US 20200330887A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2020/0330887 A1**

Samo et al. (43) **Pub. Date: Oct. 22, 2020**

(54) **TOY VEHICLE BOOSTER**

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(21) Appl. No.: **16/849,263**

(22) Filed: **Apr. 15, 2020**

Related U.S. Application Data

(60) Provisional application No. 62/837,341, filed on Apr. 23, 2019, provisional application No. 62/834,571, filed on Apr. 16, 2019.

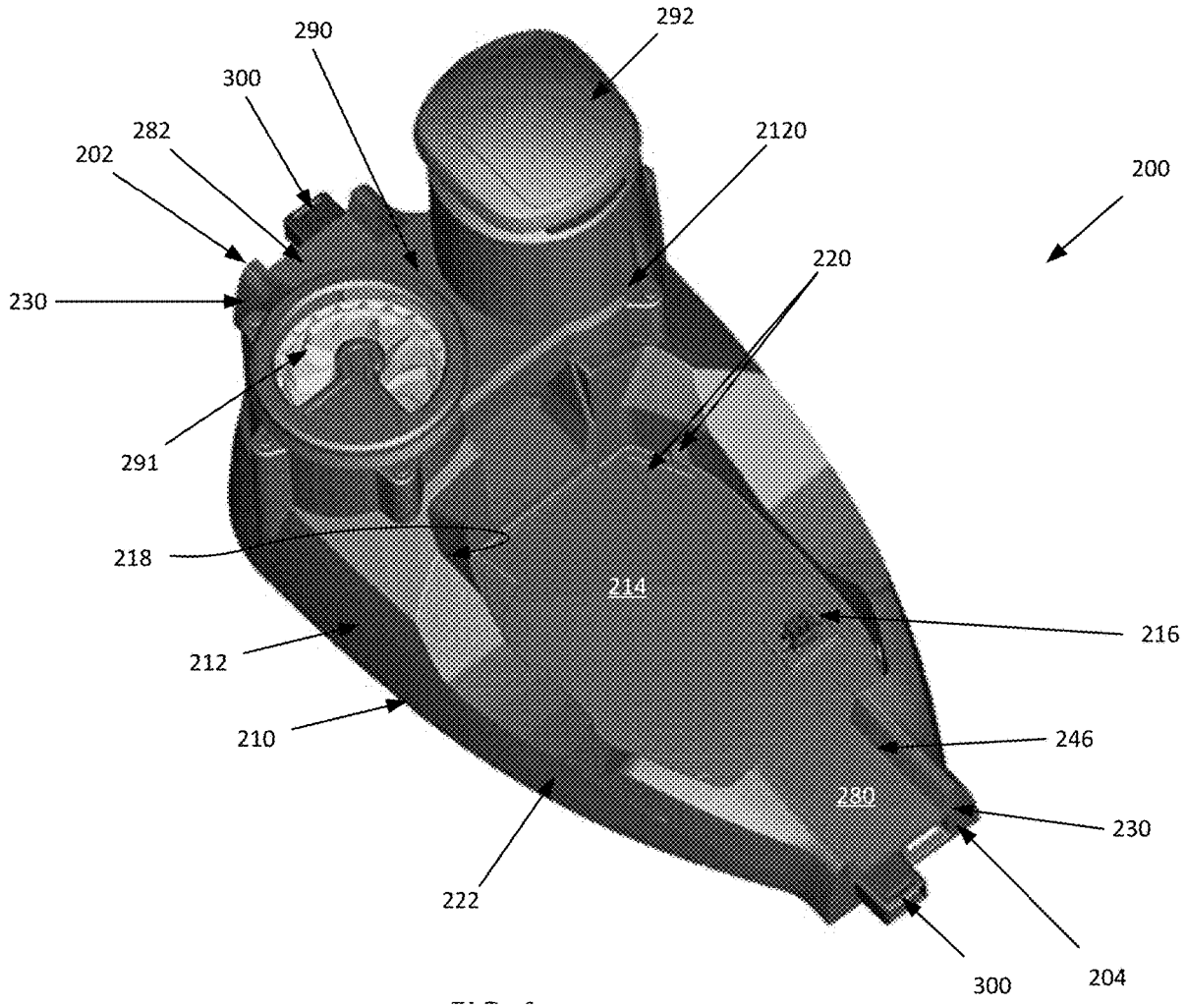
Publication Classification

(51) **Int. Cl.**
A63H 18/02 (2006.01)

(52) **U.S. Cl.**
CPC *A63H 18/026* (2013.01); *A63H 2200/00* (2013.01)

(57) **ABSTRACT**

A toy vehicle booster includes a launcher that can be actuated via repeated user actuations of an actuator. The force of each actuation is mechanically transferred to a booster assembly to cause rotation of the booster assembly and repeated actuations of the actuator continuously increase the rotational speed of the booster assembly. The toy vehicle booster also includes a feedback portion configured to provide feedback based on a rotational speed of the booster assembly and/or a speed at which the booster assembly will boost a toy vehicle. In at least some instances, the feedback is based on the detected rotational speed of booster wheels. The detected rotational speed may also be transmitted to an electronic device to provide additional feedback at the electronic device.



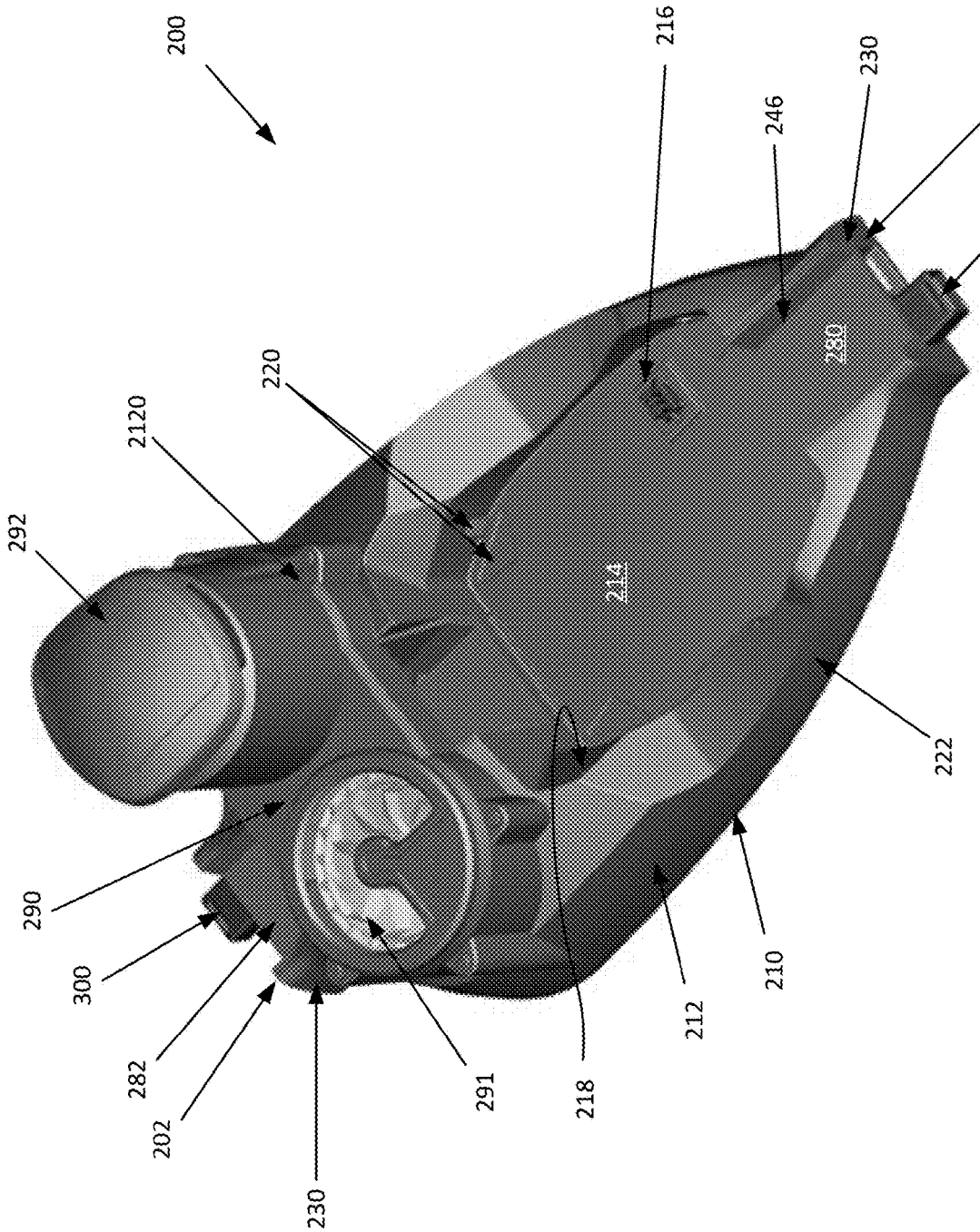

200
216
246
230
204
300
220
2120
280
292
214
222
290
300
282
202
230
291
218
212
210

