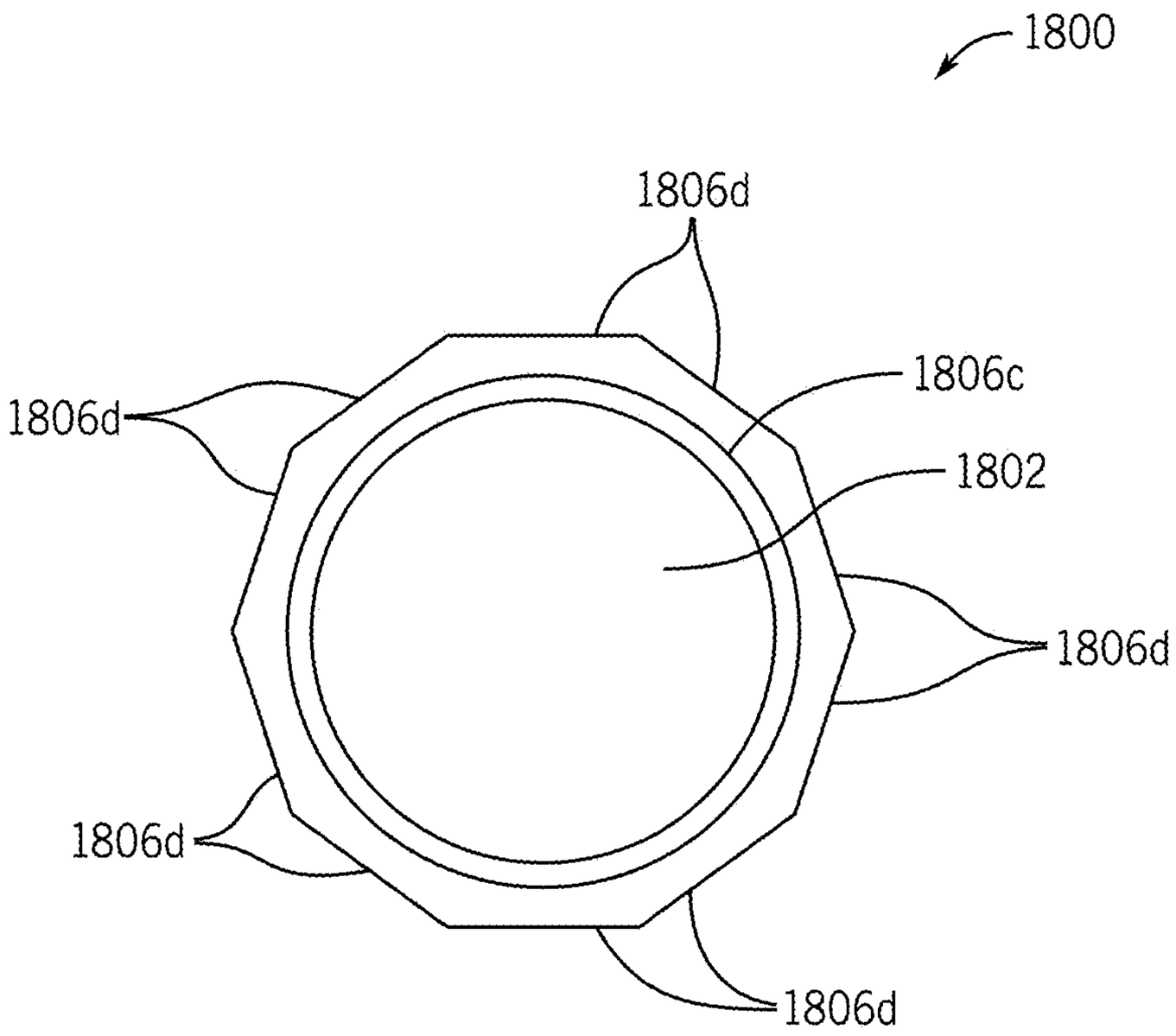
1800
1806d
1806d
1806c
1802
1806d
1806d
1806d

FIG. 13

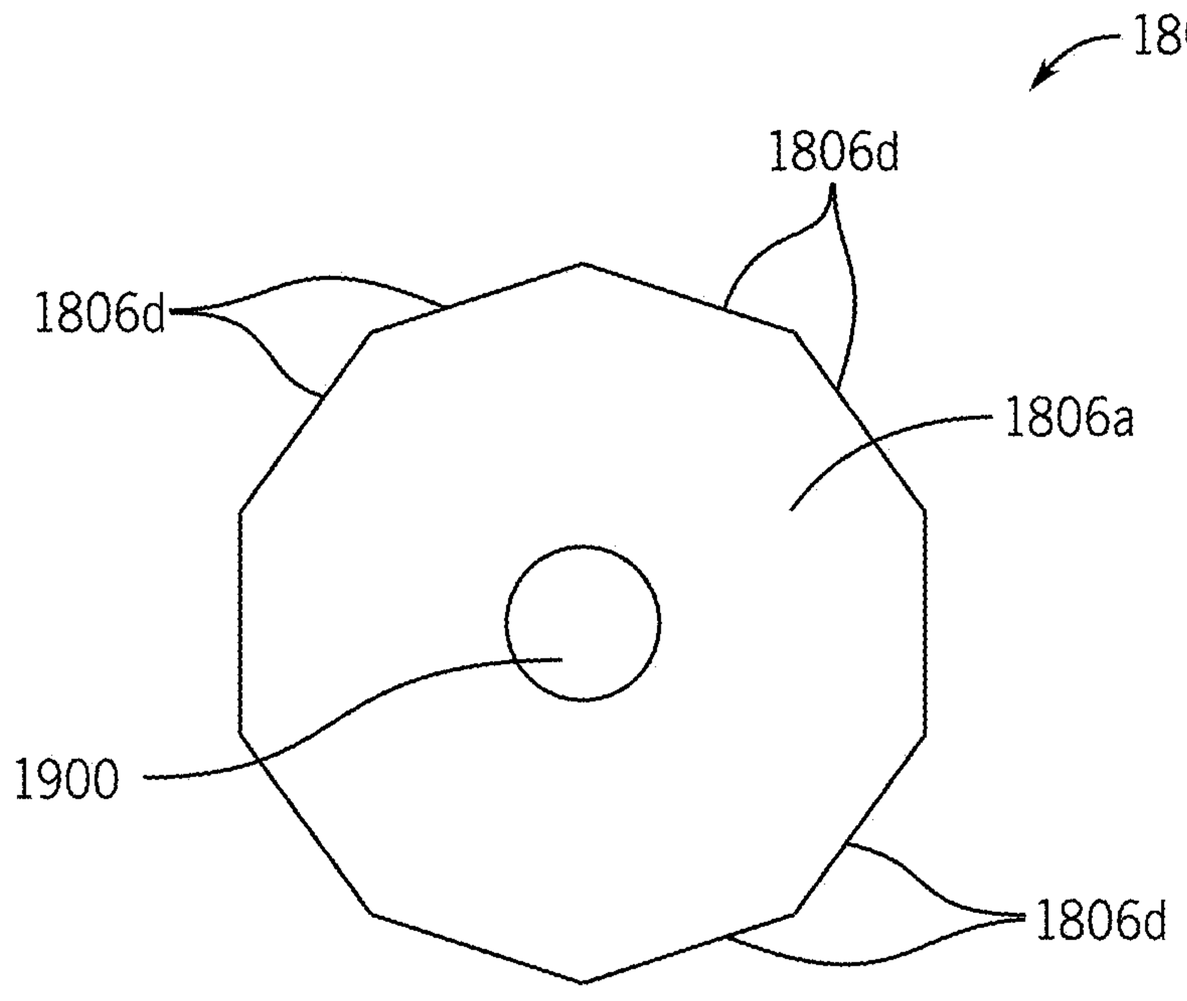
1800
1806d
1806d
1806a
1900
1806d

FIG. 14

VEHICULAR MOUNTED RAIL SYSTEM

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

This application is a Continuation of U.S. Non-Provisional application Ser. No. 18/152,109, filed Jan. 9, 2023, which is a Continuation of U.S. Non-Provisional application Ser. No. 17/027,603, filed Sep. 21, 2020, which is a Continuation-In-Part of U.S. Non-Provisional application Ser. No. 16/779,288, filed on Jan. 31, 2020, the disclosures of which are hereby incorporated by reference in their entirety.

