US 20110152020A1

(19) United States

(12) Patent Application Publication

Brind'Amour et al.

(10) Pub. No.: US 2011/0152020 A1

(43) Pub. Date: Jun. 23, 2011

(54) **ELECTRONICALLY CONTROLLED CONTINUOUSLY VARIABLE TRANSMISSION WITH AXIALLY MOVABLE TORQUE TRANSMITTING MECHANISM**

(76) Inventors: **François Brind'Amour**, Drummondville (CA); **Hubert Roberge**, Drummondville (CA); **Lionel Thiébault**, Drummondville (CA)

(21) Appl. No.: **12/976,773**

(22) Filed: **Dec. 22, 2010**

**Related U.S. Application Data**

(60) Provisional application No. 61/289,857, filed on Dec. 23, 2009, provisional application No. 61/289,821, filed on Dec. 23, 2009, provisional application No. 61/289,850, filed on Dec. 23, 2009, provisional application No. 61/289,834, filed on Dec. 23, 2009.

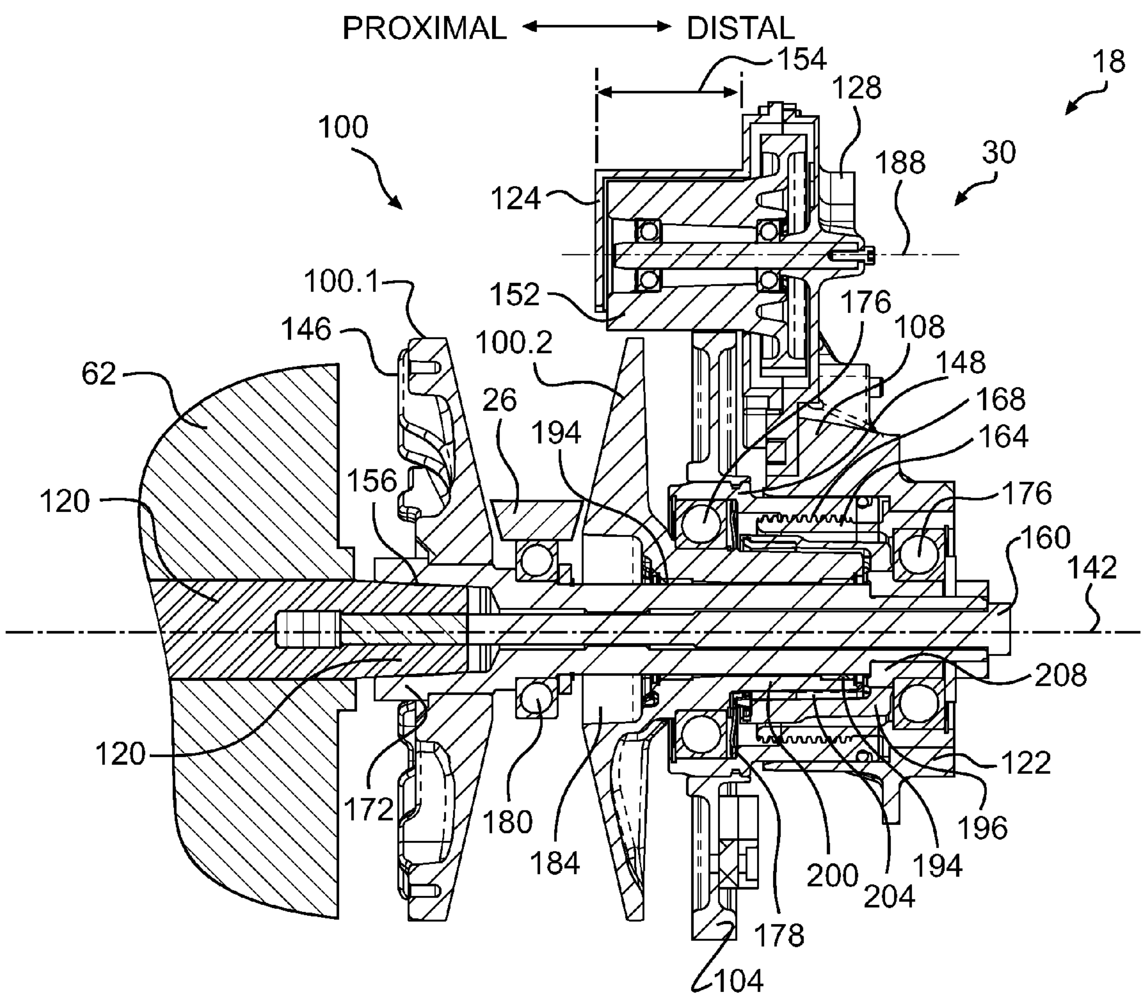
**Publication Classification**

(51) **Int. Cl.**
*F16H 55/56* (2006.01)

(52) **U.S. Cl.** ........................................................ **474/8**

(57) **ABSTRACT**

An electronically controlled CVT driving pulley comprising a pair of opposed sheaves adapted to rotate about a driving pulley rotation axis is hereby provided, one of the sheaves including an axial protrusion including a series of teeth cooperating with an axial bearing mechanism providing a relative axial displacement between the opposed sheaves and to transmit a torque between the opposed sheaves. A kit and a method for transmitting a torque between two opposed sheaves of an electronically controlled CVT is also provided.