FIG. 1

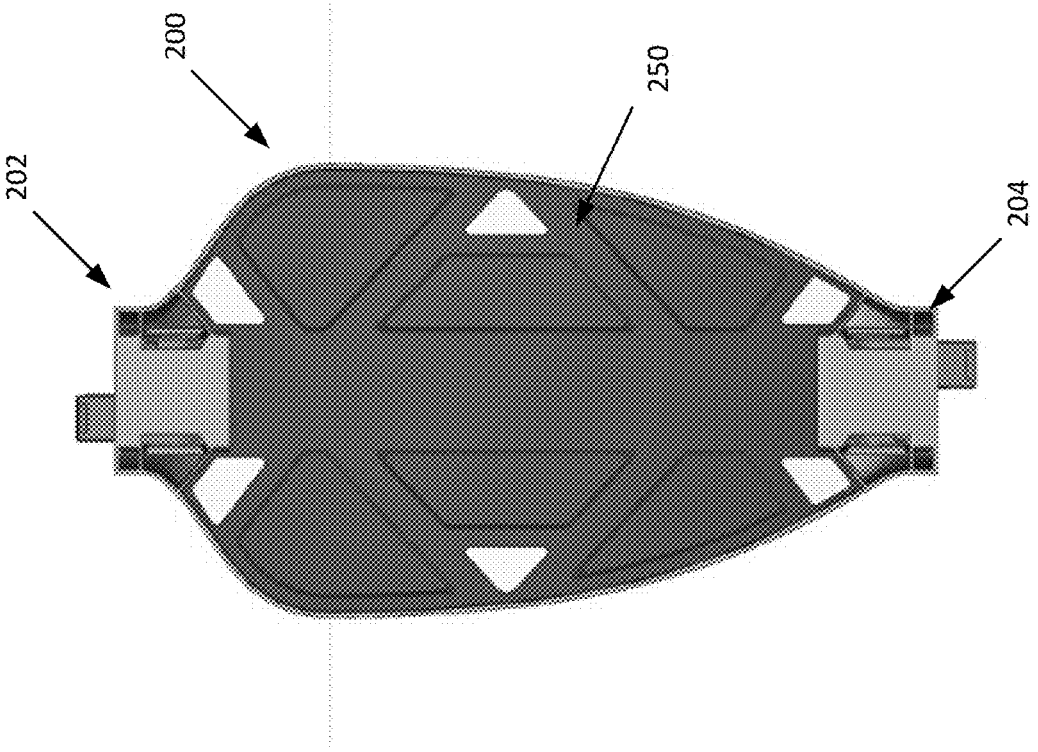

200
250
202
204

FIG. 3

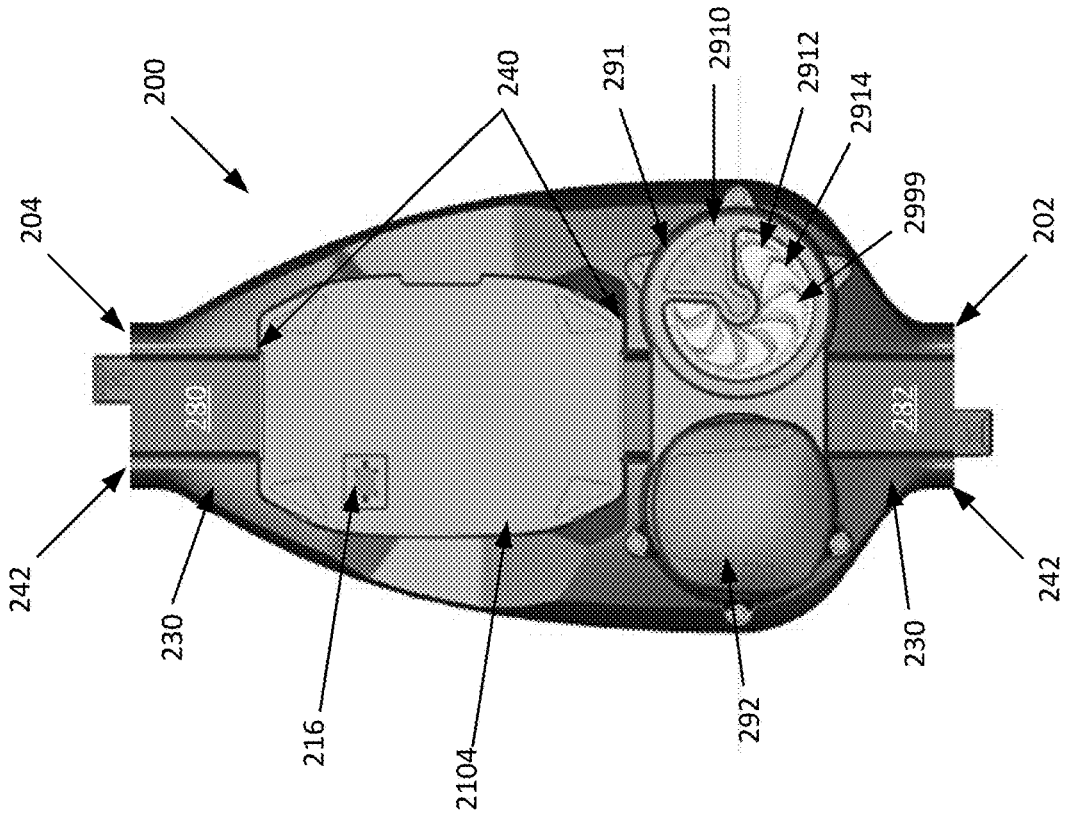

200
240
291
2910
2912
2914
2999
204
202
242
230
216
2104
292
230
242

FIG. 2

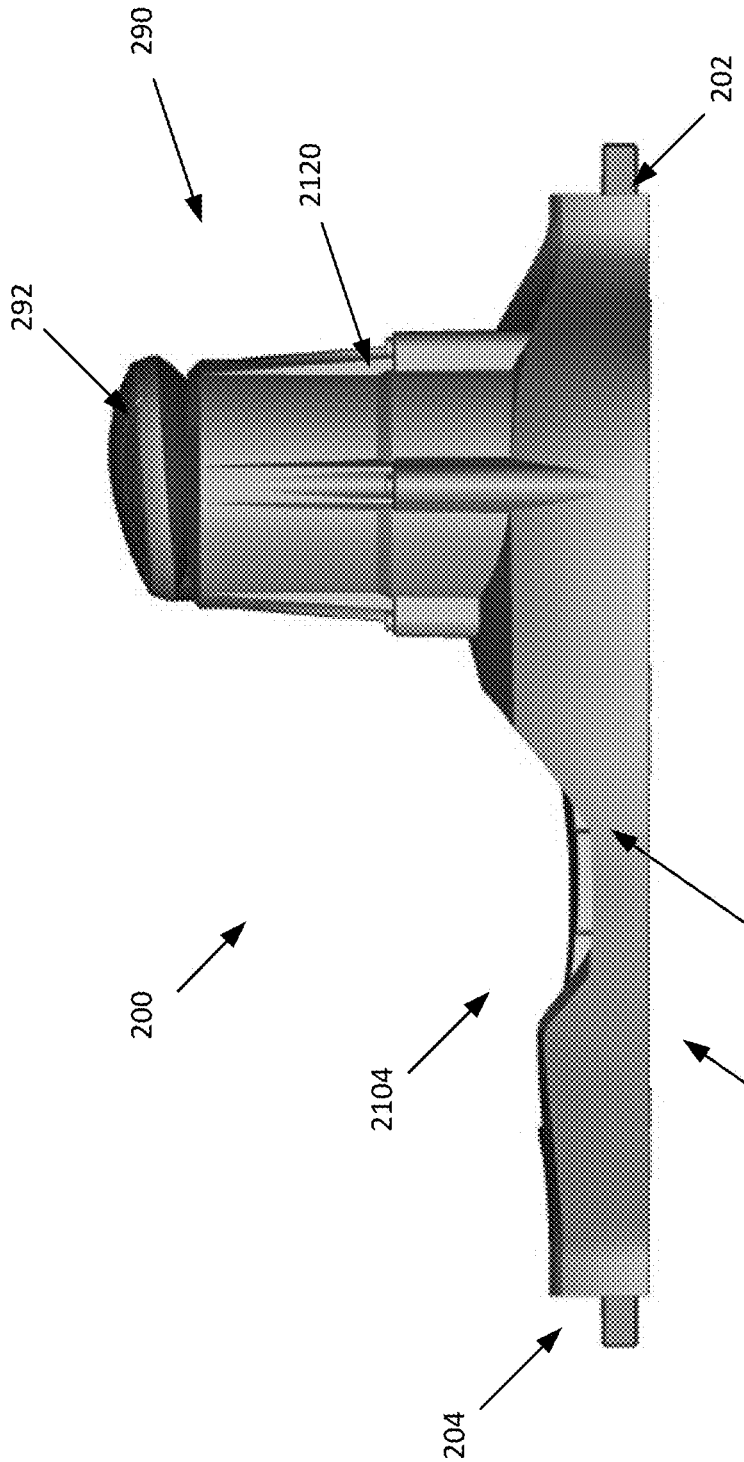


FIG. 4

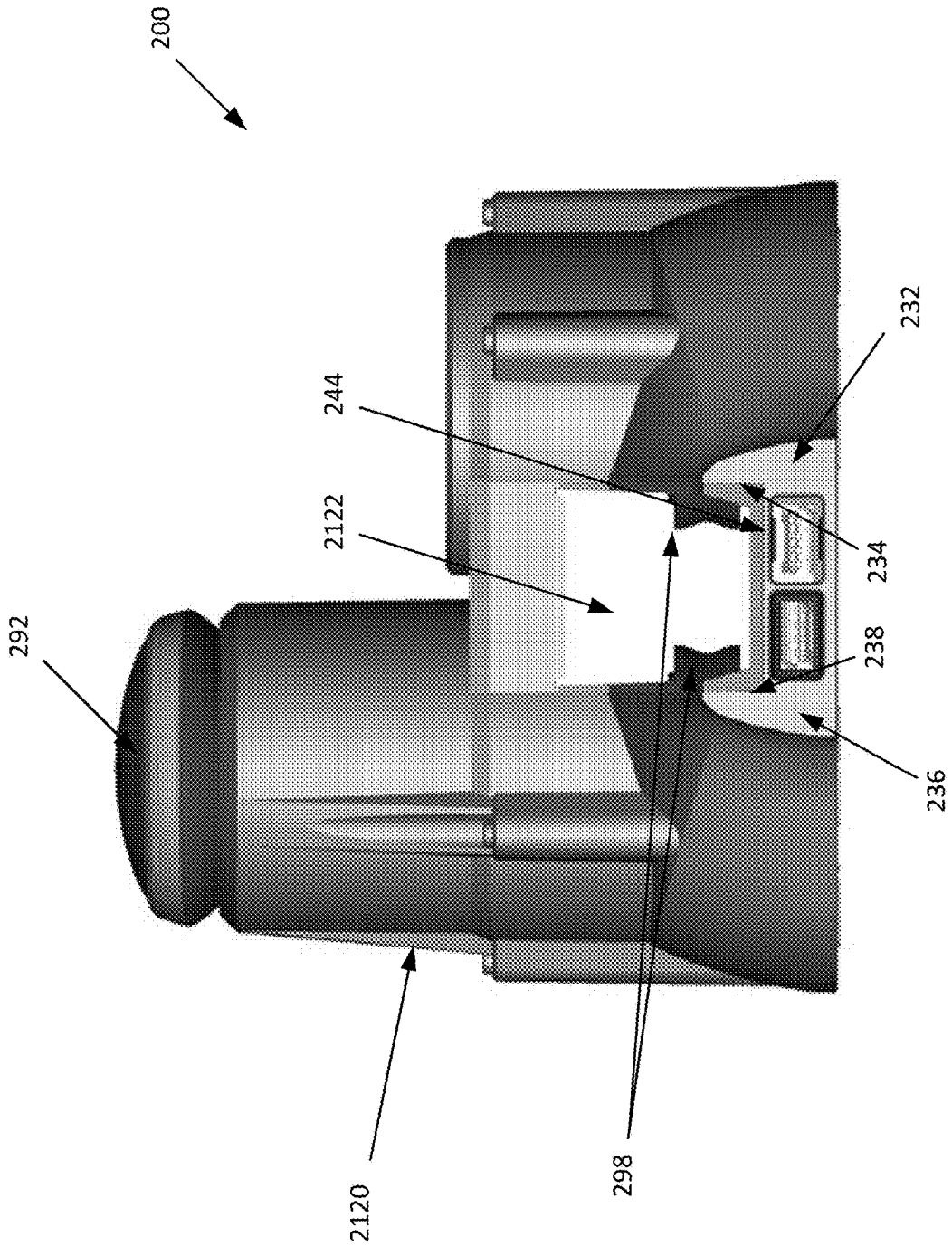


FIG. 5

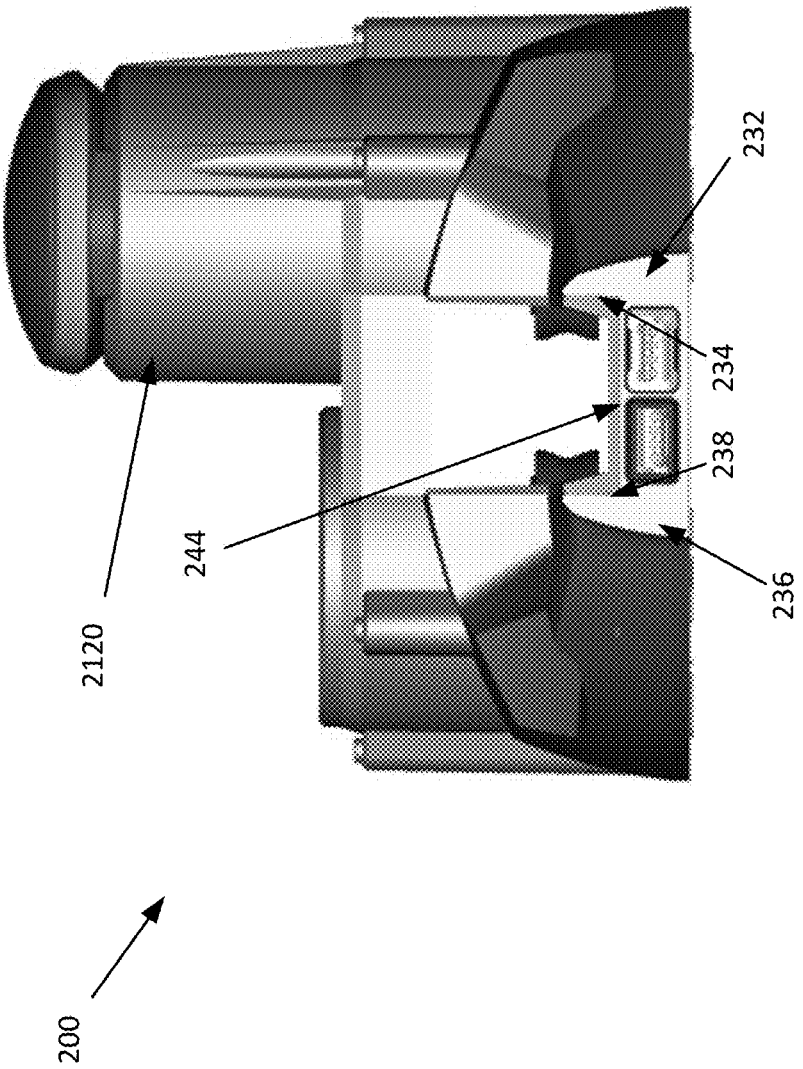


FIG. 6

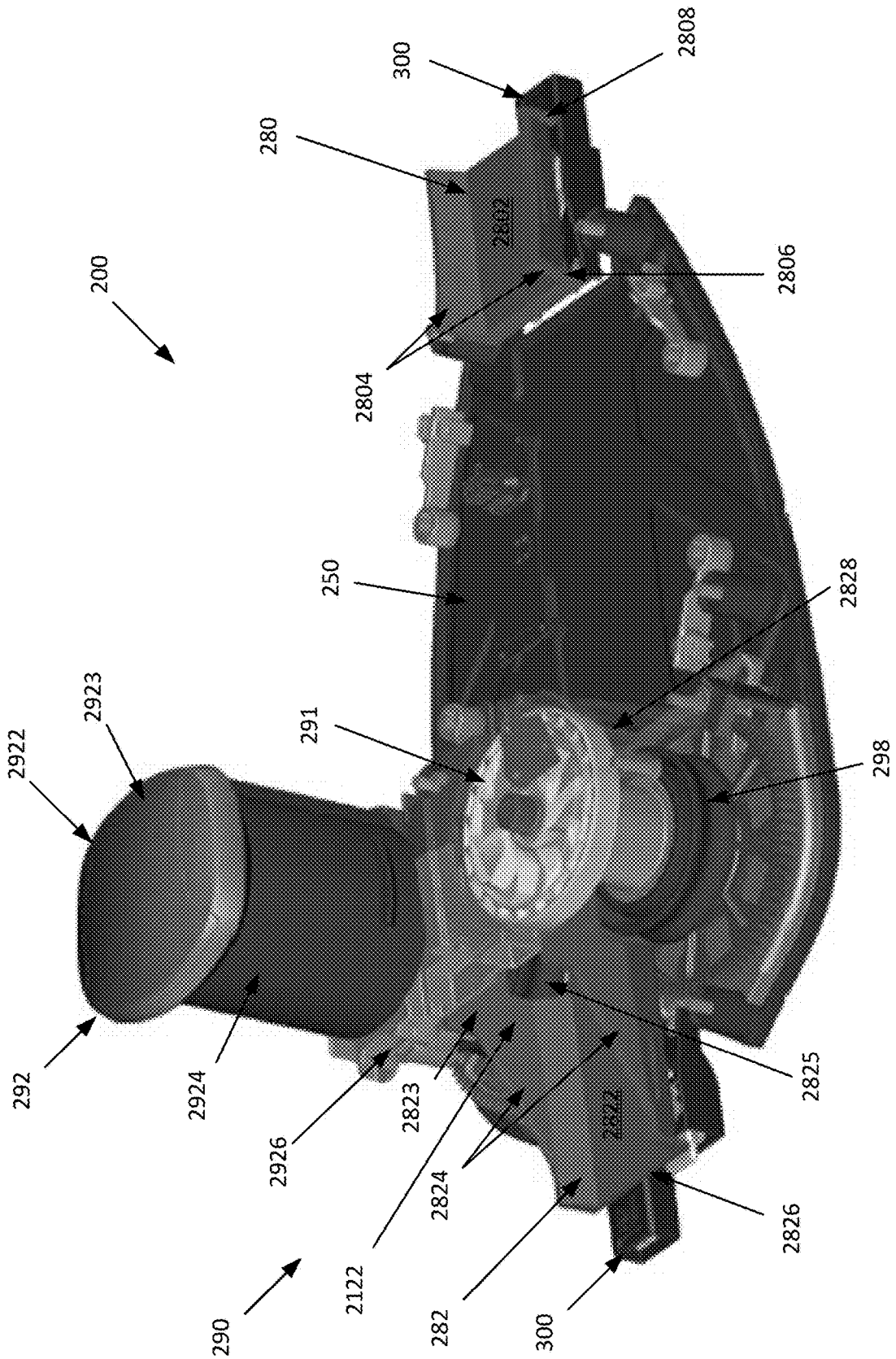

200
280
300
2808
2806
2804
2802
250
2828
291
298
2922
2923
292
2924
2926
2823
2825
2824
2827
2826
2122
282
290
300