BACKGROUND

With the wide adoption of mobile electronic devices, such as smartphones and tablets, the use of the mobile electronic devices in everyday life has become pervasive. Mobile apps, such as mapping apps for driving directions, has become commonly used by drivers and vehicles, both for consumer and commercial uses.

One challenge for users of the mobile devices in vehicles is safety in using the mobile devices when driving because holding the device leaves only one hand to control the steering wheel, and placing the electronic device on a lap, seat, or center console pulls a driver's attention away from the road. To help with safety for drivers when using mobile devices, aftermarket electronic device mounting systems that are mounted onto a dashboard have been developed. Existing mounting systems, however, are often not easily connected to dashboards as a result of vehicular dashboards often having complex and/or compound shapes (e.g., surfaces that are not linear), and, thus, problematic for the mounting systems to be adapted to the dashboard and be sufficiently stable to support the mobile devices. As such, there is a need for a vehicular mobile device mounting system that offers ease of installation and stability in supporting mobile electronic devices.

BRIEF SUMMARY

To overcome the shortcomings of existing dashboard mounting systems for supporting mobile electronic devices, a dashboard mounting system may include a rail defined by a pair of sidewalls with external walls having an inwardly acute angle relative to a bottom surface of a bottom wall of the rail. The sidewalls may each include top walls that extend over internal walls of the sidewalls, where a gap separates the top surfaces so as to form a rail feature. The bottom wall of the rail may define a pair of recessed openings that enable a user to directly or indirectly mount the rail to a dashboard of a vehicle. In an embodiment, the top walls may have semi-circles defined in each one directly above the recessed openings, thereby enabling a fastener to be extended therethrough and simplify mounting of the rail to the dashboard. Additionally, the recessed openings and spaces defined by the semi-circles in the top surfaces may enable the manufacturer to use a single tool to both carve the semi-circles into the top surface and form the recessed opening in the base. In an embodiment, internal walls of the sidewalls, top surface of bottom wall, and bottom surfaces of the top walls may form a channel with a defined shape, such as a geometric (e.g., star, triangle, etc.) or non-geometric shape (e.g., curvilinear with abstract shapes). A base of a ball mount that extends into the channel may have a reciprocal defined shape, thereby enabling the ball mount to slide into and along the channel and through the rail feature to a desired position along the rail to lock the ball mount.

In an alternative embodiment, rather than using a rail with a channel of the rail, a bar mount that defines one or more fixed positions for a bar mount adapter may be provided. The fixed position(s) may be configured to resist or prevent rotation of the bar mount adapter during use, for example. In an embodiment, one or more anti-rotation features may be included at the fixed position and base of the bar mount adapter, where the anti-rotation feature(s) may include, but not be limited to, shape of recess or seat for the base of the bar mount adapter to reside, one or more protrusions, one or more corresponding recesses, or any combination thereof, where the feature(s) are offset from an axial center location of the bar mount adapter and reciprocal to engage with one another. In an embodiment, the bar mount adapter may include a ball, stem, and base formed from a single material (i.e., a single unit). Alternative configurations of the bar mount adapter may be utilized (e.g., multiple components that are connected together).

One embodiment of the present disclosure relates to a mounting system for supporting an electronic device. The mounting system may include a mount, an adapter, and a base component. The mount may include a first opening. The adapter may include a first feature configured to be supported by the mount. The first feature may be configured to mate with the mount to prevent relative rotation between the mount and the adapter. The base component may be configured to enable securing the mount to a structural feature of a system in which the mounting system is being transported while supporting the electronic device.

Another embodiment of the present disclosure relates to an adapter for use in a mounting system for supporting an electronic device. The adapter may include an adapter feature, a shaft, a base, and a feature coupled to the base. The shaft may include a first axial end and a second axial end. The first axial end of the shaft may be connected to the adapter feature. The base may be connected to the second axial end of the shaft. The feature may be configured to mate with a mount to prevent rotation of the base relative to the mount.

Yet another embodiment of the present disclosure relates to a method of installing a mounting system for supporting an electronic device. The method may include mating a first feature of an adapter to a mount inclusive of a second feature that is shaped reciprocal to the first feature. The first feature may be configured to prevent relative rotation between the adapter and the mount when the second feature is mated with the first feature. The method may also include aligning a first opening of the mount with a second opening defined by a base component. The method may further include security the mount to a structural feature of a system in which the mounting system is to be transported while supporting the electronic device by connecting the base component to the mount using a fastening member that extends into the first opening and the second opening.

BRIEF DESCRIPTION OF THE DRAWINGS

Illustrative embodiments of the present invention are described in detail below with reference to the attached drawing figures, which are incorporated by reference herein and wherein:

FIG. **1** shows illustrations of a number of different illustrative embodiments of a rail that is part of a rail mount system for mounting to a dashboard of a vehicle so as to support an electronic device;

FIG. **2** shows illustrations of illustrative bases that define a recessed opening into which a fastener with a profile that is reciprocal to a profile of the recessed opening to secure the bases to a structural member of a vehicle;

FIG. **3** shows illustrations of illustrative retention or sub-base components configured to be disposed below a surface of a dashboard and be configured to enable a connection or fastening device, such as a bolt, to extend therethrough so as to retain the rail and sub-base component on respective sides of the surface of the dashboard;

FIG. **4** shows illustrations of an illustrative rail system that includes the rail, end bases, intermediate base(s), and rail adapter(s) to attach an arm or electronic mounting mechanism;

FIG. **5** shows illustrations of a rail adapter, in this case a trackball mounted to a base that includes a key portion that extends between top walls defined by or connected to sidewalls of a rail;

FIG. **6** shows illustrations of alternative configurations of rail a rail adapter, in this case a trackball, for mounting to a rail;

FIG. **7** shows illustrations of alternative embodiments of rail adapters that include anti-rotation members and regions for fastening members to be connected and/or retained by the rail adapters;

FIG. **8** shows illustrations of an illustrative bar mount; and

FIG. **9** shows illustrations of an illustrative rail.

FIGS. **10-14** show illustrations of an illustrative rail adapter, in this case a trackball, for mounting to a rail.