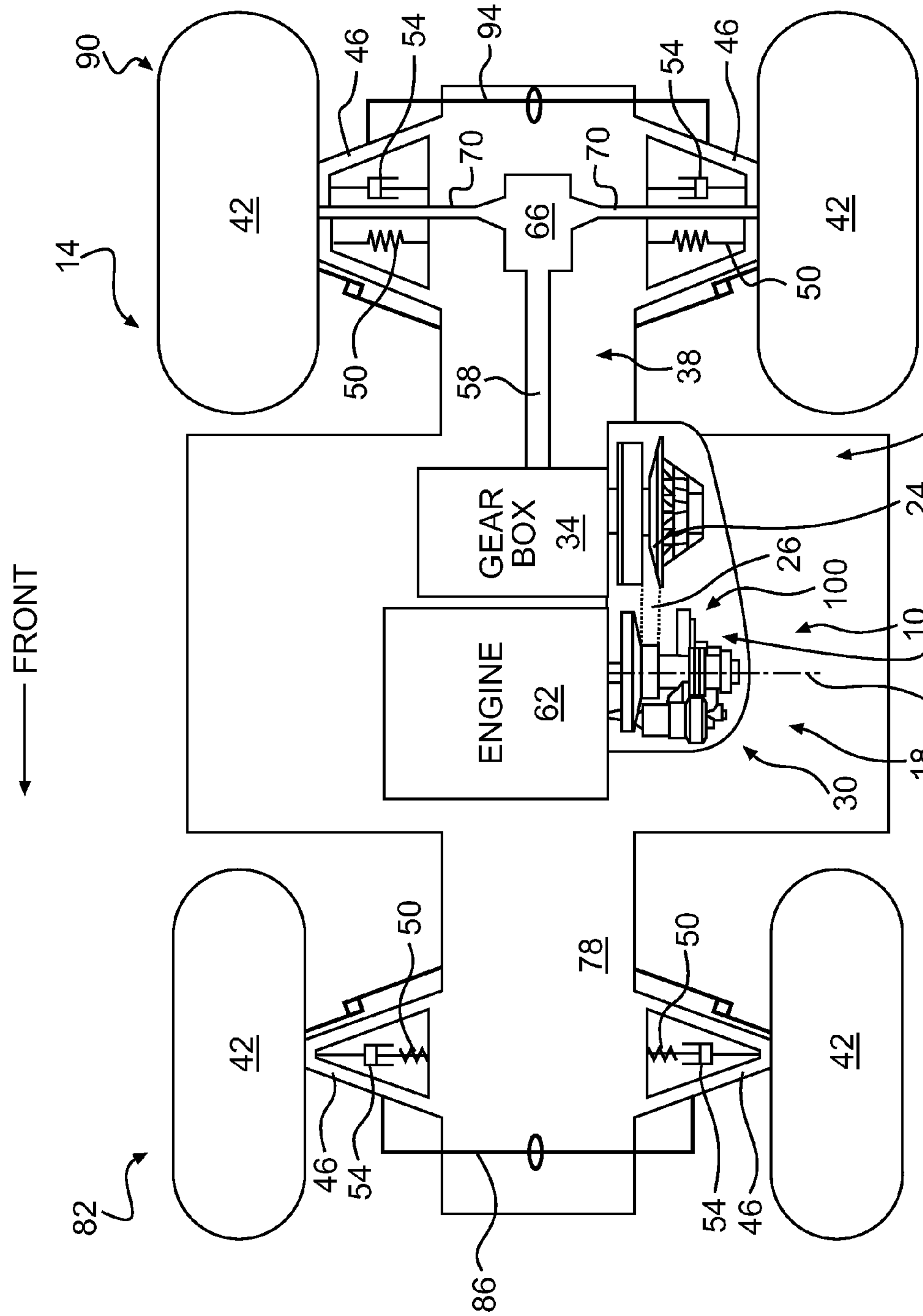

FRONT
GEAR BOX
34
ENGINE
62
66
78
42
46
50
54
58
70
38
22
24
26
100
10
286
142
18
30
14
90
94
82
86

FIG. 1

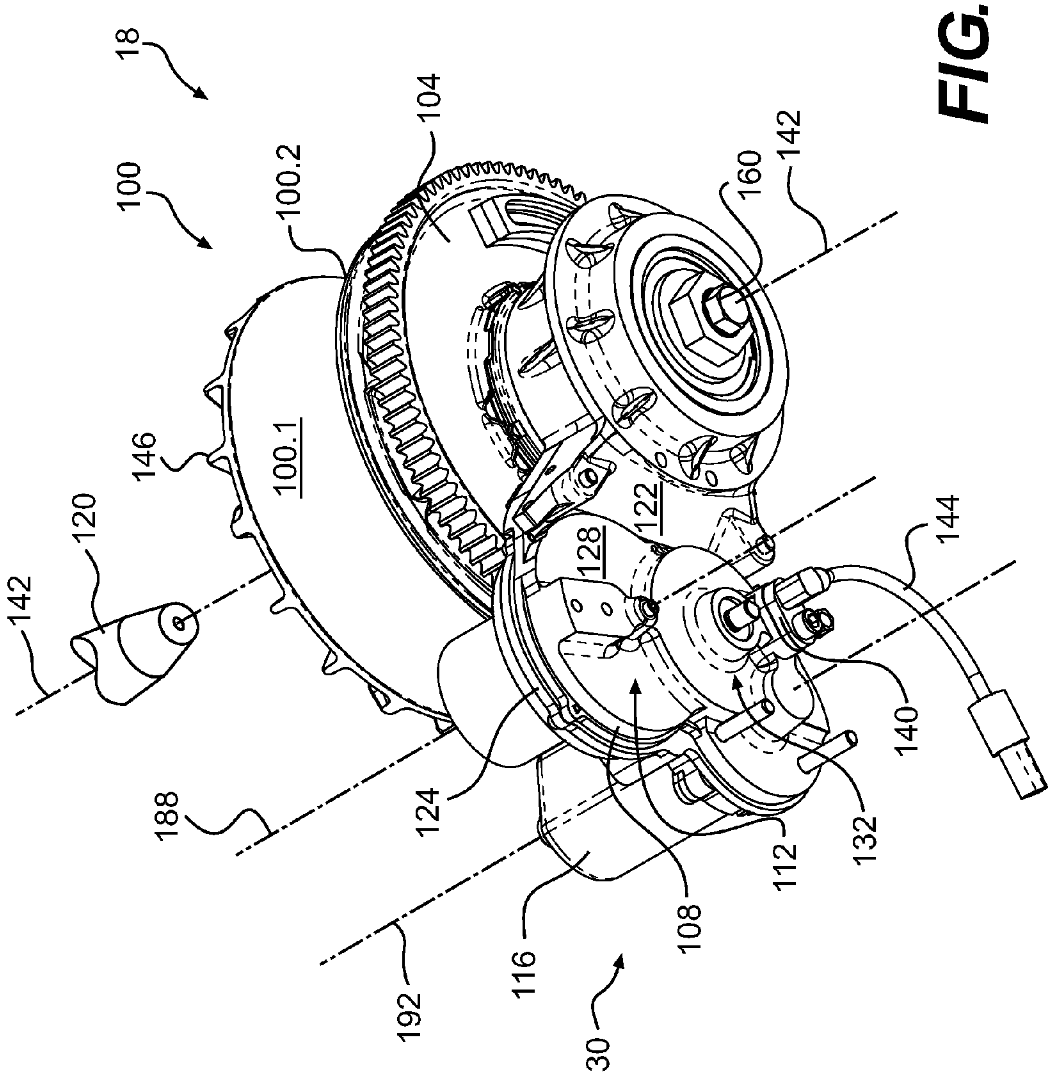

18
100
100.2
104
160
142
146
100.1
120
142
122
128
144
124
140
188
132
112
108
116
192
30