FIG. 7

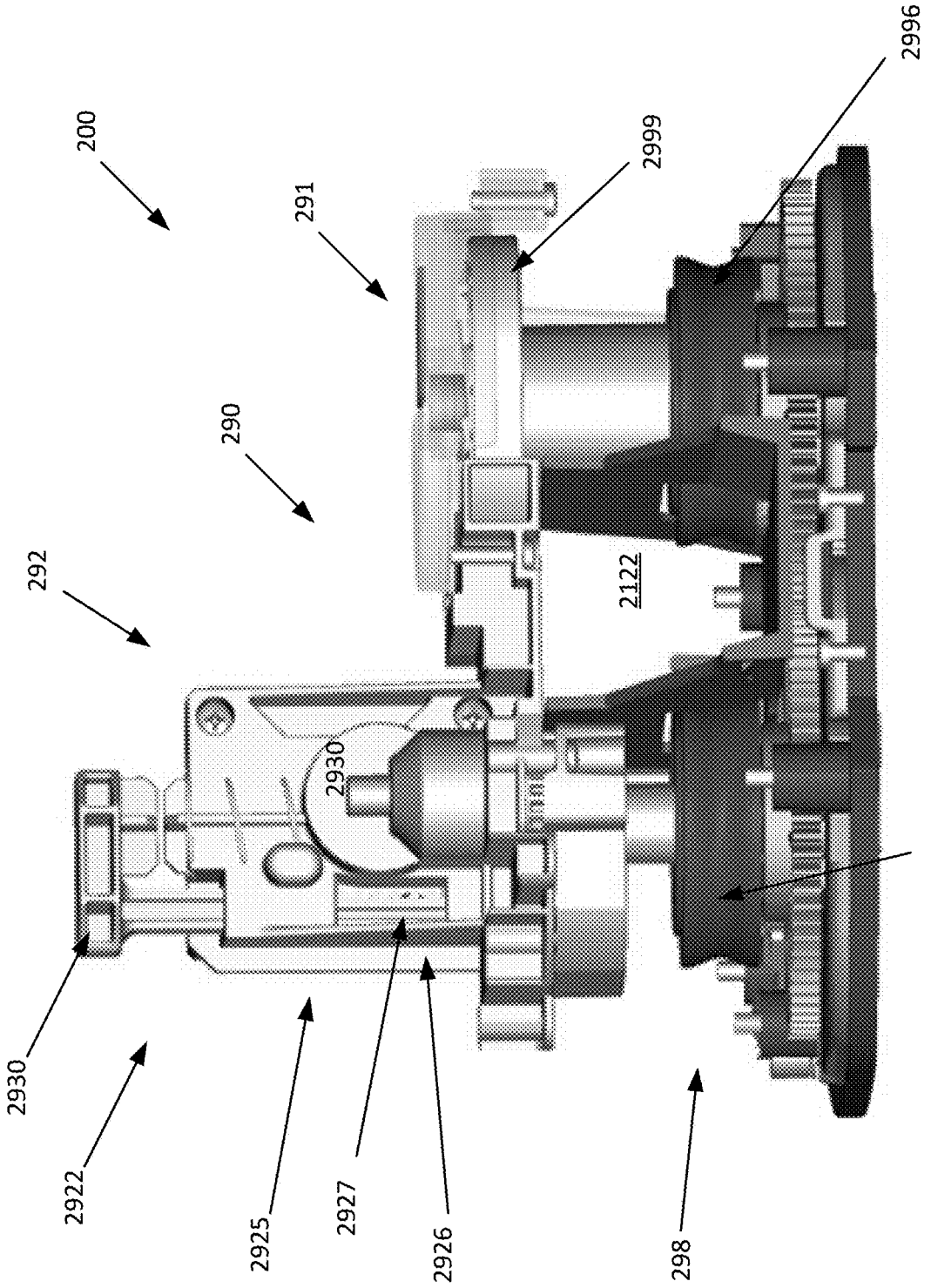

200
291
2999
2996
290
292
2122
2930
2986
2930
2922
2925
2927
2926
298

FIG. 8

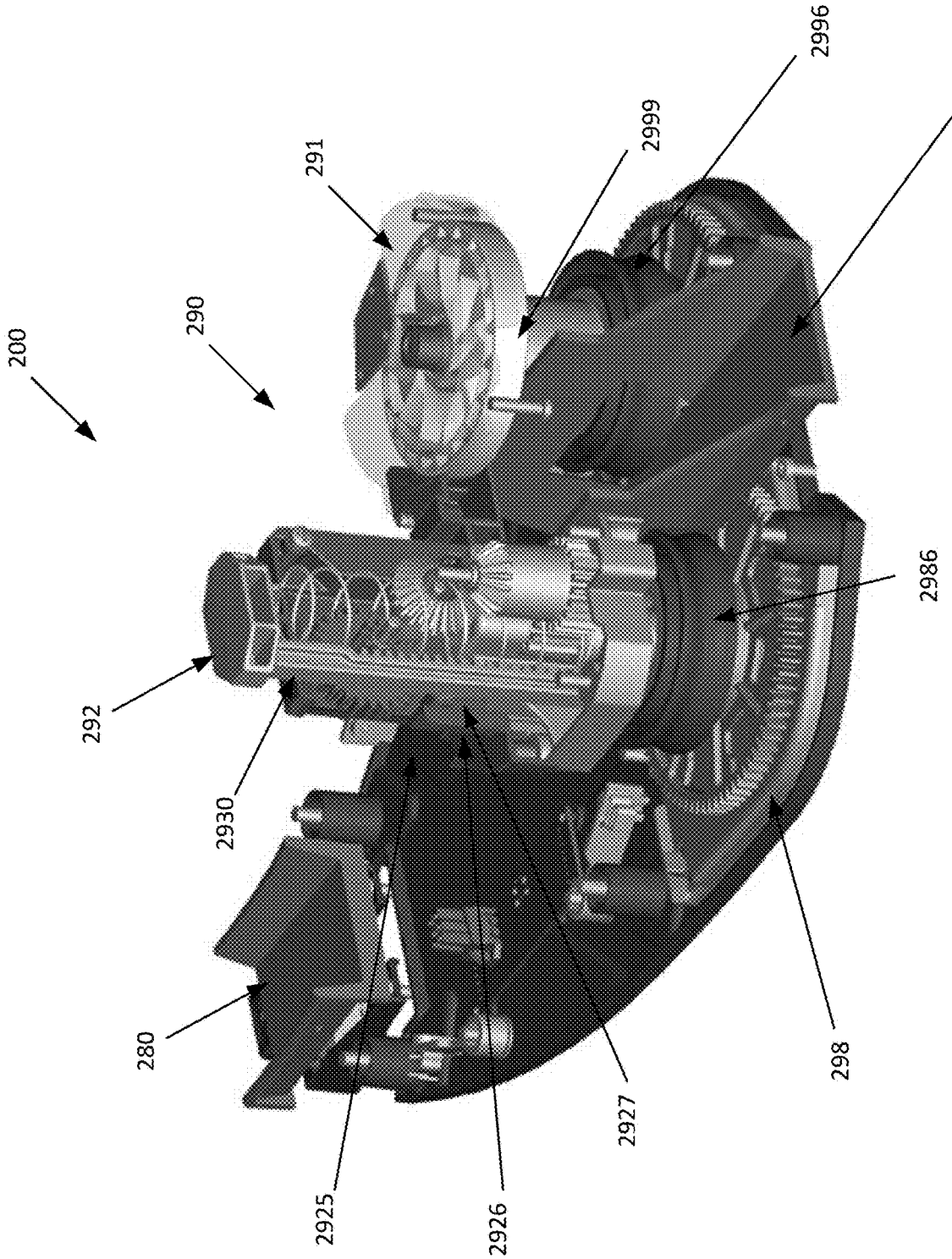


FIG. 9

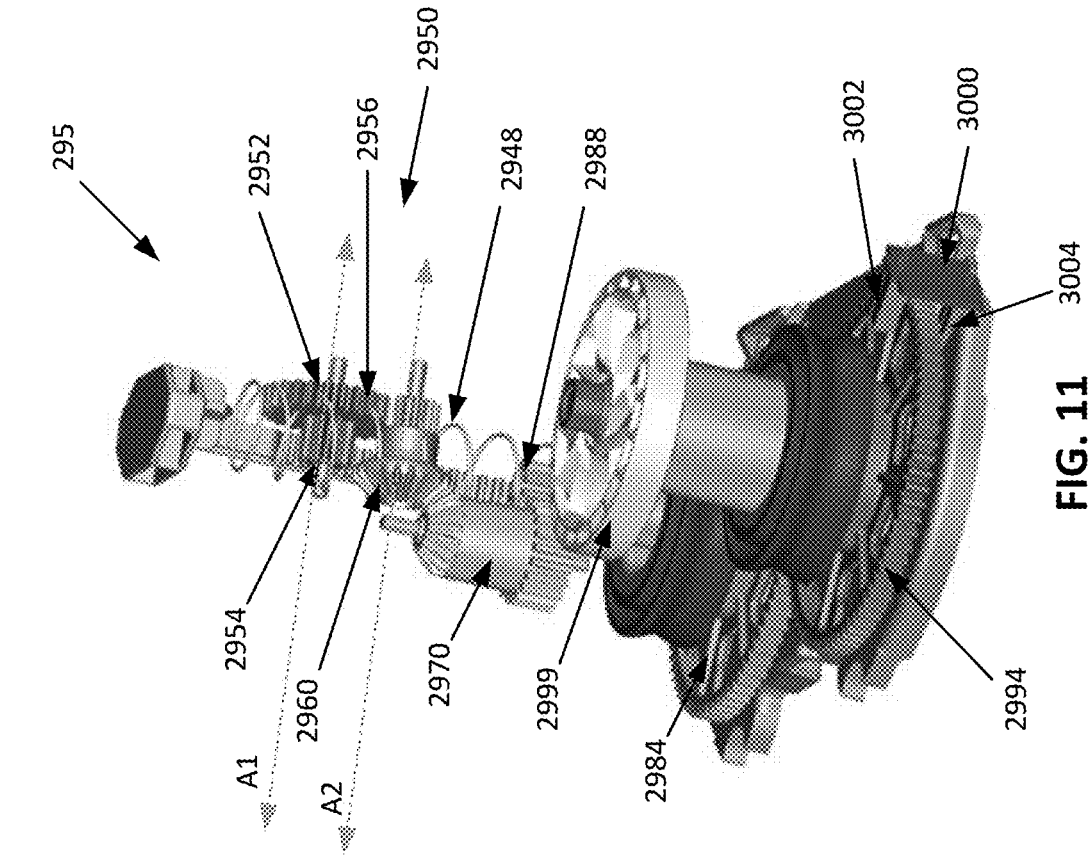

295
2952
2956
2950
2948
2988
3002
3000
3004
2954
2960
2970
2999
2984
2994
A1
A2

FIG. 11

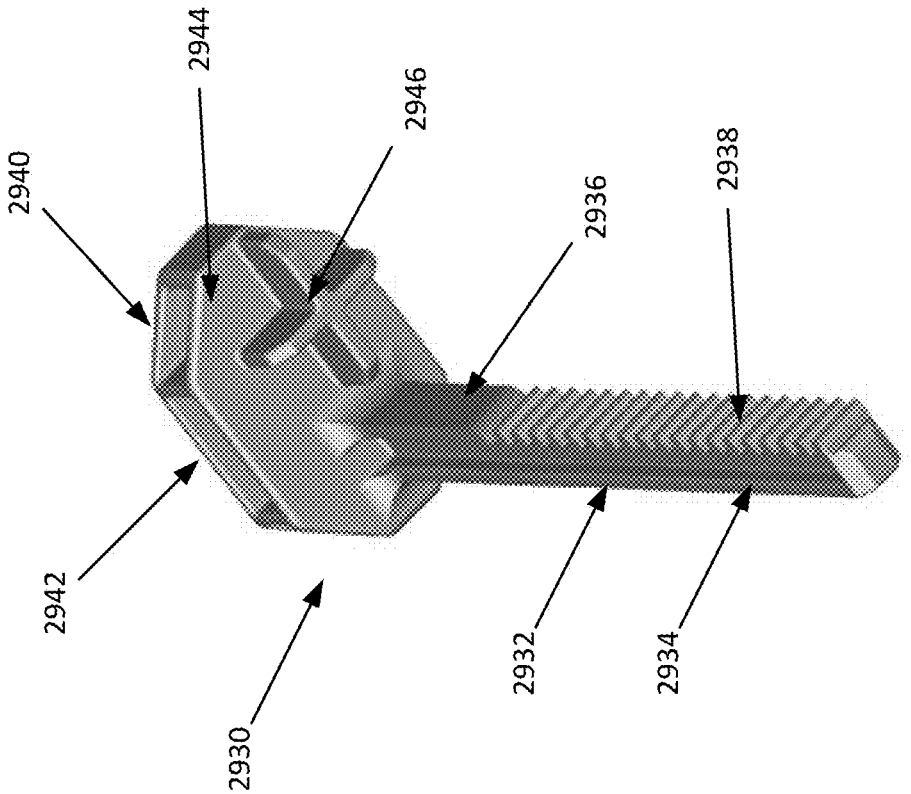

2940
2944
2946
2936
2938
2942
2930
2932
2934

FIG. 10