DETAILED DESCRIPTION OF THE DRAWINGS

With regard to FIG. **1**, a number of different embodiments of a rail **100***a*-**100***d* that is part of a rail mount system for mounting to a dashboard of a vehicle so as to support an electronic device are shown. The rails **100***a*-**100***d* are shown along a top row to include a number of channels with different internal rail profiles **102***a*-**102***d* defined by a bottom wall **104***a*-**104***d* having bottom surfaces **104***a*'-**104***d*' and inner surfaces **104***a*"-**104***d*", sidewalls **106***a*-**106***d* having outer surfaces **106***a*'-**106***d*' and inner surfaces **106***a*"-**106***d*", and top walls **108***a*-**108***d* (if included) having outer surfaces **108***a*'**108***d*' and inner or bottom surfaces **108***a*"-**108***d*". In each of the embodiments, the side walls **106***a*-**106***d* have outer surfaces **106***a*'-**106***d*' that are angled inward or are acute relative to a plane X along which the bottom surface **104***a*'-**104***d*' of the bottom wall **104***a*-**104***d* extends. In an embodiment, an angle θa-θd defines the acute angle. The external or outer profile of each rail **100***a*-**100***d* may be trapezoidal or generally trapezoidal, where being generally trapezoidal may mean that the walls **106***a*-**106***d* may have other features or angles that deviate from being a perfect trapezoid. For example, a feature **110***a*-**110***d* may extend upwards along and/or from the respective bottom wall **104***a*-**104***d* so as to meet the respective side wall **106***a*-**106***d* at a defined angle αa-αd. The side wall **106***a*-**106***d* thereafter may be angled upward and inward. By using acute angles, rotation of the bottom wall **104***a*-**104***d* may be minimized when engaged or attached to base(s), such as outer base(s) and intermediate base(s) (collectively base(s)), that mount to a surface of a dashboard.

It should be understood that non-trapezoidal profiles of the rail **100***a*-**100***d* may be utilized, but provide for the same or similar functionality as a rail with a trapezoidal profile. In an embodiment, the non-trapezoidal profile may have a hexagonal or other geometric profile (e.g., spline profile). The outer profile of the rail **100***a*-**100***d* may be symmetric or non-symmetric across hemispheric axes (i.e., side-to-side or top-to-bottom). Although the rail **100***a*-**100***d* is shown to be longitudinally or axially linear, it should be understood that the rail may be curved (e.g., semi-circular, s-shaped, triangular, or otherwise). If the rail **100***a*-**100***d* is not linear or not completely linear, then the base(s) (e.g., bases **200***a*-**200***c* shown in FIG. **2**) may be shaped (e.g., curved, curved in part, straight in part) to be able to slide at least partially along the rail for installation or movement. Similarly, any rail adapters (e.g., track balls **300***a*-**300***c* (FIG. **5**), **900***a*-**900***b* (FIG. **6**), **1300***a*-**1300***b* (FIG. **7**)) to be utilized with the non-linear rail may be shaped to be able to mount to or at least partially slide along the rail.

The outer base(s) and intermediate base(s) (collectively "bases") may define reciprocal profiles to the profile of the bottom and outer surfaces of the rail so as to provide a friction fit that resists or prevents relative rotation between the base(s) and rail. By using outer base(s) and intermediate base(s) that have internal profiles that may reciprocally match a standard external rail profile, but have different external profiles that may match the profile of a dashboard, a common rail may be utilized for different surface shapes of vehicles, thereby minimizing or eliminating the need to produce a rail with different shaped profiles (i.e., the external sides of the base and/or sidewalls may be common for different structural features of vehicles). It should be understood that the internal profile of the base(s) may be reciprocal to the outer profile of the rail, thereby enabling the base(s) to resist relative rotational motion between the base(s) and the rail.

The outer base(s) and intermediate base(s) may be formed of any material, such as plastic, epoxy, steel, aluminum, or otherwise, and be sufficiently rigid or resistant to bending when engaged with the rail to maintain the rail in a fixed position when in use in a vehicle. The intermediate base(s) may be used when the rail is long and additional support along the rail is desired. An opening **120***a*-**120***d* (see FIG. **4**) defined by the bottom wall **104***a*-**104***d* of the rail between the recessed openings **118***a*-**118***d* may be threaded so as to enable a fastening member, such as a screw, to secure the intermediate base to the rail. The opening **120***a*-**120***d* may be recessed or not recessed because the rail adapter may not need to slide past the intermediate base.

The bottom wall **104***a*-**104***d* and sidewalls **106***a*-**106***d* of the rail **100***a*-**100***d* may be monolithic and formed from the same material at the same time using an extrusion or other process to forge or produce the rail. Alternatively, different processes may be used to form the rail **100***a*-**100***d*, where the bottom wall **104***a*-**104***d* and sidewalls **106***a*-**106***d* may be made of the same or different materials. The material of the rail **100***a*-**100***d* may be metal, such as steel, aluminum, or otherwise, plastic, ceramic, or otherwise.

In an embodiment shown in FIG. **1**, the bottom wall **104***a*-**104***d* may have one or more bottom features **112** and/or **114** that may operate as keys or alignment features to engage with another portion of the rail system. The features **112** and/or **114** may be used to help reduce or minimize translation of the rail **100***a*-**100***d* due to motion of a vehicle, as well. The bottom wall **104***a*-**104***d* further includes one or more recessed openings **118***a*-**118***d* disposed therethrough, and one or more intermediate openings **120***a*-**120***d* (see FIG. **4**) disposed therethrough between the recessed openings **118***a*-**118***d* for attaching the rail **100***a*-**100***d* to a structural feature. A rail adapter, such as a trackball (e.g., trackballs **300***a*-**300***c* of FIG. **5**, trackballs **900***a*-**900***b* of FIG. **6**, or trackballs **1300***a*-**1300***b* of FIG. **7**), may have a base feature (e.g., base **302***a*-**302***c*, **902***a*-**902***b*, **1302***a*-**1302***b*) that

extends into and is maintained by a channel with the internal rail profile **102***a*-**102***d*, where the rail adapter may slide along the rail **100***a*-**100***d* when not in a locked state. When in a locked state, the rail adapter may be prevented from moving along the rail **100***a*-**100***d*. To insert the rail adapter into the rail **100***a*-**100***d*, the base of the rail adapter may be extended through a side opening **116***a*-**116***d* of the rail. The base of the rail adapter may include either a male or female feature to operate as an anti-rotation feature that is reciprocal to a female or male feature of the rail such that when the base of the trackball engages the rail, the trackball is prevented from rotating, the details of which are discussed below with reference to the embodiments of FIGS. **5**-**7**.

With regard to FIG. **2**, illustrations of illustrative bases **200***a*-**200***c* are shown to define a recessed opening **202***a*-**202***c* into which a fastener (sec, for example, bolt **600** shown in FIG. **3**) with a profile that is reciprocal to a profile of the recessed opening **202***a*-**202***c*. It should be understood that multiple recessed openings **202***a*-**202***c* may be disposed along the base of the rail. The fastener, such as a screw, may extend into the recessed opening **202***a*-**202***c* and through an opening in a dashboard so as to secure the rail to the dashboard (see, for example, base **200***a* coupling rail **100***b* to dashboard **400** in FIG. **3**). The recessed opening **202***a*-**202***c* may have a variety of different profiles, such as frusto-conical (see, for example, recessed openings **202***a*, **202***b*), rectangular (see, for example, recessed opening **202***c*), or other profile shape, and fasteners may have reciprocal profiles. In any case, the fasteners may be configured to be fully disposed within the profile defined by the recessed opening **202***a*-**202***c*, thereby enabling a rail adapter (e.g., trackball **300***a*-**300***c*) to slide through a channel defined by the rail without obstruction by the fastener.