*FIG. 2*

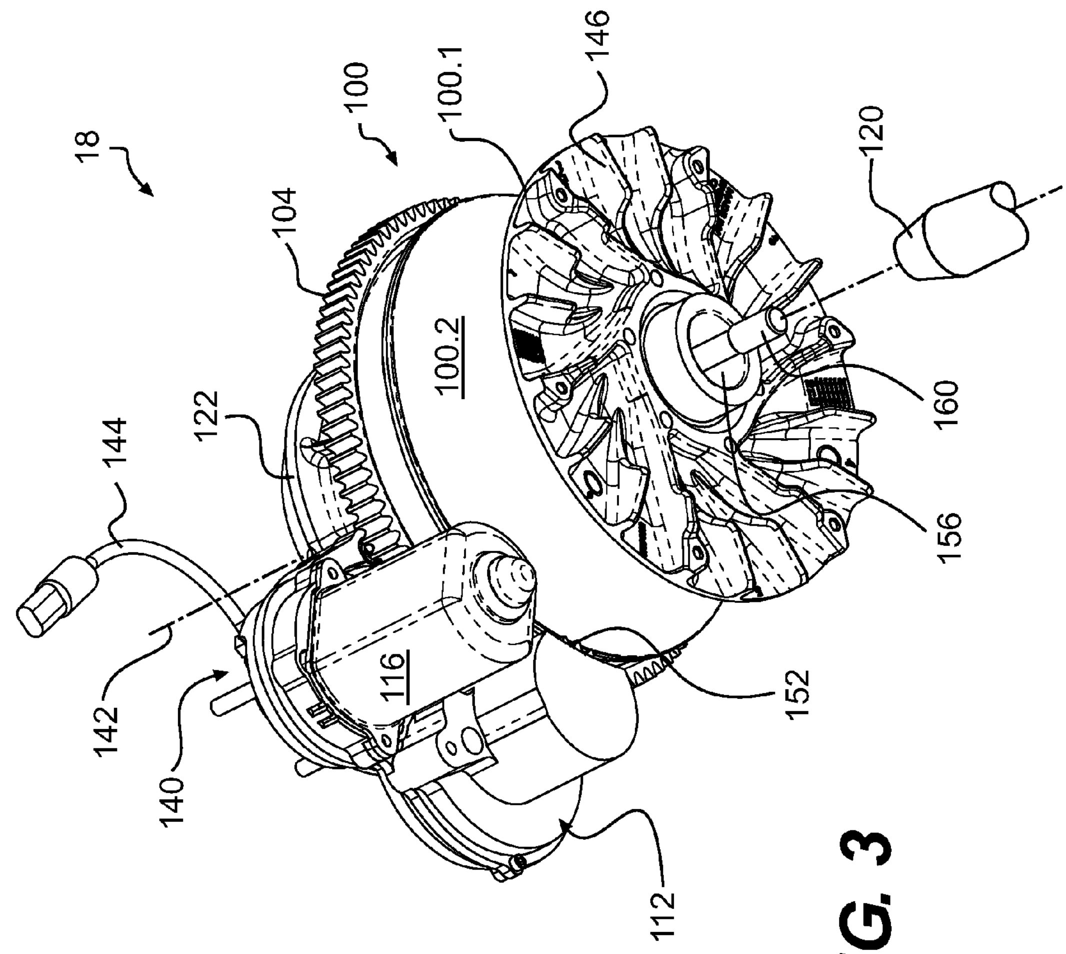



FIG. 3

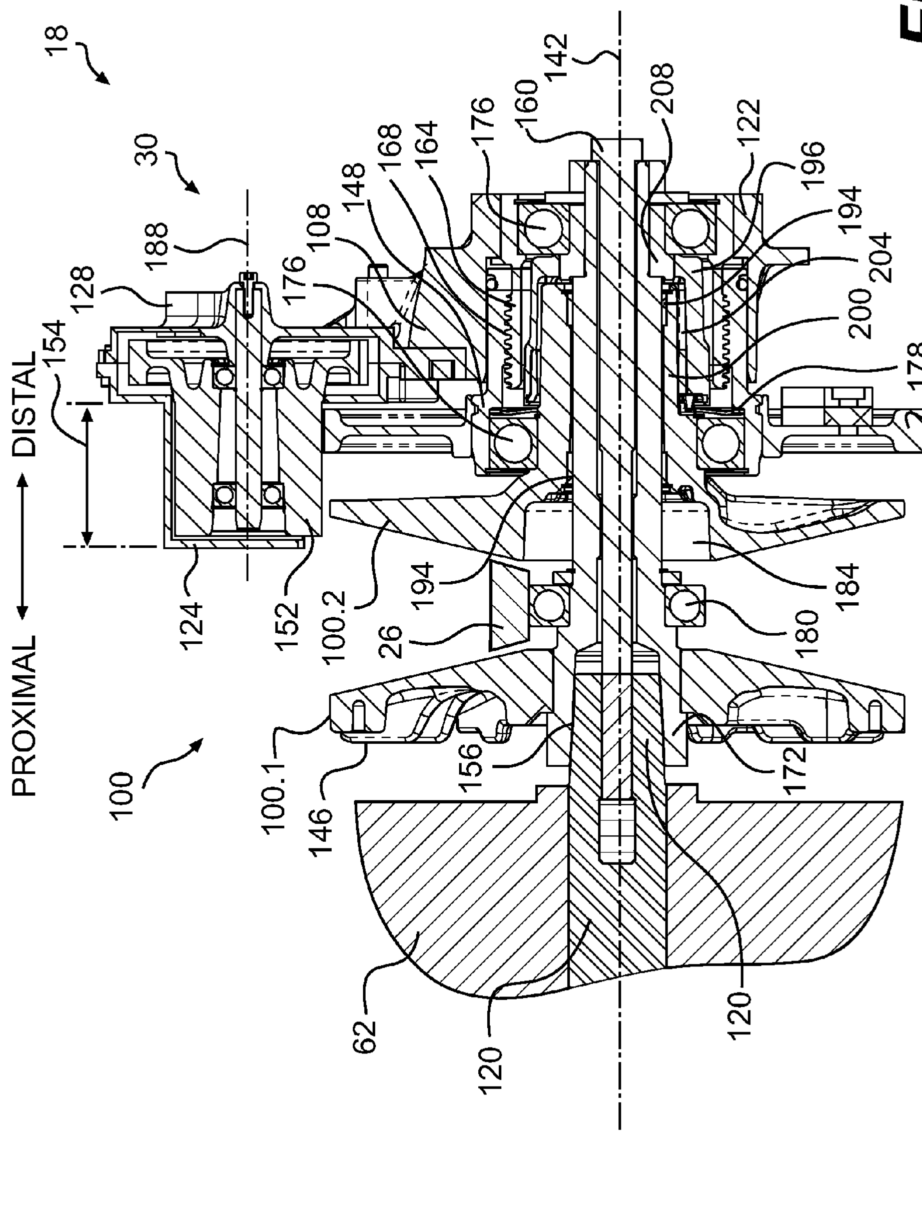

18
30
PROXIMAL
DISTAL
100
100.1
100.2
104
108
120
122
124
128
142
146
148
152
154
156
160
164
168
172
176
178
180
184
188
194
196
200
204
208
26
62