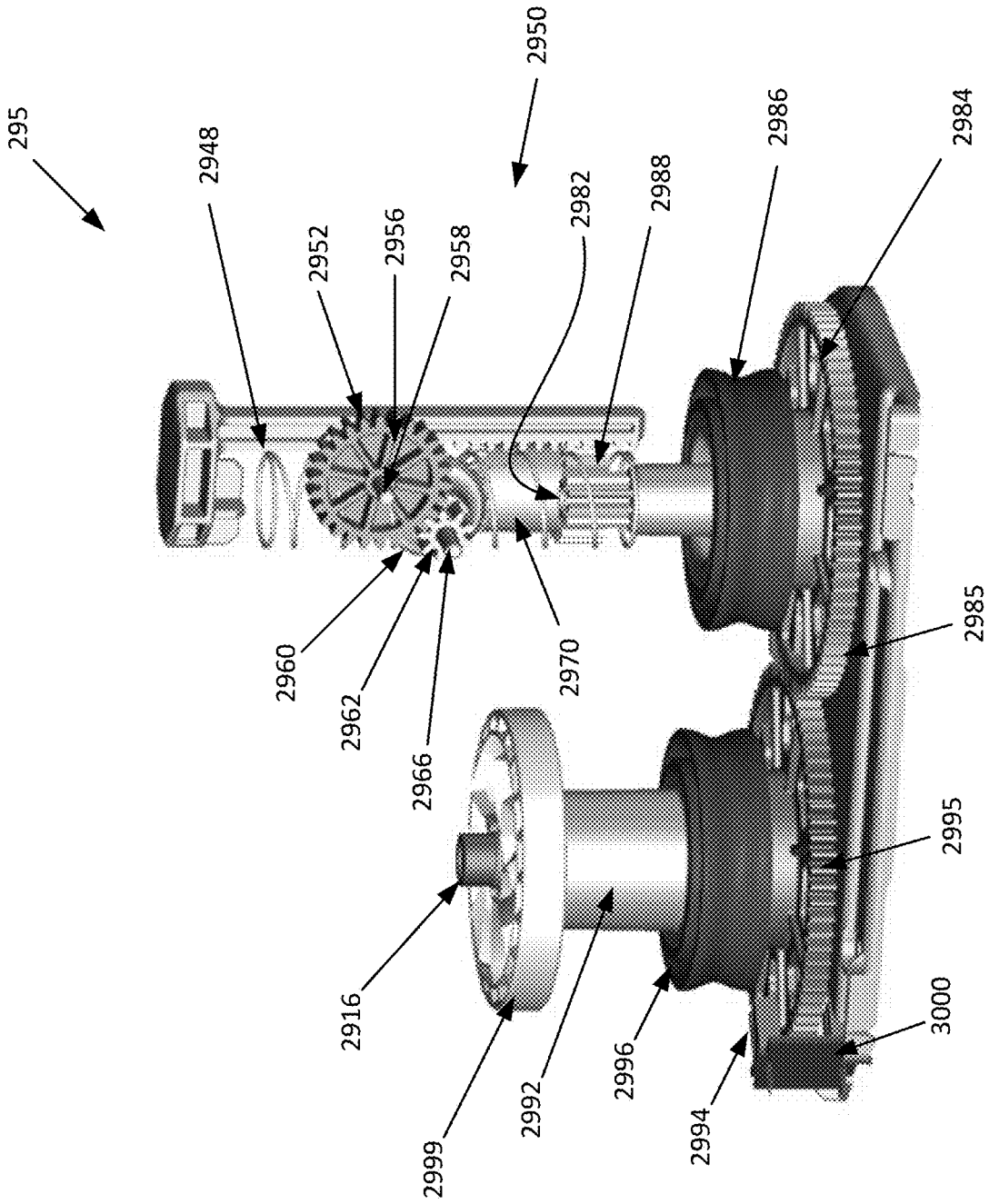

295
2948
2950
2952
2956
2958
2982
2988
2986
2984
2960
2962
2966
2970
2985
2995
2916
2999
2992
2996
2994
3000

FIG. 12

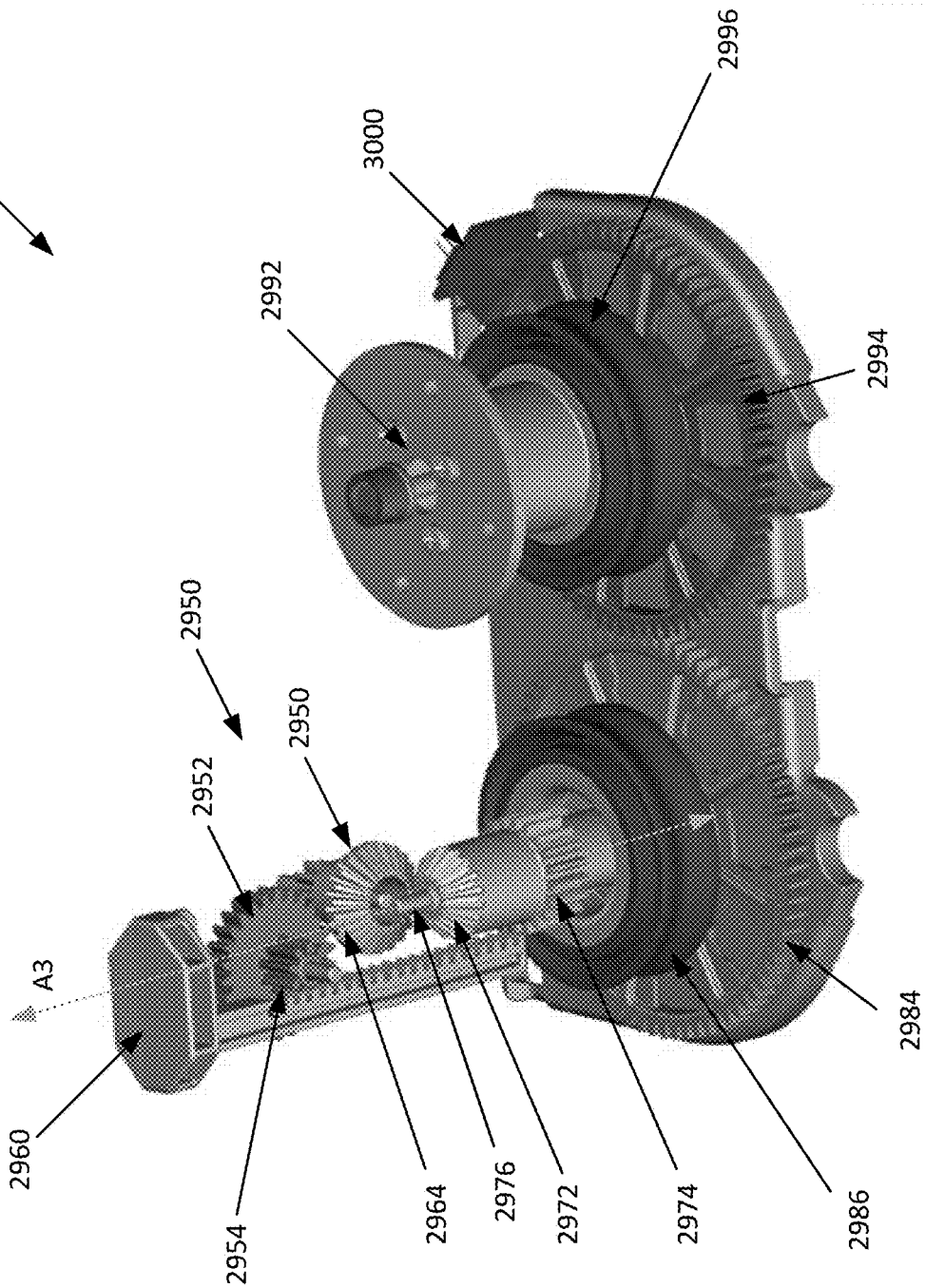

295
3000
2996
2992
2994
2950
2950
2952
A3
2960
2954
2964
2976
2972
2974
2986
2984

FIG. 13

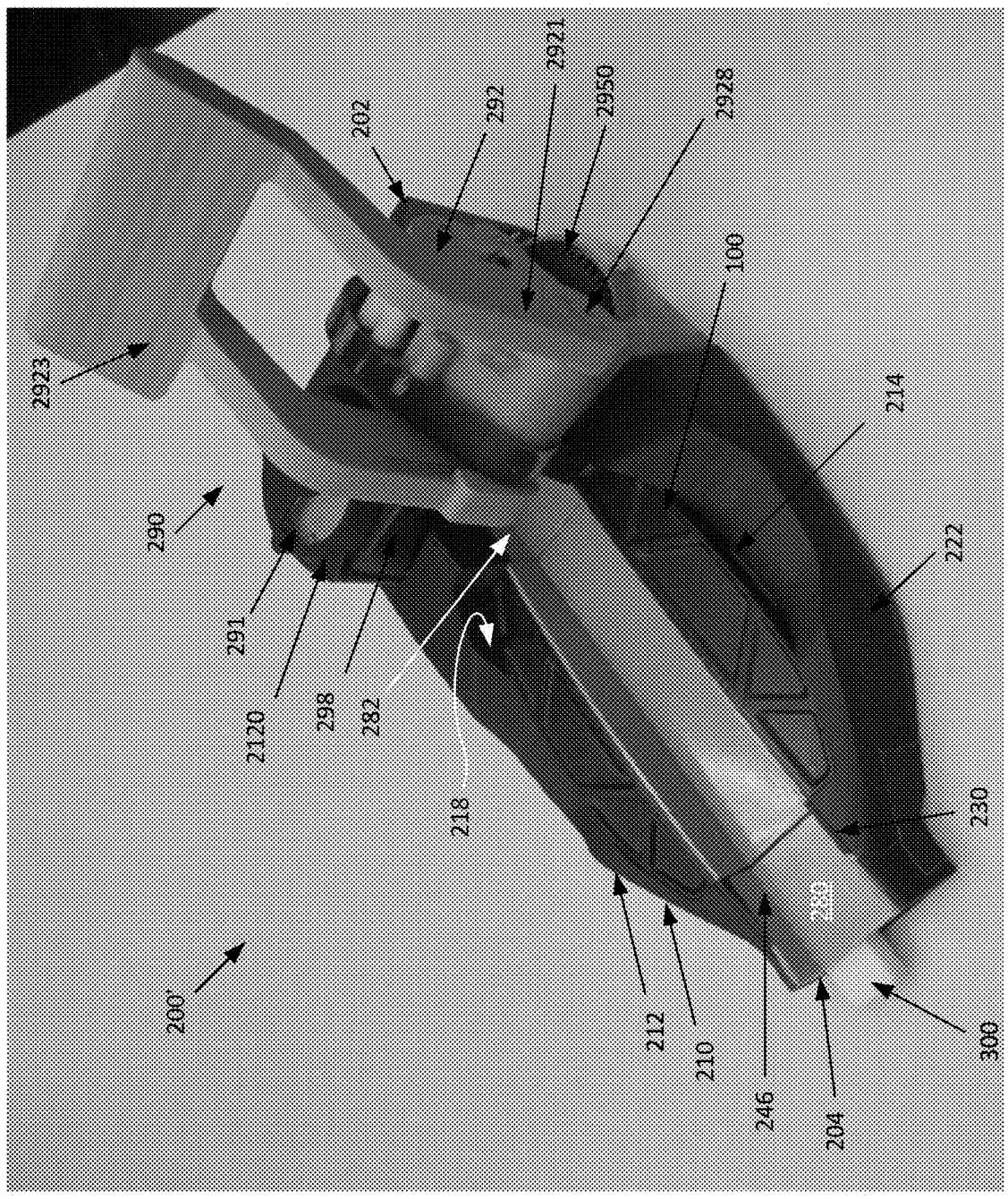

2923
202
292
2921
2950
2928
100
214
290
222
291
2120
298
282
218
230
200'
212
210
246
204
300