The bases **200***a*-**200***c* further include a bottom wall **204***a*-**204***c* having a bottom surface **204***a*'-**204***c*' and an inner surface **204***a*"-**204***c*". The bases **200***a*-**200***c* further include a side wall **206***a*-**206***c* having an outer surface **206***a*'-**206***c*' and an inner surface **206***a*"-**206***c*". The inner surfaces **204***a*"-**204***c*" of the bottom wall **204***a*-**204***c* and the inner surfaces **206***a*"-**206***c*" of the side walls **206***a*-**206***c* collectively define an opening **208***a*-**208***c* having a profile that is reciprocal to an outer profile of the rail **100***a*-**100***d*, such that the base **200***a*-**200***c* can slide onto at least a portion of the rail **100***a*-**100***d* from an end of the rail **100***a*-**100***d*. The recessed openings **202***a*-**202***c* can then be aligned with corresponding openings **118***a*-**118***d* in the rail **102***a*-**102***d*, so as to facilitate receiving a fastener therethrough for coupling the rail **102***a*-**102***d* to, for example, a vehicle dashboard. In each of the embodiments, the inner surfaces **206***a*"-**206***c*" are angled inward or are acute relative to a plane Y along which the bottom surface **204***a*'-**204***c*' of the base **204***a*-**204***c* extends. An angle ∂*a*-*c* defines the acute angle. The acute angle ∂*a*-*c* of the inner surfaces **206***a*"-**206***c*" of the side walls **206***a*-**206***c* and the complementary acute angle θ*a*-*d* of the outer surfaces **106***a*'-**106***d*' of the side walls **106***a*-**106***d* can, advantageously, help to prevent relative rotational movement between the base **200***a*-**200***c* and rail **100***a*-**100***d* when the base **200***a*-**200***c* is coupled to the rail **100***a*-**100***d*.

Because the mounting system may include the use of different attachment mechanisms for attaching the rail **100***a*-**100***d* to the dashboard (e.g., dashboard **400** shown in FIG. **3**), a recess **210***a*-**210***c* may be defined on the bottom surface **204***a*-**204***c* of the base. For example, the recess **210***b*-**210***c* may be defined to enable a head of a rivnut to be positioned on/in the dashboard and allow the base to be mounted directly or indirectly to the dashboard.

As further shown, the bottom surface **204***a*'-**204***c*' of the base **200***a*-**200***c* may be flat (as shown in the top row) or have different shaped profiles (as shown in the middle row). The bottom surface **204***a*'-**204***c*' may have the different profiles so as to match different dashboard surface profiles to which the rail **100***a*-**100***d* may be mounted. The different profiles may be linear (as shown in the top row), curved (as shown in the middle row), linear and curved, or otherwise depending on the profile of the dashboard. By reciprocally shaping the bottom surface **204***a*'**204***c*' of the base **200***a*-**200***c*, maximum contact of the bottom surface along the dashboard may be maintained. It should be understood that rather than the based **200***a*-**200***c* being mounted directly to the dashboard, an intervening plate or component may be mounted directly to the dashboard and the rail **100***a*-**100***d* may be mounted directly to the intervening plate or component.

In an embodiment, the base **200***a*-**200***c* may be dynamic in that a curable fluid (e.g., epoxy) or set of fluids may be maintained or added to a flexible pouch, mixed within the pouch, and molded to the dashboard so as to have a reciprocal shape as the dashboard. By using a curable fluid and allow a user to shape the base **200***a*-**200***c* to the dashboard, a generic rail may be provided to users for molding the rail to the various shapes of dashboards and locations on the dashboards to which the users decide to mount the rail. Rather than the rail having the curable fluid, another component to which the rail may mount may include the curable fluid. In such a configuration, the base of the rail may have a profile with a flat bottom and the top surface of the component may be flat so as to enable the rail to mount to the flat top surface of the component.

With regard to FIG. **3**, sub-base components **500***a*-**500***b* are shown to be configured to be disposed below a bottom side surface **400***b* of a dashboard **400** and be configured to enable a fastening device, such as a bolt **600**, to extend therethrough so as to retain the rail **100***a*-**100***d* and sub-base component **500***a*-**500***b* on respective sides **400***a*, **400***b* of the dashboard **400**. That is, the sub-base component **500***a*-**500***b* may include a recess **502***a*-**502***b* with threaded sides **502***a*'-**502***b*', for example, that a threaded fastening device (e.g., bolt **600**) engages, thereby tightening the sub-base component **500***a*-**500***b* against the bottom side surface **400***b* of the dashboard **400** and tightening the rail **100***a*-**100***d* to the upper side surface **400***a* of the dashboard **400**. As shown, the sub-base component **500***a*-**500***b* may have an upper side surface **504***a*-**504***b* with a profile that reciprocally matches the bottom side surface **400***b* of the dashboard **400**, while the bottom surface **204***a*'-**204***c*' of the base **200***a*-**200***c* and/or intervening component may have a profile that reciprocally matches the upper side surface **400***a* of the dashboard **400**. A nut **700** may be additionally and/or alternatively used to engage the fastening device (e.g., bolt **600**) beneath or within the sub-base component **500***a*-**500***b* such that the sub-base component **500***a*-**500***b* does not need to be threaded.

With regard to FIG. **4**, illustrations of an illustrative rail system **800** that includes the rail **100***a*-**100***d*, outer bases **200***a*-**200***c*, intermediate base(s) **200***a*-**200***c*, and rail adapter(s) **300***a*-**300***c*, **900***a*-**900***b*, **1300***a*-**1300***b* to attach an arm or electronic mounting mechanism is shown. It should be understood that the rail system is generic in that may represent any of the rails **100***a*-**100***d* of FIG. **1**. The outer bases **200***a*-**200***c* may have inside wall profiles that are reciprocal to the shape of the outer walls of the bottom of the base and sidewalls of the rail **100***a*-**100***d*. As shown in FIG. **2**, the outer bases **200***a*-**200***c* may include an end wall

212*a*-**212***c* that is configured to cover an end of the rail **100***a*-**100***d* so as to prevent a base **302***a*-**302***c* of a rail adapter to slide out of the rail. The bases **200***a*-**200***c* may be connected to the dashboard **400** using fastening members, such as screws, bolts, nuts, etc. Alternatively and/or additionally, an adhesive may be used to secure the base, rail, or other rail system components to the dashboard.

As shown in FIG. **4**, sub-base component **500***a*-**500***b* may be used to couple the outer bases **200***a*-**200***c* to a substrate, shown as a vehicle dashboard **400**. One or more sub-base components **500***a*-**500***b* are disposed on a bottom side surface **400***b* of the dashboard **400** and the outer bases **200***a*-**200***c* are disposed on an upper side surface **400***a* of the dashboard **400** opposite the sub-base components **500***a*-**500***b*. A fastening device (e.g., bolt **600**) may be inserted through an opening **118***a*-**118***d* in the rail **100***a*-**100***d* into the recessed opening **202***a*-**202***c* of the base **200** and through an opening in the dashboard **400** (e.g., drilled opening, etc.), such that the fastening device threadably engages the sub-base component **500***a*-**500***b* to secure the rail system **800** to the dashboard **400**.

The bottom surface **204***a*'-**204***c*' of the base **200***a*-**200***c* may define one or more recessed openings **202***a*-**202***c* as previously described with regard to FIG. **2**. To simplify the formation of the recessed openings **202***a*-**202***c*, the inner surface **204***a*"-**204***b*" may define semi-circular regions or features directly above the recessed openings formed by a single tool a single tooling step. That is, a tool may be configured to drive or create an opening through portions of the inner surface **204***a*"-**204***b*" and through the bottom wall **104***a*-**104***d* of the rail. The semi-circular regions may thereafter be used by rail adapter (e.g., trackballs **300***a*-**300***c*, **900***a*-**900***b*, or **1300***a*-**1300***b*) and/or bases for positioning purposes.