FIG. 4

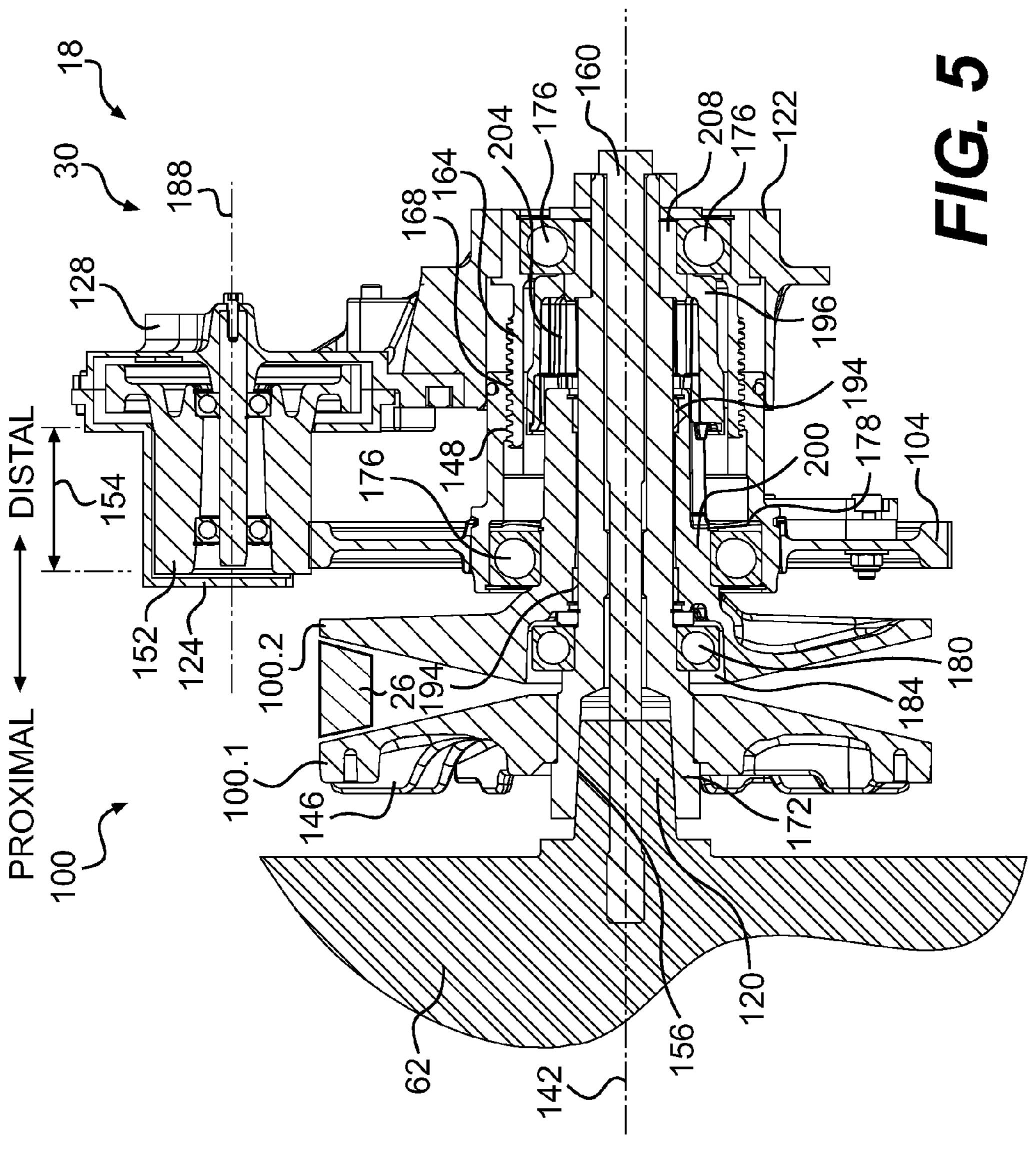

18
30
188
128
168
164
204
176
160
208
176
122
196
194
194
148
DISTAL
154
PROXIMAL
176
200
178
104
152
124
100.2
26
194
180
184
100.1
146
172
100
62
142
156
120