FIG. 14

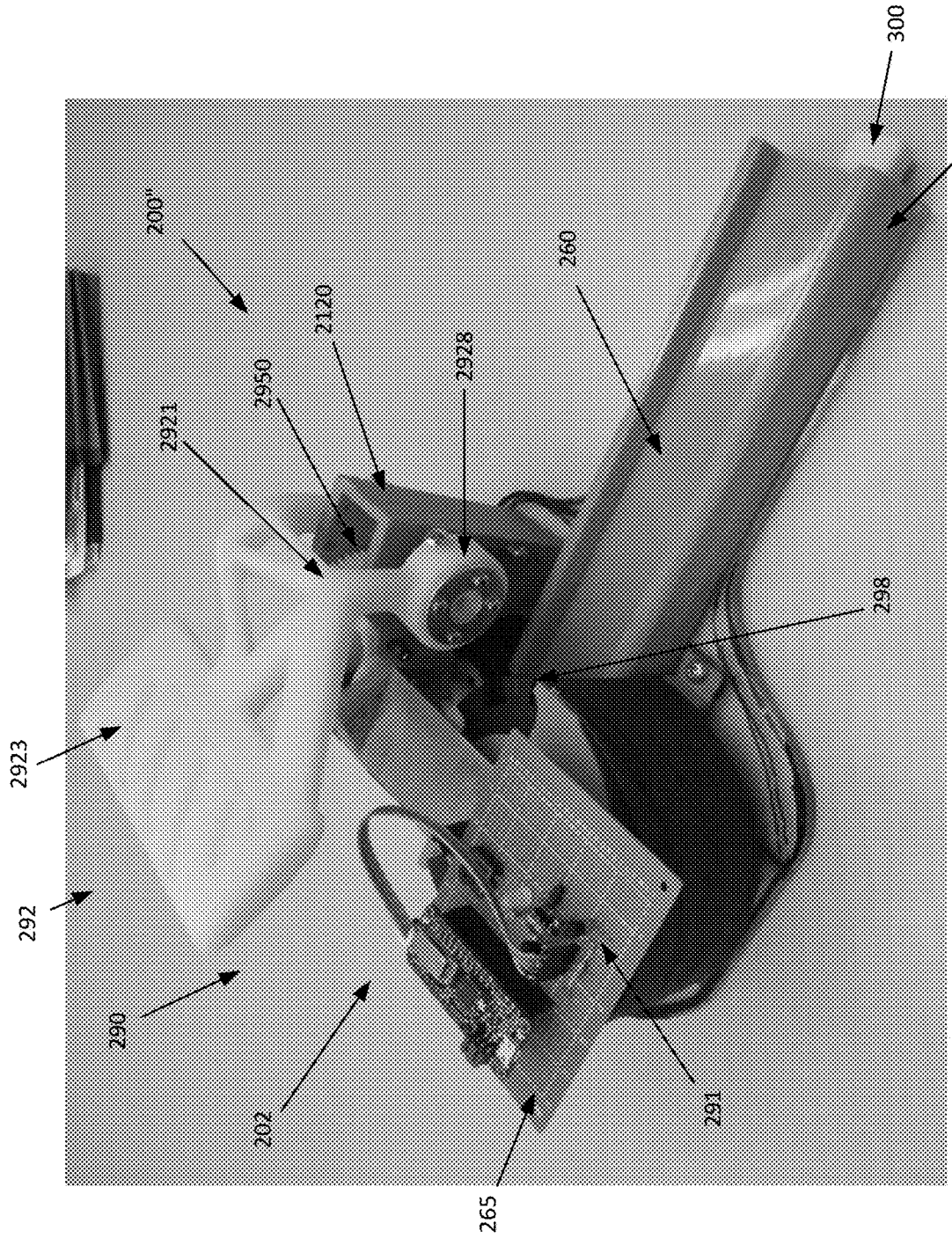

300
204
200"
260
2120
2928
2950
2921
298
2923
292
290
202
265
291

FIG. 15

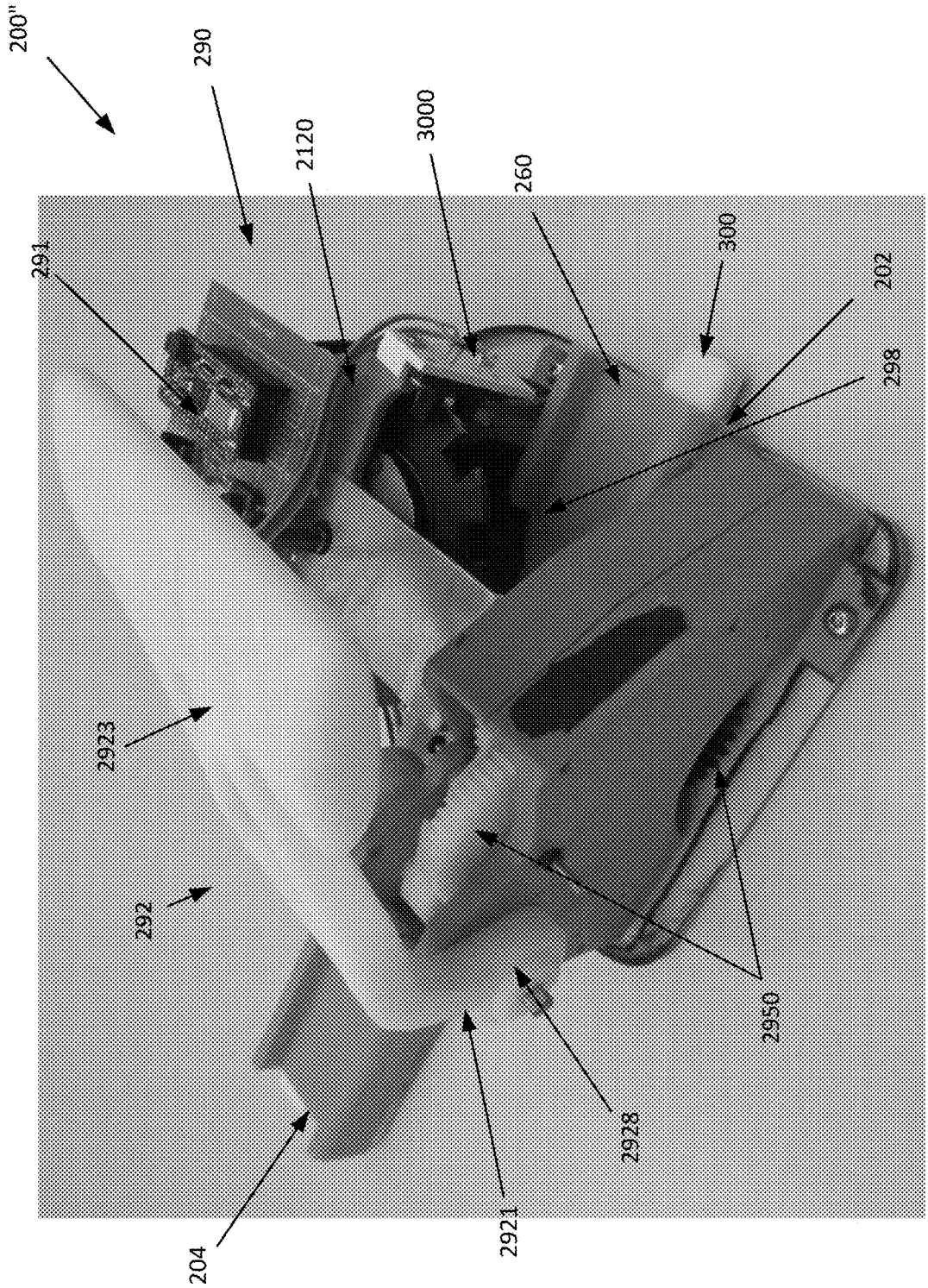

200"
290
2120
3000
260
300
202
298
291
2923
292
204
2921
2928
2950

FIG. 16

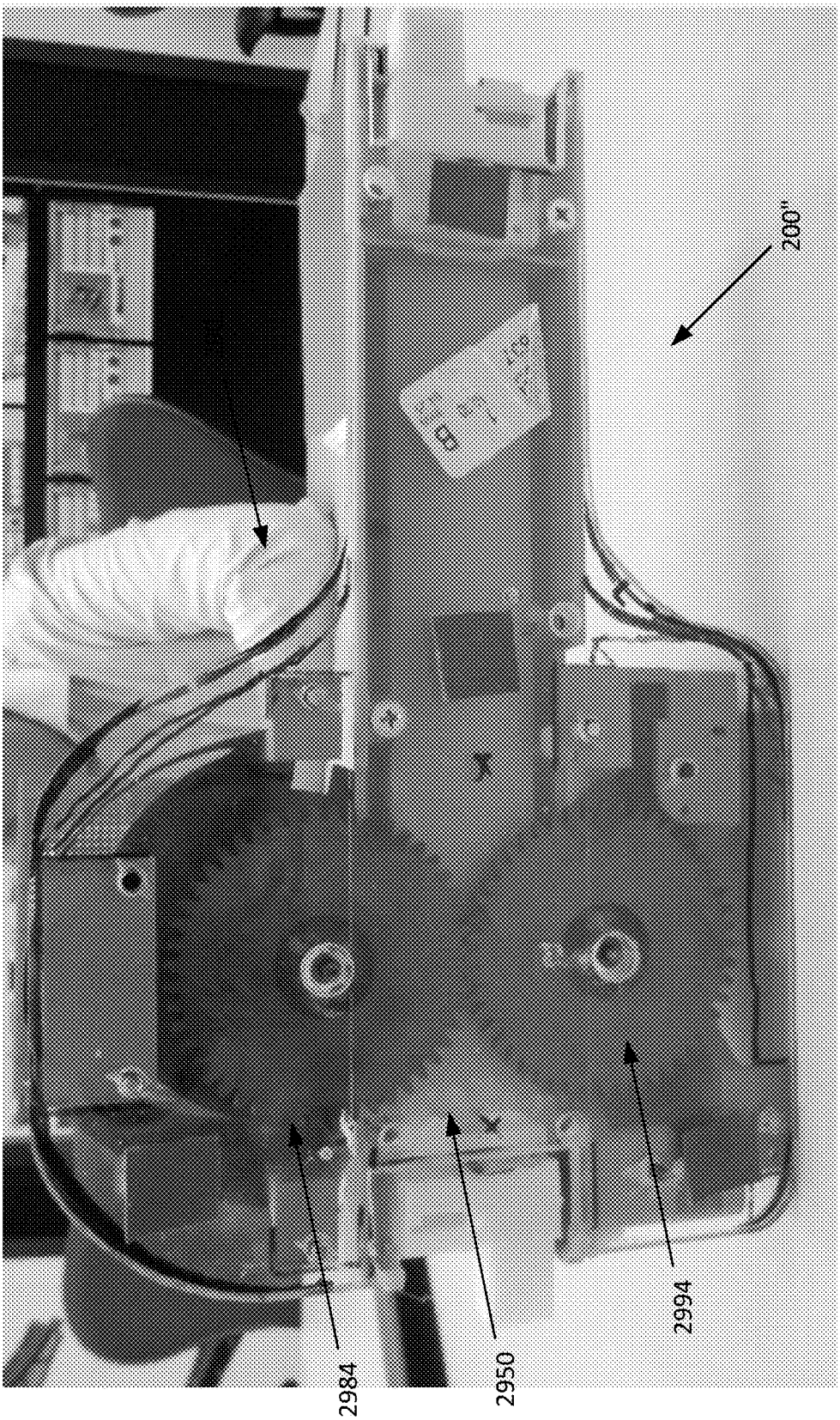


FIG. 17

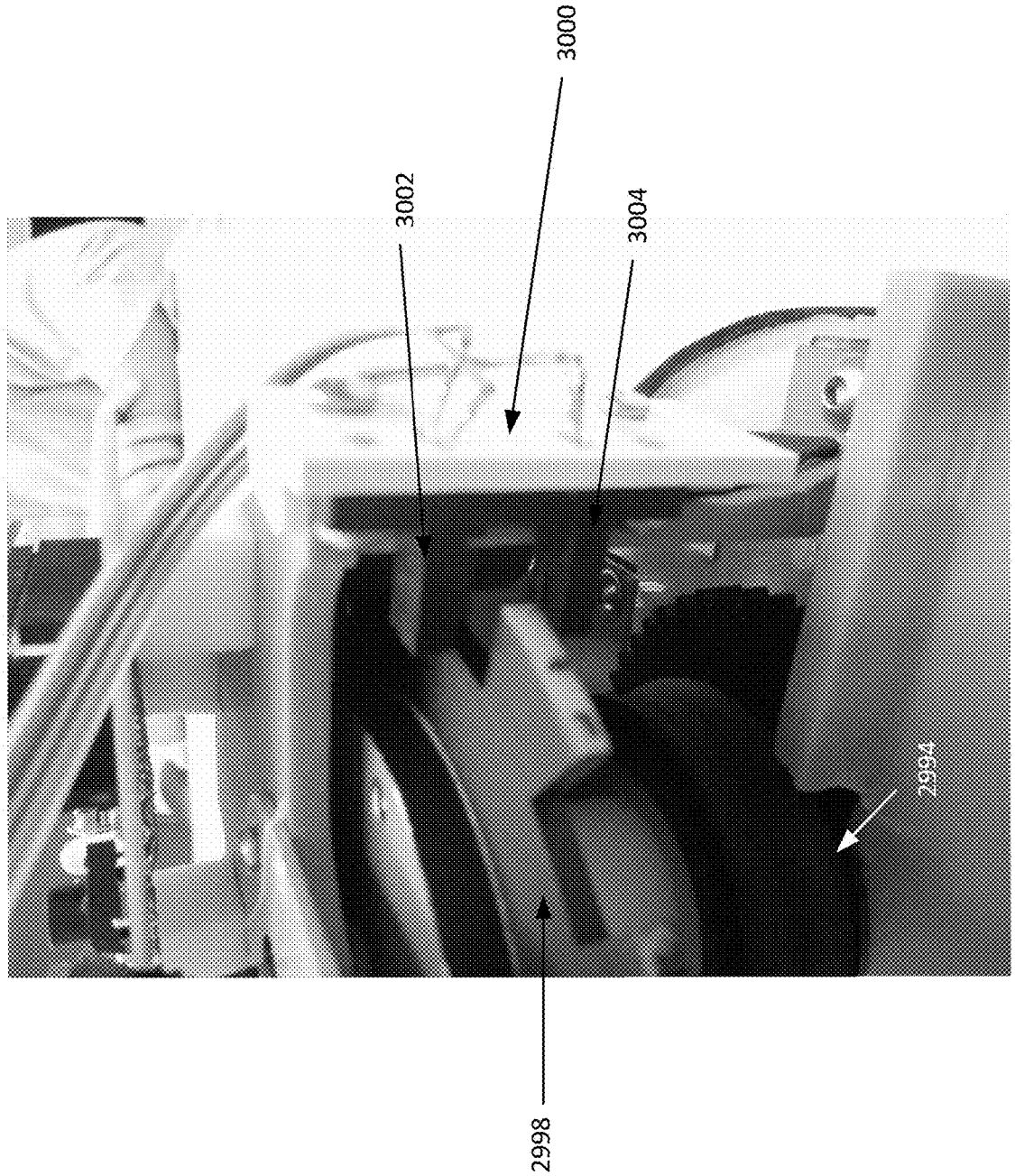


FIG. 18

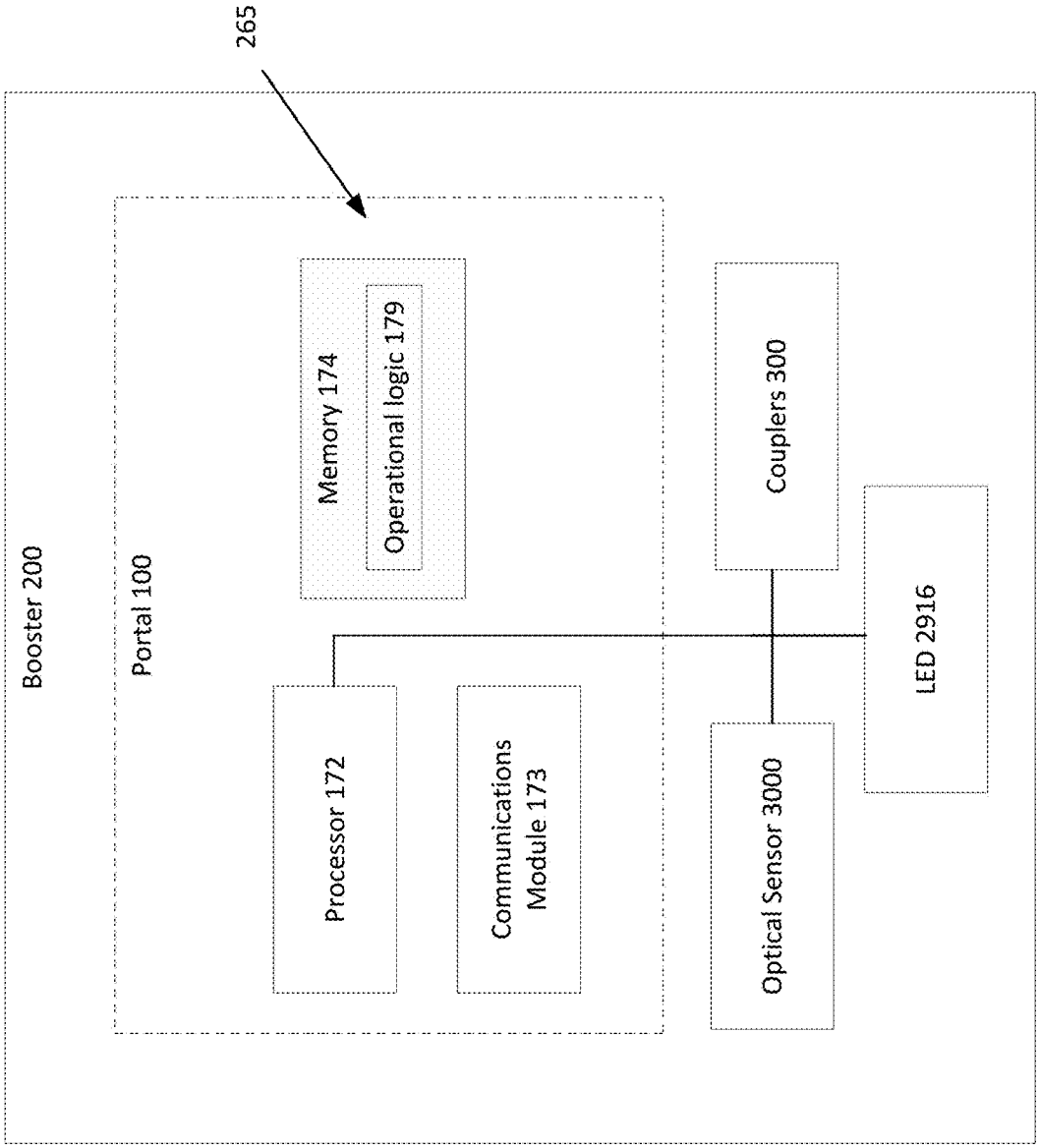

265
Booster 200
Portal 100
Memory 174
Operational logic 179
Processor 172
Communications Module 173
Couplers 300
Optical Sensor 3000
LED 2916

FIG. 19

TOY VEHICLE BOOSTER

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and is based on U.S. Patent Application No. 62/834,571, filed Apr. 16, 2019, entitled "Toy Vehicle Track System," and U.S. Patent Application No. 62/837,341, filed Apr. 23, 2019, entitled "Toy Vehicle Booster," the entire disclosures of each of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to a toy vehicle booster and, in particular, to a toy vehicle booster that can detect the rotational speed of its booster wheels when its booster wheels rotate in response to a manual input.

BACKGROUND OF THE INVENTION

[0003] Conventional toy vehicle track sets include one or more sections of track along which a toy vehicle can travel. In some track sets, accessories, such as boosters, will act on a toy vehicle as, before, or after the toy vehicle is traveling along the track. At least because children may grow tired of playing with the same accessories, accessories that provide new and interesting play features to a toy vehicle track set are continuously desired.

[0004] Additionally, in the modern world, even new and interesting physical accessories may have limited play value as compared to digital games and apps. For at least this reason, toy vehicles with identifying data stored therein have been introduced. For example, U.S. patent application Ser. No. 16/170,145, filed on Oct. 25, 2018, and entitled "Toy Vehicle Accessory and Related System," the contents of which are hereby incorporated herein in their entirety, provides a toy vehicle with a wireless tag that can be read by a reader to identify a toy vehicle and import the toy vehicle into a digital world.

[0005] To further enhance this digital-physical play, physical accessories that can add play value a digital environment related to the physical track set are also desired. Such accessories may be particularly desirable if the accessories can add play value when a play set is connected and disconnected from a virtual or digital environment. That is, accessories that can add play value to both a physical track set and a digital environment may be desired.

SUMMARY OF THE INVENTION

[0006] A toy vehicle booster is presented herein. According to one example embodiment, the toy vehicle booster includes a launcher that can be actuated via repeated user actuations of an actuator. The force of each actuation is mechanically transferred to a booster assembly to cause rotation of linked booster wheels positioned on opposite side of a track piece and repeated actuations of the actuator continuously increase the rotational speed of the linked booster wheels.

[0007] The toy vehicle booster also includes a sensor to detect the rotational speed of the booster wheels and a feedback portion configured to provide feedback based on the rotational speed of the booster wheels. In at least some embodiments, the rotational speed of the booster wheels may be representative of a speed at which the booster wheels will boost a toy vehicle and, thus, the feedback portion may also/alternatively provide feedback relating to the speed at which a toy vehicle will be boosted. Moreover, in at least some instance, the detected rotational speed may also be transmitted to an electronic device to provide additional feedback at the electronic device and/or so that the electronic device can generate digital play features in a digital environment associated with a track set in which the toy vehicle booster is included.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** illustrates a top perspective view of a toy vehicle booster formed in accordance with an example embodiment of the present application.

[0009] FIGS. **2-6** illustrate a top view, a bottom view, a side view, a back view, and a front view, respectively, of the toy vehicle booster of FIG. **1**.

[0010] FIGS. **7-9** illustrate perspective views of the toy vehicle booster of FIG. **1** with various components (e.g., covers, supports, and housings) removed to show a launcher included in the toy vehicle booster.

[0011] FIG. **10** illustrates a bottom perspective view of a plunger included in the launcher illustrated in FIGS. **7-9**.

[0012] FIGS. **11-13** illustrate different perspective views of the launcher included in the toy vehicle booster of FIG. **1**, with various components of the launcher omitted from at least some of these Figures.

[0013] FIG. **14** illustrates a top perspective view of a toy vehicle booster formed in accordance with another example embodiment of the present application.

[0014] FIGS. **15-17** illustrate a front perspective view, a back perspective view, and a bottom view, respectively, of a toy vehicle booster formed in accordance with yet another example embodiment of the present application.

[0015] FIG. **18** illustrates a detailed side view of a portion of a launcher included in the toy vehicle booster of FIGS. **15-17**.

[0016] FIG. **19** is a block diagram illustrating computing components included in a toy vehicle booster formed in accordance with an example embodiment of the present application.

[0017] Like reference numerals have been used to identify like elements throughout this disclosure.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Overall, a toy vehicle booster is presented herein. The toy vehicle booster includes a launcher that can be manually actuated via repeated user actuations of an actuator. The force of each actuation is mechanically transferred to a booster assembly to cause linked booster wheels positioned on opposite side of a track piece to rotate. Repeated actuations of the actuator continuously increase the rotational speed of the linked booster wheels. The toy vehicle booster may also include a sensor to detect the rotational speed of the booster wheels, which may be equivalent to or representative of a speed at which the booster wheels will boost a toy vehicle. Additionally or alternatively, the toy vehicle booster may include a feedback portion configured to provide feedback based on the rotational speed of the booster wheels and/or the speed at which a toy vehicle will be boosted.

[0019] In at least some embodiments, the detected speed may also be transmitted to an electronic device (e.g., a tablet

or smartphone executing an app associated with a track system in which the booster is included). Then, the electronic device can provide additional feedback, such as a speed in miles per hour that correlates to a detected rotational speed. Additionally or alternatively, an electronic device can utilize the detected speed to create a digital simulation of play on a physical track set, add play features to a digital track set, or create any other digital play features.