With regard to FIG. **5**, illustrations of a rail adapter, in this case a trackball **300***a*-**300***c* mounted to a base **302***a*-**302***c* that includes a key portion **304***a*-**304***c* that is configured to extend between top walls **108***a*-**108***d* defined by or connected to sidewalls **106***a*-**106***d* of a rail **100***a*-**100***d*, are shown. The base **302***a*-**302***c* may define various profiles that are reciprocal to an inner profile **102***a*-**102***d* defined by the rail (see, for example, the top row of FIG. **1**). A clamp (not shown) may be mounted to the trackball **300***a*-**300***c* and an arm or other electronic holding mechanism (not shown) may connect to the trackball **300***a*-**300***c*. The trackball **300***a*-**300***c* and the base **302***a*-**302***c* may have through-holes **306***a*-**306***c* that enables a fastening member (e.g., a bolt) to extend through so as to cause the trackball **300***a*-**300***c* and base **302***a*-**302***c* to move towards each other, thereby operating as a clamp against opposite sides of top walls **108***a*-**108***d* defined by side walls **106***a*-**106***d* of the rail **100***a*-**100***d*.

With regard to FIG. **6**, illustrations of alternative configurations of a rail adapter, in this case a trackball **900***a*-**900***b*, for mounting to a rail **1000***a*-**1000***b* are shown. In this case, the rail adapter **900***a*-**900***b* is formed of two elongated components **902***a*-**902***b* and **904***a*-**904***b* with a slot **906***a*-**906***b* separating the two elongated components. The elongated components **902***a*-**902***b* and **904***a*-**904***b* may be attached separate or attachable to one another, respectively. In a first alternative embodiment, shown as rail adapter **900***a*, the rail adapter **900***a* may have a base **902***a* to which a ball **906***a* is connected that includes a bottom surface **902***a*' with an indentation **902***a*", and a rail **1000***a* may have a protrusion **1002***a* that is reciprocal to the indentation **902***a*". The indentation **902***a*" and protrusion **1002***a* may engage with one another, thereby operating as a key that prevents relative rotation of the rail adapter **900***a* and rail **1000***a*. In an embodiment, the protrusion **1002***a* of the rail **1000***a* may extend the entire length of the rail. Alternatively, the protrusion **1002***a* of the rail **1000***a* may be positioned at one or more defined locations along the rail **1000***a* such that the rail adapter **900***a* is slid along the rail **1000***a* and engaged at one of the defined location(s). The shape of the indentation **902***a*" of the rail adapter **900***a* is shown to be angled inward. It should be understood that alternative geometric or non-geometric shapes may be utilized for the indentation **902***a*". That is, the profile of the bottom surface **902***a*' of the base **902***a* of the rail adapter may have any number of shapes, and the protrusion **1002***a* of the rail may have a reciprocal profile.

As further shown, the ball **906***a*, shaft **908***a*, and base **902***a* may define an opening **910***a* that extends longitudinally from the top of the ball **906***a* through the bottom of the base **902***a*, and be configured to enable a fastening member or fastener, shown as a bolt **1100**, to extend therethrough. The base **902***a* may be configured to enable the fastening member to extend through a top surface **1002***a*' and bottom surface **1004***a* of the rail **1000***a*. A retention member, such as a nut **904***a*, may be configured to extend across a channel **1006***a* defined by the rail **1000***a*, thereby preventing the fastening member from retracting from the rail **1000***a*. The fastening member and retention member, when tightened, may cause the rail adapter **900***a* to be retained in a releasably fixed position along the rail **1000***a*. It should be understood that the rail may alternatively be a bar mount (e.g., bar mount **1300**), as further described hereinbelow with regard to FIG. **8**. The ball **906***a* is shown to define a head portion **906***a*' that is recessed within the top of the ball **906***a*, thereby allowing a head **1100***a* of the fastening member to be recessed beneath the top of the ball **906***a* and prevent the ball **906***a* and rail adapter **900***a* from pulling away from the base.

In an alternative embodiment, shown as a rail adapter **900***b* in FIG. **6**, the rail adapter **900***b* includes a ball **906***b*, shaft **908***b*, and base **902***b*. The base **902***b* has a bottom surface **902***b*' with a protrusion **902***b*" that extends downwards to pass through top walls **1008***b* that extend inwards from side walls **1006***b*, thereby operating as a key that prevents rotation of the base **902***b* of the rail adapter **900***b* relative to the inside surfaces **1008***b*' of the top walls **1008***b*. A fastening member, shown as bolt **1100**, may extend through the rail adapter **900***b* in the same manner as rail adapter **900***a*, but rather than extending through a bottom surface of the rail, the fastening member may have a length that is above a bottom surface **1004***b*' of the rail **1000***b* and allows for a retention member, shown as the nut **904***b*, to be disposed on the fastening member and within a channel portion **1002***b* defined by the bottom surface **1004***b*', inner surfaces **1006***b*' of sidewalls **1006***b*, and bottom surface **1008***b*' of top walls **1008***b* that are spaced apart from one another.

With regard to FIG. **7**, illustrations of alternative embodiments of rail adapters **1300***a*-**1300***b* that include anti-rotation members and regions for fastening members (e.g., bolt **1100**) to be connected and/or retained by the rail adapters are shown. In a first embodiment, a rail adapter **1300***a* is shown to include a region **1308***a* (shown with dashes) that extends from a bottom **1302***a*' of a base **1302***a*, through a shaft **1304***a*, and into a ball **1306***a*. The region **1308***a* is sized to enable a fastening member, such as a bolt **1100**, to extend into the rail adapter **1300***a* to retain the rail adapter **1300***a* with a rail. The base **1302***a* is shown to include an upper surface **1302***a*" on a flange portion **1302***aa* and a protrusion **1302***ab* that may operate as a key that prevents rotation of the base **1302***a* and rail mount relative to a rail. The rail

adapter **1300***a* may alternatively be configured to mount to a fixed position bar mount, plate, or otherwise. In an embodiment, and as shown, the region **1308***a* may be configured to enable a head **1100***a* of a fastening member **1100** to be recessed therein. The bottom profiles of the flange portion **1302***aa* and protrusion **1302***ab* are also shown, where the protrusion **1302***ab* may be configured to have an ovular or elongated shape with rounded ends such that a slot or indentation into which the protrusion extends may be formed by a conventional rotating tool. Beneath the rail adapter **1300***a* is a bottom view showing a protrusion **1302***ab* that is used as an anti-rotation feature.

In a second embodiment shown in FIG. **7**, a rail adapter **1300***b* includes a region **1308***b* for a fastening member (e.g., bolt **1100**) that may extend through a top surface of the ball **1306***b*, and extend through a bottom surface **1302***b*' of a base **1302***b* and protrusion **1302***ba*. The protrusion **1302***ba* may be elongated with rounded tips, as shown. It should be understood that the specific shapes of the two embodiments may vary, but provide the same or similar functionality. In an alternative embodiment, for example, both protrusion(s) (e.g., protrusions **1302***ab*, **1302***ba*) and recession(s) may be used to maintain the rail adapter (or bar mount adapter) to be aligned with a structure (e.g., rail, bar mount, plate, etc.) and prevented from rotating. In yet another embodiment, multiple features may be used for alignment and anti-rotation purposes. For any of the embodiments of the rail adapter, the rail adapter may be formed from a single monolithic material so as to be a single element or multiple elements formed of the same or different materials may be utilized. Beneath the rail adapter is a bottom view showing a protrusion **1302***ab*-**1302***ba* that is used as an anti-rotation feature. It should be understood that rather than using a protrusion, the feature may be an indentation and the rail may have a reciprocal protrusion, thereby acting as an anti-rotation feature, as described further herein.