FIG. 5

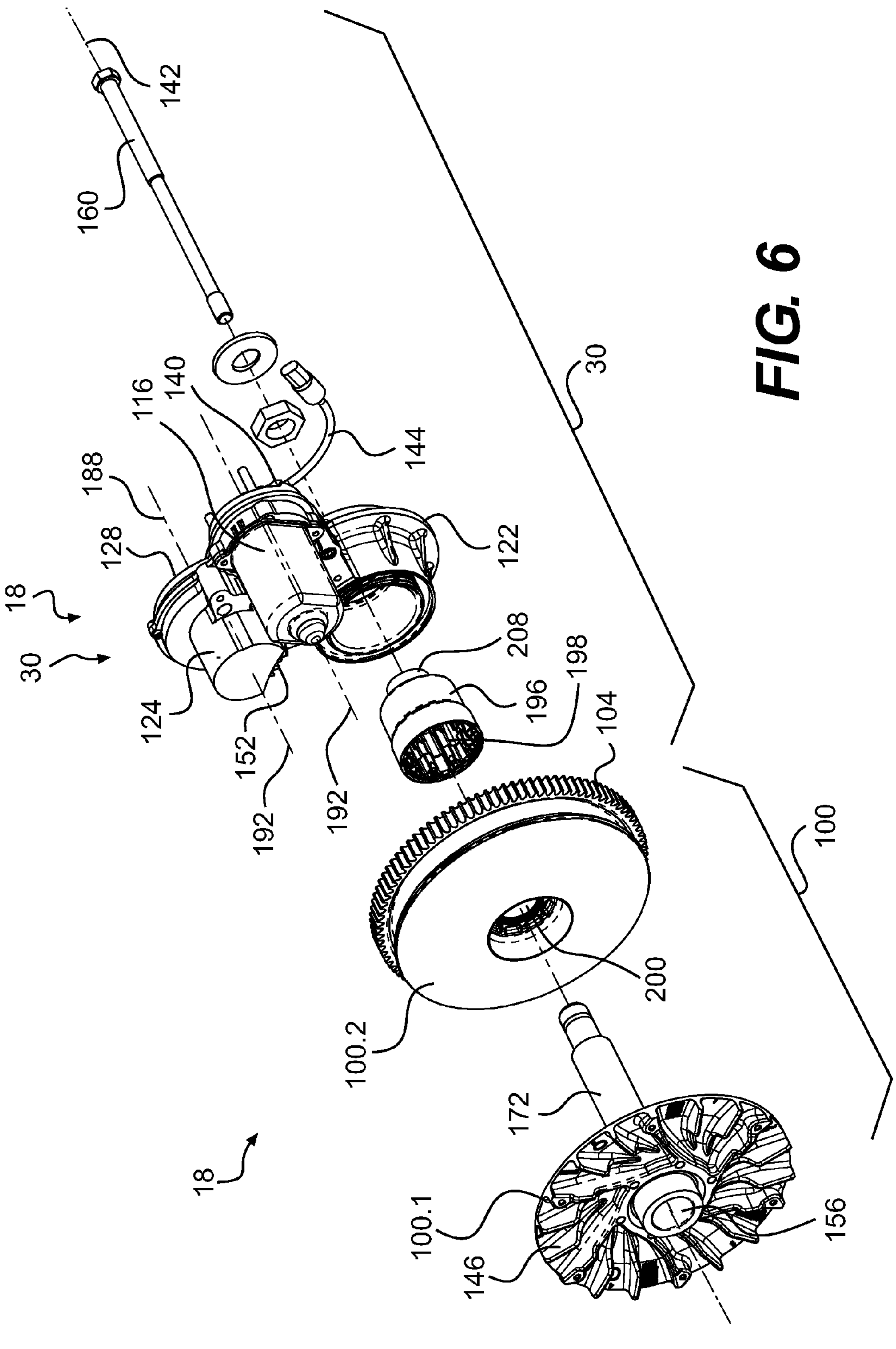

142
160
30
140
116
144
188
122
128
18
30
208
124
198
196
152
104
192
192
100
200
100.2
172
18
100.1
156
146