[0020] FIGS. **1-6** illustrate an example embodiment of the toy vehicle booster presented herein. In this example embodiment, the booster **200** includes features that allow it to be included or incorporated into a "smart" and/or electrical toy vehicle track set. In particular, the booster **200** includes electronic couplers **300** that can electrically connect the booster **200** to other track pieces that also include couplers **300**. Additionally, the booster includes a receptacle **214** configured to receive a hub or "portal piece" that may serve as a central hub for an electronic toy vehicle track system (e.g., the "brains" of a smart track set). Among other tasks, the portal piece can determine a configuration of a physical toy vehicle track set and transmit data to an electronic device (e.g., to a tablet or smartphone executing an app associated with the track system) in order to allow the electronic device to create a digital representation of the physical toy vehicle track. However, booster **200** is merely one example the toy vehicle booster presented herein and, in other embodiments, the toy vehicle booster presented herein need not include features that allow it to be included or incorporated into a "smart" and/or electrical track set (an example of which is described in connection with FIGS. **15-18**).

[0021] Nevertheless, for completeness, the booster **200** is now described in detail. The booster **200** extends from a first end **202** (an upstream end) to a second end **204** (a downstream end) and includes a base portion **210** that defines a portal receptacle **214**, track receptacles **230**, and a launcher housing **2120**, among other features. More specifically, the base portion **210** includes a housing **212** that defines the portal receptacle **214** between track receptacles **230** disposed at the opposing ends **202**, **204** of the booster **200**. The base portion **210** also defines the launcher housing **2120** so that a passageway **2122** included in the launcher housing **2120** is aligned with the track receptacle **230** disposed at the upstream end **202** of the booster **200**. Each of the portal receptacle **214**, the track receptacles **230**, and the launcher housing **2120** are generally formed in an upper side **2104** of the housing **212**, which is disposed opposite a lower side **2102**. The lower side **2102** is aligned with or defined by a bottom **250** of the housing **212**.

[0022] The portal receptacle **214** is generally shaped to mate with a peripheral surface of a portal piece, but may also include mounting receptacles **220** and/or contoured inner walls **218** configured to mate with the mounting features included on the bottom of a portal piece (e.g., via snap or press fit connections). The portal receptacle **214** may also include an electrical connector **216** (e.g., a "base connector") that is sized and positioned to mate with an electrical port included on a portal piece as the portal piece is installed in the portal receptacle **214**. Thus, overall, the portal receptacle **214** allows a portal piece to be installed in the booster **200** and may ensure that a portal piece **100** is electrically coupled to the booster **200** when it is mechanically connected to the booster **200**.

[0023] Still referring to FIGS. **1-6**, the booster **200** also includes an outer wall **222** that is spaced apart from the inner wall **218** to form a protective barrier around the portal receptacle **214**. In at least some locations, the outer wall **222** may be contoured in a substantially similar manner to the inner wall **218**, for example, to enable a user to grip a portal piece sitting in the portal receptacle **214** and disconnect the portal piece from the portal receptacle **214**. In at least some embodiments, the outer wall **222** may also define an external electrical port (not shown). The port may allow an electronic device, such as a smartphone or tablet, to connect to a portal piece installed in the booster **200** (i.e., a portal piece coupled to port **216**) and/or computing components included in the booster **200** via a wired connection. Additionally or alternatively, the port may enable power to be delivered to the booster **200** and/or a portal device installed in the booster **200**.

[0024] The track receptacles **230** formed on opposing sides of the portal receptacle **214** are sized to receive tack pieces that can align with a track section included on a portal piece and form a continuous pathway from the upstream end **202** of the booster **200** to the downstream end **204** of the booster. As can be seen best in the back and front views provided by FIGS. **5** and **6**, each of receptacles **230** is formed by an inner surface **234** of a first sidewall **232** and an opposing inner surface **238** of a second sidewall **236**. Meanwhile, and as is shown best in the top view provided by FIG. **2**, each of the track receptacles **230** spans from an outer wall **242** that is aligned with end **202** or end **204** of the booster **200** to an inner wall **240** that is aligned with the portal receptacle **214**. Put another way, the track receptacles **230** define passageways **246** from the portal receptacle **214** to either end **202** or end **204** of the booster **200**.

[0025] Still referring to FIGS. **1-6**, but now in combination with FIG. **7** as well, track sections **280** and **282** are mounted on upper surfaces **244** of the passageways **246** created by track receptacles **230**. Consequently, when a portal piece with a track is mounted in the booster **200**, the portal piece and booster **200** can cooperate to provide a track pathway from the first end (i.e., the upstream end) **202** of the base piece to the second end (i.e., the downstream end) **204** of the booster **200**.

[0026] As is shown in FIG. **7**, track section **280** extends from a first end **2806** to a second end **2808** and includes a bottom **2802** that is bounded by opposing sidewalls **2804**. Meanwhile, track section **282** extends from a first end **2826** to a second end **2828** and includes a bottom **2822** that is bounded by opposing sidewalls **2824**. In various embodiments, sidewalls **2804** and/or sidewalls **2824** can include extensions or cutouts (or other such features) to provide various portions/components of the booster **200** (e.g., portions of booster wheels) and/or of the portal with access to track section **280** and/or track section **282**. This may, for example, allow portions/components of booster **200** to extend into or have a sight line across track section **280** and/or track section **282**.

[0027] Regardless of the features included in track sections **280** and **282**, each end of booster **200** includes a track coupler **300** that allow the booster **200** to be connected to additional track pieces of a smart or electrical track set. Notably, the track coupler **300** included at the upstream end **202** of booster **200** has a mirrored arrangement as compared to the coupler **300** included at the downstream end **204** of booster **200**. Thus, if the booster **200** was flipped about its

Y-axis (i.e., rotated 180 degrees about a vertical axis extending through a center of the portal receptacle **214**), protrusions of the couplers **300** would be disposed in the same place as shown in FIGS. **1-3**.