With regard to FIGS. **10-14**, illustrations of alternative embodiments of a rail adapter **1800** that includes anti-rotation features and regions for fastening members to be connected and/or retained by the rail adapters are shown. The rail adapter **1800** is shown as a trackball or ball mount that includes a ball **1802**, a shaft **1804**, and a base **1806**. The base **1806** and/or shaft **1804** may define an opening **1808** that extends longitudinally therethrough, and be configured to enable a fastening member or fastener, shown as a bolt **1900**, to extend therethrough. In other embodiments, the opening **1808** may be at least partially threaded to enable a fastening member to threadably engage the rail adapter **1800**. In yet another embodiment, a threaded stud or bolt may extend directly from a bottom surface **1806***a* of the base **1806**, and may be configured to receive a retaining member thereon, such as a nut, so as to attach the rail adapter to a rail (e.g., rails **100***a*-**100***d*).

Still referring to FIGS. **10-14**, the base **1806** includes a bottom surface **1806***a*, an upper surface **1806***b*, first side surface **1806***c*, and second side surfaces **1806***d*. The first side surface **1806***c* extends from the second side surfaces **1806***d* to the upper surface **1806***b*. The first side surface **1806***c* has a generally frusto-conical shape and tapers inwardly from the second side surfaces **1806***d* to the upper surface **1806***b*. It should be appreciated, however, that the first side surface **1806***c* may be oriented differently or have a different profile or shape than depicted. The second side surfaces **1806***d* are arranged to define a plurality of facets or flat edges extending along an outer periphery of the base **1806**. The base **1806** may include any number of facets arranged to define a geometric cross-sectional shape, such as a pentagon, a hexagon, an octagon, a heptagon, a decagon, or any other geometric shape that is defined by one more straight/flat edges or defined by linear, curved (e.g., oval, circular with a sine wave profile), or any curvilinear shape. The second side surfaces **1806***d* extend in a generally upright or vertical direction from the bottom surface **1806***a* to the first side surface **1806***c*, although it should be appreciated that the second side surfaces **1806***d* may be oriented at an acute angle or an obtuse angle relative to a plane defined by the bottom surface **1806***a*.

The orientation of the second side surfaces **1806***d* is such that the second side surfaces **1806***d* collectively define an outer surface profile that is reciprocal to an internal surface profile of a rail channel (e.g., internal profiles **102***a*-**102***d* of rails **100***a*-**100***d*) or any other mechanism that interfaces with the base **1806**. In this manner, the second side surfaces **1806***d* can act as a key or anti-rotation feature that can help to prevent rotation of the rail adapter **1800** relative to a rail when the rail adapter **1800** is inserted into the rail channel, thereby eliminating the need for any additional components or sub-components to couple the rail adapter **1800** to the rail.

In another embodiment, the rail (e.g., rails **100***a*-**100***d*) itself may have a protrusion that defines a plurality of facets similar to the outer profile of the second side surfaces **1806***d*, and the base **1806** of the rail adapter **1800** may have a cavity or recess that is defined by an internal surface profile that is reciprocal to the outer profile of the protrusion, such that the protrusion and cavity function as an anti-rotation feature for the rail adapter **1800**. It should be appreciated that the rail adapter and rail may include any combination of cavities and/or protrusions with any geometric or non-geometric shape that cooperate to function as anti-rotation features. It should also be understood that the faceted shape of the base **1806** may further provide for an interesting ornamental appearance as compared to conventional bases that are circular.

One embodiment of a rail mount system may include a rail **102***a*-**102***d* defined by a first side wall **106***a*-**106***d* and a second side wall **106***a*-**106***d* that opposes the first side wall. The first and second side walls **106***a*-**106***d* may define respective external wall surfaces **106***a*'-**106***d*' and internal wall surfaces **106***a*"-**106***d*". The first side wall **106***a*-**106***d* may define a first top wall **108***a*-**108***d* and second side wall **106***a*-**106***d* may define a second top wall **108***a*-**108***d*, where each of the top walls **108***a*-**108***d* have bottom surfaces **108***a*"-**108***d*" that extend inward from the first and second internal surfaces **106***a*"-**106***d*" of the side walls. A bottom wall **104***a*-**104***d* may be monolithic with the first and second side walls **106***a*-**106***d*. The external side wall surfaces **106***a*'-**106***d*' may form opposing, inwardly acute angles θa-θd relative to a bottom surface **104***a*'-**104***d*' of the bottom wall. The bottom wall **104***a*-**104***d* may define multiple recessed openings **112** to enable first fastening members to secure the rail to a structural feature (e.g., dashboard, side wall, roof, etc.) of a vehicle. A rail adapter **300***a*-**300***c*, **900***a*-**900***b*, **1300***a*-**1300***b*, may include a feature that retains and enables sliding of the rail adapter within a channel defined by the internal surfaces **106***a*"-**106***d*" of the sidewalls **106***a*-**106***d*, bottom surfaces **108***a*"-**108***d*" of the top walls **108***a*-**108***d*, and inner surface **104***a*"-**104***d*" of the bottom wall **104***a*-**104***d*. One or more base components (e.g., bases **200***a*-**200***c*) may each have a bottom surface **204***a*-**204***c* and sidewalls **206***a*-**206***c* with reciprocal profiles of the external surfaces (e.g., outer side wall surfaces **106***a*'-**106***d*', bottom surfaces **104***a*'-**104***d*', top surfaces **108***a*'-**108***d*') of the rail. In an embodiment, the base components may include a pair of outer bases (e.g., outer bases **200***a*-**200***c* shown in FIG. **4**).

The bottom surface **204***a*-**204***c* may define openings **202***a*-**202***c* to be aligned with the recessed openings of the bottom wall **104***a*-**104***d* of the rail **100***a*-**100***d* to enable the fastening members to extend through the aligned openings to secure the outer base components **200***a*-**200***c* disposed beneath the rail **100***a*-**100***d* to the structural feature of the vehicle.

In an embodiment, the base component(s) **200***a*-**200***c* may be configured to slide onto an end of the rail **100***a*-**100***d* and along the rail to align the openings of both the bottom wall **104***a*-**104***d* of the rail and the bottom wall **204***a*-**204***c* of the base component(s) **200***a*-**200***c*. The base component(s) may have an end wall **212***a*-**212***c* perpendicular to the side walls **206***a*-**206***c*, and be configured to engage respective ends of the rail **100***a*-**100***d* such that when the base component(s) **200***a*-**200***c*, such as the outer base component(s) **200***a*-**200***c*, are engaged to the rail with end walls **212***a*-**212***c* of the base component(s) that are perpendicular to the axial shape of the rail are in contact with the ends of the rail that the openings **202***a*-**202***c* defined by the base component(s) are aligned with respective recessed openings **118***a*-**118***d* defined by the bottom wall **104***a*-**104***d* of the rail. In an embodiment, rather than the outer base component(s) **200***a*-**200***c* being used to prevent the rail adapter from sliding off the rail, a stopper (not shown) that is configured to be positioned within the channel of the rail may be utilized. The stopper may have any shape and be formed of any material. For example, the stopper operate as a cork at the end of the rail. Alternatively, the stopper may be extended into a channel of the rail. The stopper may be fully or partially within the channel, and be capable of preventing the rail adapter from sliding off of the rail. The stopper may be formed of any material, including rubber, plastic, metal, silicon, and/or any other material.