FIG. 6

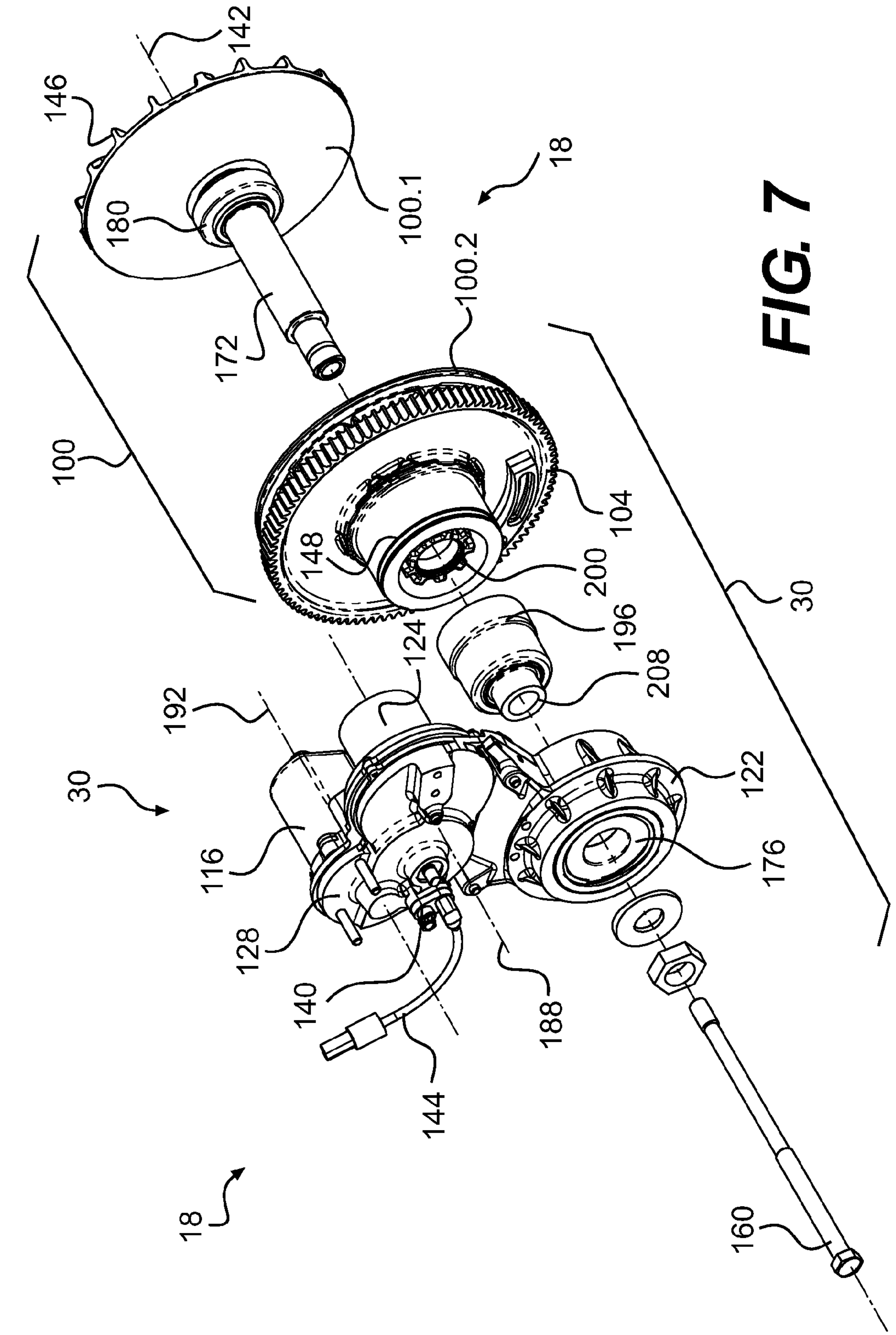

142
146
180
100.1
18
100.2
172
100
104
148
200
30
196
124
208
192
30
122
116
176
128
140
188
144
18
160