[0028] Moreover, when a portal piece is installed in the booster **200** so that an electrical connection is formed between the portal piece and the booster **200**, computing components included in the portal piece **100** will be electrically coupled to the couplers **300** included in the booster **200** (see FIG. **19**) and can communication bi-directionally with additional track pieces connected to the couplers **300**. In some embodiments, the couplers **300** connect directly to the components of the portal piece **100**. Alternatively, the booster **200** may also include computing components, such as a processor, memory, and communications module, and the couplers **300** may facilitate bi-directional communications with the computing components included in the booster **200**. In fact, in some embodiments, a portal piece does not include couplers **300** and the base piece **200** does not include computing components (e.g., a processor). Thus, these components cooperate to bi-directionally communicate with other track pieces.

[0029] Still referring to FIGS. **1-7**, at a high-level, the launcher housing **2120** houses a launcher **290** that can boost (i.e., propel) toy vehicles towards the downstream end **204** of the booster **200** (through the portal receptacle **214**). The launcher **290** includes a feedback portion **291**, an actuator portion **292** (also referred to as the actuator assembly **292**), and a booster wheel assembly **298**. In the depicted embodiment, upon actuation of the actuator portion **292**, the booster assembly **298** will engage and propel a toy vehicle traveling through passageway **2122** (along a track section **282** disposed in the upstream track receptacle **230**) through the portal receptacle **214** (e.g., along a track included in a portal piece installed in portal receptacle **214**) towards the downstream end **204** of the booster **200**. Actuation of the actuator portion **292** may also cause feedback portion **291** to provide feedback relating to the boost provided by booster assembly **298**.

[0030] In FIGS. **7-9**, the upper side **2104** of housing **212** is removed to show at least the launcher **290**, track section **280**, and track section **282** in further detail. Notably, while track section **280** includes sidewalls **2804** with a relatively uniform height, track section **282** includes sidewalls **2824** with extensions **2823** that extend upwards into passageway **2122**. Booster wheel cutouts **2825** are formed in the extensions **2823** and allow booster wheels **2986** and **2996** (see FIGS. **8** and **9**) of booster assembly **298** to extend laterally inwards from both sides of track section **282**. This inward extension allows the booster assembly **298** to engage both sides of a toy vehicle traveling along track section **282**, which allows the booster assembly **298** to grip and propel the toy vehicle along the track section **282**. In this embodiment, the extensions **2823** and wheel cutouts **2825** comprise the track section features mentioned above.

[0031] Still referring to FIGS. **7-9**, each of the feedback portion **291**, the actuator portion **292**, and the booster wheel assembly **298** may be at least partially covered by launcher housing **2120** and may be supported internally by various support members. For example, the actuator portion **292** includes an actuator **2922**, which, in turn, includes a handle **2923** and a gear assembly **2950** (see FIGS. **11** and **12**). The handle **2923** is mounted on a cylindrical actuator housing **2924** and the components included in the gear assembly **2950** are supported by a support member **2926**. The actuator housing **2924** may define an internal cavity **2925** (see FIG. **8**) that houses portions of the actuator **2922**, such as a plunger **2930** (and also at least a portion of support member **2926**), while support member **2926** may include various chambers or channels, such as a plunger channel **2927**, to ensure various components of gear assembly **2950** are positioned to engage with each other. The actuator housing **2924** is shown in FIG. **7** and removed in FIG. **8**, while the support member **2926** is shown in FIG. **8** and partially removed in FIG. **9**.

[0032] Now turning to FIG. **10**, this figure illustrates the plunger **2930** that is included in the actuator **2922** of the actuator portion **292**. The plunger **2930** includes an elongate portion **2932** and a head portion **2940**. The elongate portion **2932** is formed by a body **2934** that extends from a lower surface **2944** of the head portion **2940**. The body **2934** includes a surface **2936** that faces the direction in which the head portion **2940** primarily extends and this surface **2936** includes a toothed rack **2938** that engages a component of the gear assembly **2950** (as is described in further detail below). The lower surface **2944** of the head portion **2940** also includes a tab structure **2946** that is configured to engage a biasing member **2948** included in the actuator **2922**. A top surface **2942** of the head portion **2940** is disposed opposite the lower surface **2944** and is configured to engage the handle **2923** of the actuator **2922**.

[0033] In view of the foregoing features, when a user actuates (e.g., depresses) the handle **2923**, the actuation may drive the plunger **2930** downwards (in channel **2927**), causing the toothed rack **2938** to drive the gear assembly **2950** and causing the tab structure **2946** to compress biasing member **2948**. Then, when the user releases the handle **2923**, the compressed biasing member **2948** drives the plunger **2930** and handle **2923** upwards, back towards their rest positions. That is, the biasing member **2948** automatically resets the plunger **2930** after each actuation, which, in turn, automatically resets the handle **2923** after each actuation.

[0034] Now turning to FIGS. **11-13**, but with continued reference to FIGS. **7-10**, the gear assembly **2950** generally connects the plunger **2930** to the booster assembly **298** so that an actuation of actuator **2922** (e.g., via depression of handle **2923**) causes rotation of booster wheels **2986** and **2996** included in the booster assembly **298**. To effectuate this, the gear assembly **2950** of the depicted embodiment includes a throw out gear **2952** that engages the toothed rack **2938**, a reduction gear **2970** that engages a drive gear **2988** included in the booster assembly **298**, and a beveled output gear **2960** that engages the throw out gear **2952** at one end and engages the reduction gear **2970** at its other end.

[0035] More specifically, the throw out gear **2952** includes a first gear portion **2954** that engages the toothed rack **2938** and a second gear portion **2956** that has a larger diameter than the first gear portion **2954**. Gear portion **2954** and gear portion **2956** are both mounted on an axle **2958** that allows the gear portions to rotate about axis A**1**, which is oriented perpendicular to a direction in which the plunger **2930** translates. The beveled output gear **2960** includes a first gear portion **2962** that engages the second gear portion **2956** of the throw out gear **2952** and a beveled gear portion **2964** that engages an upper gear portion **2972** of the reduction gear **2970**. Gear portion **2962** and gear portion **2964** are both mounted on an axle **2966** that allows the gear portions to rotate about axis A**2**, which is oriented parallel to axis A**1**.

Finally, a lower gear portion **2974** of the reduction gear **2970**, which has a larger diameter than the upper gear portion **2972** of the reduction gear **2970**, engages the booster assembly **298**. Gear portion **2972** and gear portion **2974** are both mounted on an axle **2976** that allows the gear portions to rotate about axis A**3**, which is oriented perpendicular to axes A**1** and A**2**.

[0036] Still referring to FIGS. **11-13**, with continued reference to FIGS. **7-10**, the booster assembly includes two posts that support booster wheel **2986** and booster wheel **2996** on opposite sides of track section **282** (as discussed above): post **2982** and post **2992**. Post **2982** is arranged generally beneath the actuator portion **292** and supports a drive gear **2988** at one end (its top end) and a linkage gear **2984** at its other end (its bottom end). Meanwhile, post **2992** is arranged generally beneath the feedback portion **291** and supports a flywheel **2999** at one end (its top end) and a linkage gear **2994** at its other end (its bottom end).

[0037] Each of the components supported by/mounted on post **2982** and **2992** (e.g., the linkage gears, booster wheels, flywheel, and drive gear) is fixed to its respective posts and, thus, rotates with its post. Meanwhile, an outer periphery **2985** of the linkage gear **2984** included on the first post **2982** engages an outer periphery **2995** of the linkage gear **2994** included on the second post **2992** to link rotational movement of posts **2982** and **2992**. Thus, booster wheel **2986** and booster wheel **2996** operate in synchronization (i.e., rotate at the same time and at the same speed), but in opposite directions (i.e., one booster wheel rotates in a clockwise direction and the other rotates in a counter-clockwise direction). Thus, booster wheel **2986** and booster wheel **2996** may be described as operating in reverse synchronization.

[0038] At a high-level, booster wheel **2986** and booster wheel **2996** rotate in response to actuations of actuator **2922** (e.g., downward depressions of handle **2923**). More specifically, in response to a downward, linear actuation of the actuator **2922**, the gear assembly **2950** converts linear motion of actuator **2922** into rotational motion and rotates drive gear **2988**. Since the drive gear **2988**, the booster wheel **2986**, and the linkage gear **2984** are all fixedly mounted on a post **2982**, rotation of the drive gear **2988** causes rotation of the booster wheel **2986** and the linkage gear **2984**, which, in turn, causes rotation of post **2992** and booster wheel **2996**.

[0039] Moreover, rotating post **2992** rotates the flywheel **2999** mounted atop post **2992**. This may generate additional rotation energy beyond the rotational energy generated by gear assembly **2950**. This additional rotational energy may continue rotating post **2992** after rotational energy generated by gear assembly **2950** dissipates and, due to the connection between linkage gears **2984** and **2994**, the rotational movement generated by flywheel **2999** will rotate both booster wheel **2986** and booster wheel **2996**.

[0040] Due to the mechanical arrangement of the components in actuator portion **292** and booster assembly **298**, continuous actuation of the actuator **2922** may continuously increase the speed at which booster wheel **2986** and booster wheel **2996** rotate. The rotational speed of booster wheels **2986** and **2996** controls the speed at which toy vehicles are propelled away from the launcher **290** and, thus, launcher **290** may offer a user fine-tuned, manual control over the speed at which their vehicles are launched by launcher **290**.

[0041] In some instances, a user may continuously actuate (e.g., press) that actuator **2922** to increase the speed of subsequent launches (or to build up speed for a single launch). Alternatively, a user can intermittently actuate (e.g., press) the actuator **2922** to try to maintain a certain speed (with smaller intervals of time between the intermittent actuations maintaining a faster speed than larger intervals of time). Regardless, after each actuation of the actuator **2922** (via the handle **2923**), the biasing member **2948** may drive the plunger **2930** upwards and the top surface **2942** of the head portion **2940** of the plunger **2930** may press the handle **2923** upwards to return the handle **2923** to a rest position and enable subsequent actuations.

[0042] Now turning back to FIG. **2**, but with reference to FIGS. **7-13** as well, in at least some embodiments, the play value of booster **200** is enhanced by feedback portion **291**. In the depicted embodiment, the feedback section **291** is disposed above the flywheel **2999** and includes a feedback housing **2910** that covers the flywheel **2999** (housing **2910** may be a portion of launcher housing **2120**). The feedback housing **2910** includes an opening **2912** that is sealed with a translucent lens **2914**. The lens **2914** allows a user to see the flywheel **2999** spinning within the housing **2910** during operation of the launcher **290**, which provides visual feedback to a user during operation of launcher **290**. Specifically, since the flywheel **2999** will rotate faster as the launcher **290** is operated at higher speeds, the flywheel **2999** provides the user with visual feedback of the speed they are creating with continuous (e.g., repeated) actuations.

[0043] Still referring to FIG. **2**, but now in combination with FIGS. **11-13**, in at least some embodiments, the view of the spinning flywheel **2999** may be the only feedback provided by the feedback portion **291**. Alternatively, the visual feedback provided by flywheel **2999** spinning may be supplemented by additional feedback, such as feedback generated based on a detected speed of booster wheels **2986** and **2996**. For example, in the depicted embodiment, the feedback portion **291** includes a rotational sensor **3000** to determine the rotational speed of booster wheel **2996**, post **2992** and/or the components fixedly mounted on post **2992**, which, as mentioned, may be representative of a speed at which the booster wheels will boost a toy vehicle.

[0044] Specifically, in the depicted embodiment, the rotational sensor **3000** is an optical rotary encoder and, thus, includes a top member **3002** and a bottom member **3002** that can generate data representative of the rotational speed of booster wheel **2996** based on light patterns created by the rotation of linkage gear **2994**. The sensor **3000** can then transmit this data to a processor that can determine the rotational speed of booster wheel **2996** (which is also the rotational speed of booster wheel **2986**). As is explained below, in some embodiments, the booster **200** may include a processor, but in other embodiments, the booster **200** may transmit rotational speed data to a processor included in a portal piece installed in the booster **200**.

[0045] Once a processor determines the rotational speed of booster wheels **2986** and **2996**, the processor can cause the feedback portion **291** to provide additional feedback based on the speed. For example, in the depicted embodiment, the feedback portion **291** includes a light **2916** (e.g., one or more light emitting diodes (LEDs)) and the processor may control the color, frequency, or some other light characteristic of the light **2916** based on the speed of booster wheels **2986** and **2996** and/or the speed at which the booster wheels **2986** and **2996** will boost a toy vehicle. For example, the light may change from red to yellow to green as the speed of booster

wheels **2986** and **2996** increases towards a desirable speed and then may continue changing from green back to yellow back to red if the speed of booster wheels **2986** and **2996** increases past the desirable speed.

[0046] Additionally or alternatively, the feedback portion **291** may include other feedback mechanisms. For example, a processor (included in booster **200** and/or in a portal piece installed in booster **200**) could cause light **2916** or a display screen to display a rotational velocity of booster wheels **2986** and **2996**, a number representing the rotational velocity (e.g., a mile per hour speed correlated to the rotational speed of booster wheels **2986** and **2996**), and/or any other data/indicia. This data could be displayed in a heads-up manner on lens **2914** or on some other display screen included in the feedback portion **291**. As another example, the feedback portion **291** could include a speedometer dial that is controlled by a processor based on the speed of booster wheels **2986** and **2996**. The dial may even rotate with respect to a gauge.

[0047] Now turning to FIGS. **14-17**, these Figures illustrate additional embodiments of a toy vehicle booster formed in accordance with the present application. These additional embodiments are both relatively similar to booster **200**. For example, booster **200'** (FIG. **14**) and booster **200"** (FIGS. **15-17**) each drive two linked booster wheels disposed on opposite sides of a track in response to manual actuations of an actuator (linkage gears **2984** and **2994** of booster **200"** are shown in FIG. **17**), each allow a user to continuously actuate the booster, and each provide at least some feedback regarding the speed of booster wheels included therein. Thus, for brevity, components of booster **200'** and booster **200"** that are labeled with reference numbers used to describe components of booster **200** are not described again below. Instead, any description of these components included above is intended to apply to the like components included in booster **200'** and booster **200"** and the foregoing description focuses on the differences between booster **200**, booster **200'**, and booster **200"**.