The bottom surface **104***a*'-**104***d*' of the bottom wall **104***a*-**104***d* may define at least one groove **112** that extends parallel to the channel. The base(s) **200***a*-**200***c* may include at least one protrusion **212***a*-**212***b* that aligns with and extends into the groove(s) **112** so as to operate as an alignment feature when mating the base component(s) **200***a*-**200***c* and rail **100***a*-**100***d*. In an alternative embodiment, rather than the bottom surface **104***a*'**104***d*' of the bottom wall **104***a*-**104***d* including a groove, the bottom wall **104***a*-**104***d* may include at least one protrusion **114** and the base component(s) **200***a*-**200***c* may have at least one groove **214***a*. Still yet, the bottom surface **104***a*'**104***d*' of the bottom wall **104***a*-**104***d* may include both a groove and protrusion, and the base component(s) **200***a*-**200***c* may have reciprocal protrusion(s) and groove(s). Other alignment or key features may also be included on the bottom surface **104***a*'-**104***d*' of the bottom wall **104***a*-**104***d* and base component(s) **200***a*-**200***c*. Although the base **200***a*-**200***c* is shown to be circular, it should be understood that alternative shapes may be utilized.

The bottom wall **104***a*-**104***d* may further define an intermediate opening **120***a*-**120***d* between the recessed openings **118***a*-**118***d*. An intermediate base component **200***a*-**200***c* having an inner surface **204***a*"-**204***c*" and inner sidewall surfaces **206***a*"-**206***c*" with reciprocal profiles of the external sidewalls of the rail **100***a*-**100***d*. The bottom wall **204***a*-**204***c* of the intermediate base component **200***a*-**200***c* may define an opening **202***a*-**202***c* that aligns with the intermediate opening **120***a*-**120***d* when the intermediate base **200***a*-**200***c* is engaged with the rail **100***a*-**100***d* and positioned at the intermediate opening.

In an embodiment, the intermediate opening **120***a*-**120***d* defines a threaded sidewall.

The bottom surfaces **204***a*'-**204***c*' of each of the base component(s) **200***a*-**200***c* may have a recess section **210***a*-**210***c* that maintains a gap between a top surface **400***a* of a dashboard **400** on which the base component(s) **200***a*-**200***c* are positioned, thereby enabling a head of a fastening component that is mounted to the dashboard surface to be covered by a bottom surface **204***a*'-**204***c*' and within a space defined by the recess section **210***a*-**210***c* of the base component(s) **200***a*-**200***c* and top of the dashboard surface. In an embodiment, the fastening component includes a rivnut.

In an embodiment, the base component(s) **200***a*-**200***c* are linear. In an alternative embodiment, the base component(s) **200***a*-**200***c* are at least partially non-linear. The base components **200***a*-**200***c* may be reciprocally identical. Alternatively, the base components **200***a*-**200***c* may be reciprocally different from one another.

The system may further include a sub-surface base component **500***a*-**500***b* that is at least partially non-linear and configured to receive a fastening member via a connection socket defined by a recess **502***a*-**502***b* with threaded sides **502***a*'-**502***b*' of the sub-surface base component **500***a*-**500***b* that vertically aligns with a connection socket defined by a recessed opening **202***a*-**202***c* of the base component(s) **200***a*-**200***c* through which the fastening member extends from a top side of the dashboard.

In an embodiment, a base plate **500***a* onto which the rail may be attached. The base plate **500***a* may be configured (e.g., shaped) to connect to a surface **400***a* of the structural feature of the vehicle.

The structural feature may be a dashboard **400** or any other structural feature of a vehicle or non-vehicle.

It should be understood that various processes for manufacturing, assembling, and installing the vehicular mounted rail system using the hardware components described herein.

Bar Mount

As an alternative to a rail, FIG. **8** is an illustration of an illustrative bar mount **1400**. The bar mount **1400** may be configured with one or more fixed positions for bar mount adapter(s) (e.g., trackballs **300***a*-**300***c*, **900***a*-**900***b*, **1300***a*-**1300***b*) to be positioned. In contrast to a rail that has a slide for a rail adapter to be selectively positioned by a user using fastening member(s), the bar mount **1400** may be configured with one or more fixed positions **1402** for a bar mount adapter to be positioned. A fixed position **1402** may be a location or seat adapted to receive a base (e.g., base **302***a*-**302***c*, **902***a*-**902***b*, **1302***a*-**1302***b*) of the bar mount adapter. The fixed position **1402** may include one or more features that enable the bar mount adapter to be held in position and prevented from rotating. As shown, the bar mount **1400** may be an elongated piece of material, such as metal, plastic, ceramic, aluminum, and/or any other rigid material with position(s) disposed at a top surface. The rails described hereinabove may be formed of any of the materials, as well.

In the embodiment shown, there are three fixed positions **1402** at which bar mount adapters may be attached to the bar mount **1400**. Each of the positions may define a feature, such as a recess, into which a base of the bar mount adapter may be aligned and positioned. Alternatively, rather than the features being a recess, the features may include protrusion(s) that engage recess(es) on bar mount adapters. The features may be the same or different at each position. To restrict or prevent rotation of the bar mount adapter, the feature may be as a slot, indentation, and/or protrusion, and be disposed at the position (e.g., extending into or from a surface of the position). To retain a bar mount adapter with the bar mount **1400**, the bar mount may define an opening **1408** partially or entirely through the bar mount **1400** so that fastening member(s) may be used to temporarily attach the bar mount adapter(s) to the bar mount. The opening **1408**

may be configured with a recess(es) **1408***a* so that heads of fastening members or bases may be positioned below or above the surface of the respective top surface or bottom surface of the bar mount.

Base members **1500** that are adapted to retain the bar mount **1400** may be configured to be shaped and connected to a surface of a structural feature of a vehicle (or non-vehicle). Two base members **1500**, one at each end of the bar mount **1400**, are shown. It should be understood that more or fewer than two base members **1500** may be utilized. The bar mount **1400** may be shaped so that the base member **1500** may have reciprocal shapes to retain the bar mount **1400** from vertical, horizontal, and/or axial directions. The bar mount **1400** may define an opening **14010** through which fastening member(s) (e.g., bolt **600**) may extend to connect the bar mount **1400** to the base members **1500** or through the bar mount **1400** and through a surface of a structural feature (e.g., dashboard) on which the base members **1500** are positioned. The bar mount **1400** may have the same or similar bottom and/or external side wall shapes, as previously described. Again, to maintain the bar mount **1400** in position when mounted to a structural feature, the base members **1500** may have a reciprocal shape, as described above.

A retention member (e.g., nut **700**) may be positioned on an opposite side of the structural feature, thereby preventing the bar mount **1400** from separating from the structural feature (e.g., dashboard **400**) and maintaining a strong connection (e.g., prevent relative rotation or translation) between the bar mount **1400** and the structural feature. As shown in the bottom row, the bar mount **1400** may have inwardly angled sidewalls **1406**, and base member(s) **1500** may have inside walls **1506** that are reciprocally inwardly angled, such that when the bar mount **1400** and base member(s) **1500** are engaged, the bar mount **1400** is unable to separate vertically from the base member(s) **1500**. The base member(s) **1500** may have a bottom wall **1504** that defines any external surface profile to be mounted to a surface of a structural feature, such as a vehicle dashboard. Similarly, a bottom wall **1404** of the bar mount may have any shape to be mounted to a surface of a structural feature.

With regard to FIG. **9**, illustrations of an illustrative rail **1600** are shown. The illustrations show a top view, side view, and end view of the rail **1600**. The rail **1600** is shown to be an elongated member having a channel **1602**, which is a region defined by sidewalls **1606**, top surface **1604***a* of a bottom wall **1604**, and bottom surfaces **1608***a* of top walls **1608** extending inwards from the sidewalls **1606**. A space **1610** between inside surfaces **1608***b* of the top walls **1608** may enable a rail adapter shown as a trackball **1700**, which has the same configuration as the trackballs **300***a*-**300***c*, **900***a*-**900***b*, or **1300***a*-**1300***b* disclosed herein, to extend through to allow the rail adapter **1700** to slide along the rail **1600**. As previously shown with reference to track balls **300***a*-**300***c*, **900***a*-**900***b*, **1300***a*-**1300***b*, the rail adapter may be configured to be secured at any location along the rail **1600**. The rail adapter **1700** may have a ball **1702** disposed thereon, but alternatively shaped adapters may be used, as well.