FIG. 7

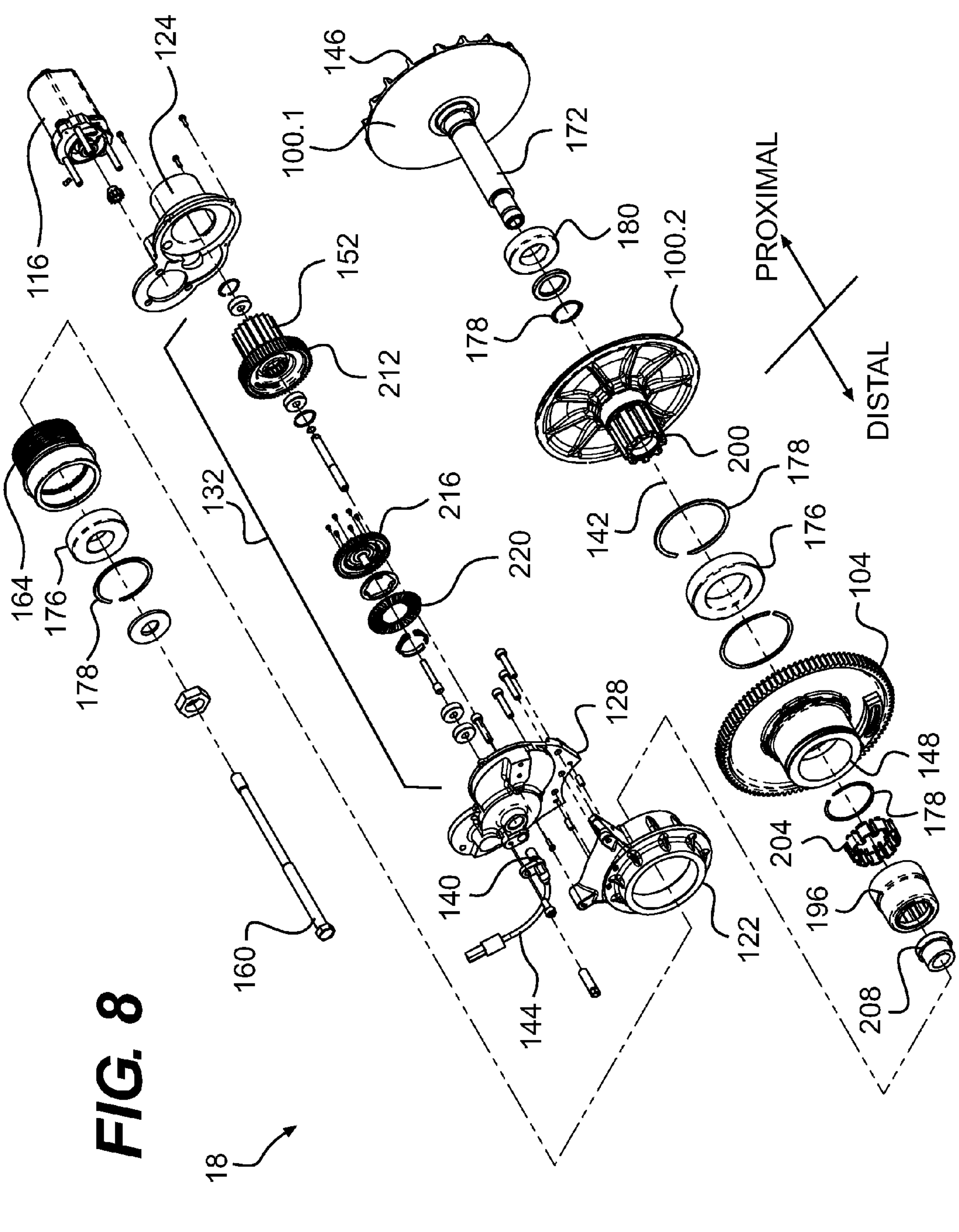

116
124
146
100.1
172
180
100.2
PROXIMAL
DISTAL
152
212
178
132
216
220
200
142
178
176
164
176
178
104
128
148
178
204
196