[0048] One notable difference between booster **200** and boosters **200'** and **200"** is that boosters **200'** and **200"** each include a handle **2923** that is rotatably coupled to the launcher portion **292**, instead of a handle **2923** that is linearly translatable with respect to the launcher portion **292**. To achieve this, the handles **2923** included in booster **200'** and booster **200"** each include a mounting portion **2921** that extends around the launcher portion **292**. Then, the mounting portion **2921** is coupled to the actuator housing **2924** of launcher portion **292** via a rotatable coupling **2928**. The rotatable coupling **2928** drives the gear assembly **2950** in response to rotational motion of the handle **2923** (e.g., clockwise motion). Consequently, like booster **200**, booster **200'** and booster **200"** can each drive booster wheel **2986** and booster wheel **2996** in response to repeated manual actuations.

[0049] Other than the handle **2923**, booster **200'** is largely identical to booster **200**. On the other hand, booster **200"** has a number of other differences, albeit differences that are largely unrelated to the mechanical operations of launcher **290**. For example, instead of providing the launcher **290** within a launcher housing **2120** that is part of a larger housing **212**, booster **200"** includes a launcher housing **2120** that is mounted on a unitary track piece **260**. Track piece **260** still extends from an upstream end **202** to a downstream end **204** (and includes couplers **300** at each of ends **202** and **204**). However, neither launcher housing **2120** nor track piece **260** define a portal receptacle **214** (among other features). Thus, booster **200"** is not configured to receive a portal piece that houses computing components associated with the booster **200**. Instead, the booster **200** includes any electrical/computing components (generally denoted at **265**) therein/thereon (computing components **265** are described in further detail below in connection with FIG. **19**).

[0050] Now turning to FIG. **18**, this Figure provides a detailed view of a portion of booster **200"** that is visible in the back perspective view of FIG. **16**. This portion includes the sensor **3000** that is described above in connection with booster **200**. However, now, the sensor **3000** is not generating data based directly on rotational movements of linkage gear **2994**. Instead, post **2992** includes an optical ring **2998** with spaced apart protrusions, and the top member **3002** and the bottom member **3002** are disposed above and below the protrusions, respectively. Thus, the sensor **3000** can determine the rotational speed of booster wheel **2986** and booster wheel **2996** based on rotational movement of the optical ring **2998**. That said, optical ring **2998** is merely one additional example of a component that the sensor **3000** can monitor to determine the rotational speed of booster wheel **2986** and booster wheel **2996** (in addition to linkage gear **2994**). In other embodiments, the rotational speed of booster wheel **2986** and booster wheel **2996** can be monitored/determined in any manner now known or developed hereafter.

[0051] Now turning to FIG. **19**, this Figure illustrates, at a high-level, example arrangements of computing/electrical components **265** that could be included in the booster **200** and/or a portal piece **100** installed in (and, thus, electrically connected to) the booster **200**. As is discussed above, in some embodiments a majority of (if not all of) computing components **265** reside in a portal piece **100** installed in booster **200** (e.g., the embodiment shown in FIGS. **1-13**), but in other embodiments computing components **265** all reside in booster **200** (e.g., the embodiment shown in FIGS. **15-17**). Thus, in the depicted embodiment, portal piece **100** is shown with dashed lines to illustrate both of these example embodiments. However, these are merely two example arrangements and in other embodiments, components **265** could be arranged in any desired configuration.

[0052] Nevertheless, for simplicity, components **265** are described below as being included in portal **100**, with the understanding that this description applies to components included in portal **100** or in booster **200**. For example, in the depicted embodiment, booster **200** includes optical sensor **3000**, couplers **300**, and LED **2916** while the portal piece **100** includes a processor **172**, a memory **174**, and a communications module **173** (each of which may be powered by a battery module and/or wired power). Notably, the actuator launcher **290** itself, or at least the actuator assembly **292** and the booster assembly **298** thereof, does/do not include electrical components that cause actuations of the launcher **290**; the launcher **290** requires manual, mechanical actuations to generate rotational speed. That is, the actuator assembly **292** and the booster assembly **298** may be purely mechanical.

[0053] The memory **174** may store operational logic **179** that may allow the processor **172** to operate and/or monitor the various electrical components of booster **200** (e.g., optical sensor **3000**, couplers **300**, and LED **2916**). For example, the processor **172** can operate the LED **2916** based on data received from optical sensor **3000**, which may

generate data representative of the rotational velocity of booster wheel **2986** and booster wheel **2996**.

[0054] More specifically, memory **174** may include random access memory (RAM) or other dynamic storage devices (i.e., dynamic RAM (DRAM), static RAM (SRAM), and synchronous DRAM (SD RAM)), for storing information and instructions to be executed by processor **172**. The memory **174** may also include a read only memory (ROM) or other static storage device (i.e., programmable ROM (PROM), erasable PROM (EPROM), and electrically erasable PROM (EEPROM)) for storing static information and instructions for the processor **172**.

[0055] Although FIG. **19** only explicitly shows connections between processor **172** and the optical sensor **3000**, the LED **2916**, and the couplers **300**, the portal piece **100** and/or booster **200** may also include a bus or other communication mechanism for communicating information between the processor **172**, memory **174**, and communications module **173**. Additionally, although FIG. **19** shows the processor **172** as a single box, it should be understood that the processor **172** may represent a plurality of processing cores, each of which can perform separate processing. The processor **172** may also include special purpose logic devices (i.e., application specific integrated circuits (ASICs)) or configurable logic devices (i.e., simple programmable logic devices (SPLDs), complex programmable logic devices (CPLDs), and field programmable gate arrays (FPGAs)), that, in addition to microprocessors and digital signal processors may individually, or collectively, are types of processing circuitry.

[0056] Generally, the processor **172** performs a portion or all of the processing steps required to execute instructions received at communication module **173** and/or instructions contained in memory **174**. Such instructions may be read into memory **174** from another computer readable medium. One or more processors in a multi-processing arrangement may also be employed to execute the sequences of instructions contained in memory **174**. In alternative embodiments, hard-wired circuitry may be used in place of or in combination with software instructions. Thus, embodiments are not limited to any specific combination of hardware circuitry and software. Put another way, portal **100** and/or booster **200** includes at least one computer readable medium or memory for holding instructions programmed according to the embodiments presented herein and for containing data structures, tables, records, or other data described herein.

[0057] Still referring to FIG. **19**, the communication module **173** provides a two-way data communication coupling to a network, such as a local area network (LAN) or the Internet. The two-way data communication coupling provided by the communication module **173** can be wired (e.g., via a data port) or wireless. Moreover, the two-way communication may allow the portal piece **100** and/or the booster **200** to communicate with other track pieces, via couplers **300**, in accordance with a specific communications protocol. Additionally or alternatively, the two-way communication may allow the portal piece to communicate with an electronic device that is coupled to the track system (e.g., via a wired connection and/or via a wireless connection, such as a BLUETOOTH LE connection).

[0058] Although an electronic device is not shown in FIG. **19**, the portal piece **100** can connect to any personal electronic device, including portable electronic devices like smartphones, tablets, and laptops running a variety of operating systems (e.g., iOS, Android, etc.), as well as desktops or other computing device that require wired power. This may allow the portal **100** and/or the booster **200** to transmit the rotational speed of booster wheel **2986** and booster wheel **2996** to an electronic device, which can display the speed (or a representation thereof, such as a mile per hour speed correlated to the rotational speed), use the speed in creating a digital simulation of toy vehicle's traversing a digital track, or execute other operations involving the booster speed.

[0059] It is to be understood that terms such as "left," "right," "top," "bottom," "front," "rear," "side," "height," "length," "width," "upper," "lower," "interior," "exterior," "inner," "outer" and the like as may be used herein, merely describe points or portions of reference and do not limit the present invention to any particular orientation or configuration. Further, the term "exemplary" is used herein to describe an example or illustration. Any embodiment described herein as exemplary is not to be construed as a preferred or advantageous embodiment, but rather as one example or illustration of a possible embodiment of the invention.

[0060] Although the disclosed inventions are illustrated and described herein as embodied in one or more specific examples, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the scope of the inventions and within the scope and range of equivalents of the claims. In addition, various features from one of the embodiments may be incorporated into another of the embodiments. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the disclosure as set forth in the following claims.

What is claimed is:

1. A toy vehicle booster comprising:

a housing that defines a passageway along which a toy vehicle may be boosted; and

a launcher disposed in or on the housing, the launcher comprising:

an actuator assembly;

a booster assembly that can engage the toy vehicle to boost the toy vehicle along the passageway, wherein the booster assembly be driven at increasing speeds via repeated user actuations of the actuator assembly; and

a feedback portion that provides visual feedback relating to a speed at which the booster assembly will boost the toy vehicle.

2. The toy vehicle booster of claim **1**, wherein the booster assembly comprises linked booster wheels disposed on opposite sides of the passageway, the linked booster wheels operating in reverse synchronization.

3. The toy vehicle booster of claim **2**, wherein:

the linked booster wheels comprise a first wheel with a drive gear that is driven by the actuator assembly and a first linkage gear and a second wheel with a second linkage gear that is driven by the first linkage gear; and

the feedback portion comprises an optical rotational sensor configured to generate data representative a rotational speed of linked booster wheels based on light patterns created by rotation of the first linkage gear, the second linkage gear, or an optical ring rotationally coupled to the first wheel or the second wheel, wherein

a processor included in or connected to the toy vehicle booster produces the visual feedback based on the data.

4. The toy vehicle booster of claim **1**, wherein:

the booster assembly comprises at least one booster wheel and a flywheel that rotates with the booster assembly in response to the repeated user actuations while generating additional rotational energy;

the feedback portion includes an opening that provides a view of the flywheel; and

the visual feedback comprises rotations of the flywheel.

5. The toy vehicle booster of claim **1**, wherein the actuator assembly comprises:

an actuator with a handle, wherein the repeated user actuations of the handle cause repeated movements of the actuator;

a biasing member configured to automatically reset the actuator after each actuation of the repeated user actuations; and

a gear assembly that translates each movement of the repeated movements of the actuator to the booster assembly.

6. The toy vehicle booster of claim **5**, wherein the actuator comprises a plunger that is linearly translatable within an actuator housing.

7. The toy vehicle booster of claim **6**, wherein the booster assembly comprises at least one booster wheel and the gear assembly translates linear movement of the plunger to rotational motion that drives the at least one booster wheel.

8. The toy vehicle booster of claim **5**, wherein the actuator is rotatably coupled to the housing and engages the gear assembly via a rotatable coupling.

9. The toy vehicle booster of claim **1**, wherein the booster assembly comprises at least one booster wheel and the feedback portion comprises:

a rotational sensor configured to generate data representative of a rotational speed of the at least one booster wheel, wherein a processor included in or connected to the toy vehicle booster produces the visual feedback based on the data.

10. The toy vehicle booster of claim **1**, wherein the housing defines a track pathway that extends through the passageway or the housing is mountable onto a track piece in a position that aligns the track piece with the passageway.

11. The toy vehicle booster of claim **1**, wherein the housing includes electrical connectors that can connect the toy vehicle booster to additional electrical track pieces and allow bi-directional communication between the toy vehicle booster and one or more of the additional electrical track pieces.

12. The toy vehicle booster of claim **1**, wherein the toy vehicle booster includes or is connectable to a communications module that can transmit data representative of the speed at which the booster assembly will boost the toy vehicle to a computing device that is usable independently from the toy vehicle booster so that the computing device can: (a) provide additional visual feedback; (b) operate digital play features in a digital environment based on the data; or (c) perform (a) and (b) in combination.

13. A toy vehicle booster comprising:

a housing that defines a passageway along which a toy vehicle may be boosted;

a launcher disposed in or on the housing, the launcher comprising:

an actuator assembly;

a booster assembly including at least one booster wheel that can engage the toy vehicle to boost the toy vehicle along the passageway; and

a feedback portion with a rotational sensor configured to generate data representative of a rotational speed of the at least one booster wheel, wherein a processor included in or connected to the toy vehicle booster causes the feedback portion to generate visual feedback relating to a speed at which the booster assembly will boost the toy vehicle based on the data.

14. The toy vehicle booster of claim **13**, wherein the feedback portion comprises:

one or more lights, the visual feedback comprising a light characteristic output by the one or more lights, wherein the processor controls the light characteristic based on the data.

15. The toy vehicle booster of claim **14**, wherein the light characteristic is color and the processor causes the one or more lights to output a first light color when the speed at which the booster assembly will boost the toy vehicle is within a range of values and output a second light color when the speed at which the booster assembly will boost the toy vehicle is outside the range of values.

16. The toy vehicle booster of claim **13**, wherein the feedback portion comprises:

a lens or a display, wherein the processor causes the speed at which the booster assembly will boost the toy vehicle to be displayed on the display or the lens.

17. The toy vehicle booster of claim **13**, wherein the housing further comprises:

a portal receptacle and a portal connector, the portal receptacle being sized to receive a portal piece and the portal connector being configured to connect the portal piece to the feedback portion, wherein the portal piece includes the processor.

18. The toy vehicle booster of claim **17**, wherein the actuator assembly and the booster assembly are purely mechanical.

19. A toy vehicle booster comprising:

a housing that defines a passageway along which a toy vehicle may be boosted;

a launcher disposed in or on the housing, the launcher comprising:

an actuator assembly;

a booster assembly including at least one booster wheel that can engage the toy vehicle to boost the toy vehicle along the passageway; and

a rotational sensor configured to generate data representative of a rotational speed of the at least one booster wheel, wherein a communications module included in or connected to the toy vehicle booster that is configured to transmit the data to a computing device that is usable independently from the toy vehicle booster so that the computing device can: (a) provide visual feedback relating to a speed at which the booster assembly will boost the toy vehicle; (b) operate digital play features in a digital environment based on the data; or (c) perform (a) and (b) in combination.

20. The toy vehicle booster of claim **19**, wherein the housing further comprises:

a portal receptacle and a portal connector, the portal receptacle being sized to receive a portal piece and the portal connector being configured to connect the portal piece to the rotational sensor, wherein the portal piece includes the communications module.

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