An embodiment of a vehicular mounting system for supporting an electronic device may include an elongated member defined by a bottom surface and sidewalls, the sidewalls having external surfaces being inwardly angled or curved. An adapter may include a feature that is configured to be supported by the elongated member. One or more base components may each have a bottom surface and sidewalls with reciprocal profiles of external surfaces of the sidewalls of the elongated member. The respective bottom surfaces of the base component(s) may define openings to be aligned with openings of the bottom wall of the elongated member to enable fastening members to extend through the aligned openings to secure the base component(s) disposed beneath the elongated member to a structural feature of the vehicle.

The elongated member may be a rail. The elongated member may be a bar mount. A profile of the bottom surface and external surfaces of the sidewalls of the elongated member may be trapezoidal. The adapter may include a ball, a shaft connected to and extending from the ball, and a base connected to an opposite end of the shaft. The base may be configured to mate with at least one feature defined by the elongated member.

The elongated member may include a protrusion and the base of the adapter may include a recess that is a reciprocal with the protrusion such that when the adapter is mated with the base, the adapter is prevented from rotating. The protrusion may be elongated with curved ends.

The elongated member may include a recess and the base of the adapter may include a protrusion that is a reciprocal with the recess such that when the adapter is mated with the elongated member, the adapter is prevented from rotating. The protrusion may be elongated with curved ends. The elongated member may define one or more locations at which the adapter is connectable. The location(s) may include a recess into which a bottom wall of the adapter is positioned.

A method of manufacturing the elongated member, adapter, and base components may be performed in a number of ways described herein. If the elongated member is a bar mount, then discrete locations may be formed to mate with a base of the adapter. The discrete locations may include a recess, protrusion, or both, and be configured to be reciprocal to features on a bottom surface of the adapter. In an embodiment, a tool may be used to form an elongated recess with curved ends that is reciprocal to a protrusion of a bottom surface of a base of the adapter.

The previous description is of a preferred embodiment for implementing the invention, and the scope of the invention should not necessarily be limited by this description. The scope of the present invention is instead defined by the following claims.

What is claimed is:

1. A mounting system for supporting an electronic device, comprising:

a mount defining a first opening;

an adapter including:

an adapter feature;

a shaft having a first axial end and a second axial end, the first axial end connected to the adapter feature;

a non-elongated base having a dimension defining a maximum distance laterally across the non-elongated base and connected to the second axial end of the shaft; and

an elongated feature extending from a bottom surface of the non-elongated base and configured to be supported by the mount, the elongated feature configured to mate with the mount to prevent rotation of the non-elongated base relative to the mount, the elongated feature defining an opening that extends at least partially through the non-elongated base; and

a base component configured to enable securing the mount to a structural feature of a system in which the mounting system is being transported while supporting the electronic device, the base component defining a

second opening that aligns with the first opening of the mount to enable the mount to be connected to the base component.

2. The system according to claim **1**, wherein the mount is one of a bar mount or a rail.

3. The system according to claim **1**, wherein the mount defines a second feature that is shaped reciprocal to the elongated feature, such that when the adapter is mated with the mount, the adapter is prevented from rotating.

4. The system according to claim **1**, wherein the mount includes a protrusion and the elongated feature is a recess that is a reciprocal with the protrusion such that the protrusion of the mount extends into the recess of the adapter, thereby restricting rotation of the adapter relative to the mount when the adapter is mated with the mount.

5. The system according to claim **1**, wherein the mount defines a recess into which a base portion of the adapter is positioned, the mount including a second feature that is shaped reciprocal to the elongated feature, the second feature disposed in the recess.

6. The system according to claim **1**, wherein the elongated feature comprises a protrusion that is engaged with and extends axially away from the non-elongated base.

7. The system according to claim **1**, wherein the elongated feature includes an elongated protrusion that extends radially across the opening defined by the non-elongated base.

8. The system according to claim **7**, further comprising a bolt extending through the opening and into the mount, and a retention feature coupled to the bolt and preventing separation of the adapter from the mount.

9. An adapter for use in a mounting system for supporting an electronic device, comprising:

an adapter feature;

a shaft having a first axial end and a second axial end, the first axial end connected to the adapter feature;

a non-elongated base having a dimension defining a maximum distance laterally across the non-elongated base and connected to the second axial end of the shaft; and

an elongated feature extending from a bottom surface of the non-elongated base and configured to mate with a mount to prevent rotation of the non-elongated base relative to the mount, the elongated feature defining an opening that extends at least partially through the non-elongated base.

10. The adapter according to claim **9**, wherein the non-elongated base and the elongated feature are integrally formed as a single monolithic piece of material.

11. The adapter according to claim **10**, wherein the single monolithic piece of material is metallic.

12. The adapter according to claim **9**, wherein the elongated feature comprises a protrusion that is engaged with and extends axially away from an opposite axial end of the non-elongated base as the shaft.

13. The adapter according to claim **12**, wherein the non-elongated base includes a flange that circumscribes the protrusion.

14. The adapter according to claim **9**, wherein the elongated feature includes an elongated protrusion that extends radially across the opening defined by the non-elongated base.

15. The adapter according to claim **9**, wherein the opening further extends at least partially through the shaft.

16. The adapter according to claim **15**, further comprising a bolt extending through the opening, and a retention feature coupled to the bolt.

17. The adapter according to claim **15**, wherein the opening extends through the shaft and the adapter feature.

18. The adapter according to claim **9**, wherein the elongated feature extends radially across the non-elongated base from a first edge of the non-elongated base to a second edge of the non-elongated base.

19. The adapter feature according to claim **9**, wherein a side surface of the non-elongated base is contiguous with a side surface of the elongated feature.

20. The adapter feature of claim **19**, wherein the side surface of the non-elongated base and the side surface of the elongated feature define a diameter of a circle.

21. The adapter feature of claim **9**, wherein the elongated feature extends across a central axis of the non-elongated base.

22. The adapter feature of claim **9**, wherein opposing sidewalls of the elongated feature that face along a radial direction relative to a central axis of the non-elongated base are equidistant from the central axis.

23. The adapter feature of claim **9**, wherein the elongated feature is configured to interface with a stationary mount defining at least one feature that is reciprocal to the elongated feature thereby restricting rotation between the non-elongated base and the stationary mount.

24. The adapter according to claim **9**, wherein the elongated feature includes an elongated recess defined by the non-elongated base that extends radially across the non-elongated base.

25. An adapter for use in a mounting system for supporting an electronic device, comprising:

an adapter feature;

a shaft having a first axial end and a second axial end, the first axial end connected to the adapter feature;

a non-elongated base having a dimension defining a maximum distance laterally across the non-elongated base and connected to the second axial end of the shaft; and

an elongated feature extending from a bottom surface of the non-elongated base and configured to mate with a mount to prevent rotation of the non-elongated base relative to the mount, wherein opposing sidewalls of the elongated feature that face along a radial direction relative to a central axis of the non-elongated base are equidistant from the central axis.

26. The adapter according to claim **25**, wherein the elongated feature defines at least part of a fastener opening that is configured to receive and support at least a portion of a fastener therein.

27. The adapter according to claim **25**, wherein a first portion of the opening through the elongated feature has a larger dimension than a second portion of the opening through the non-elongated base.

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