208
140
144
122
160
18

FIG. 8

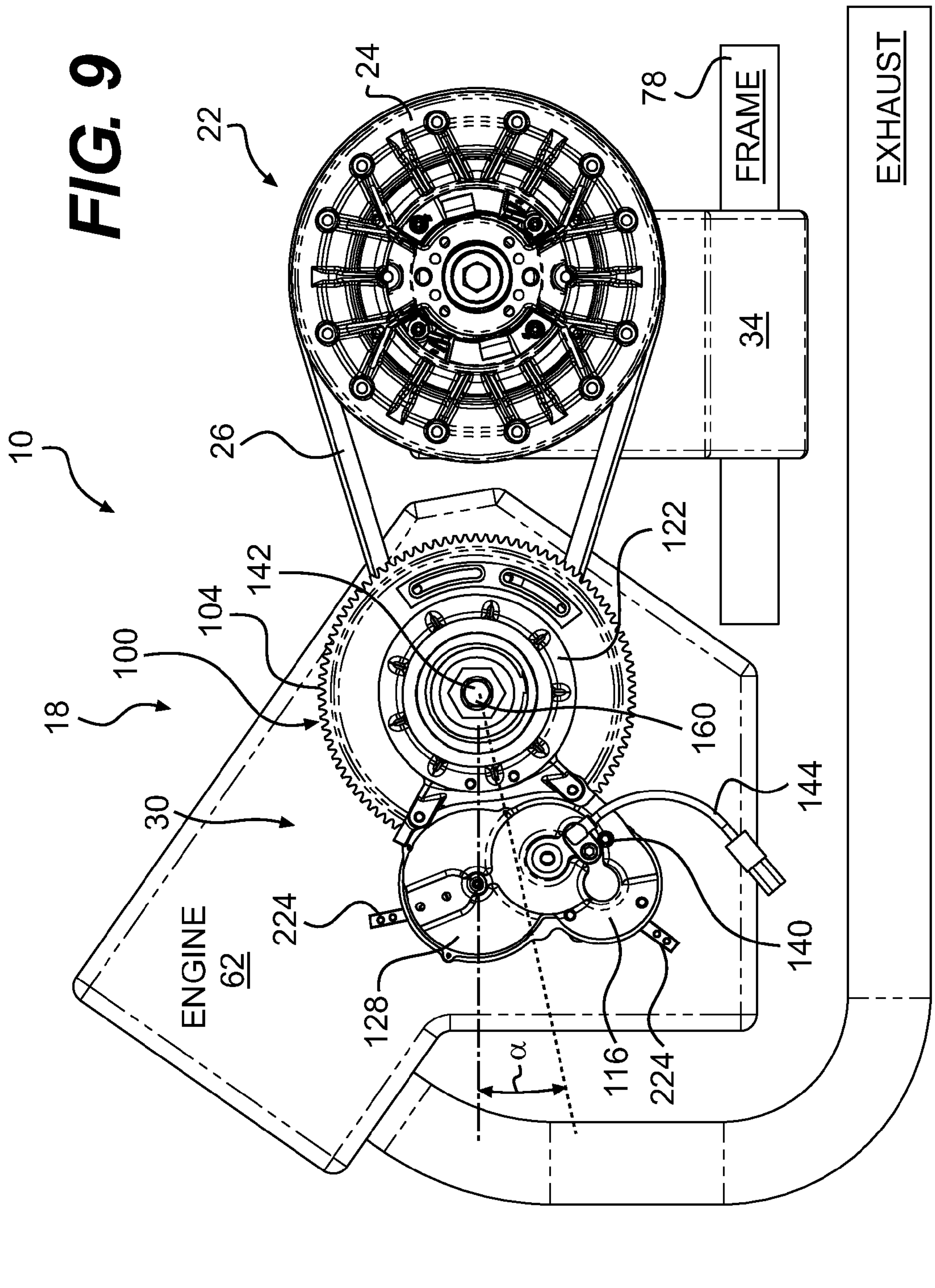

10
18
100
104
142
122
26
22
24
78
FRAME
EXHAUST
34
160
144
140
30
ENGINE
62
224
128
116
224
α

FIG. 9

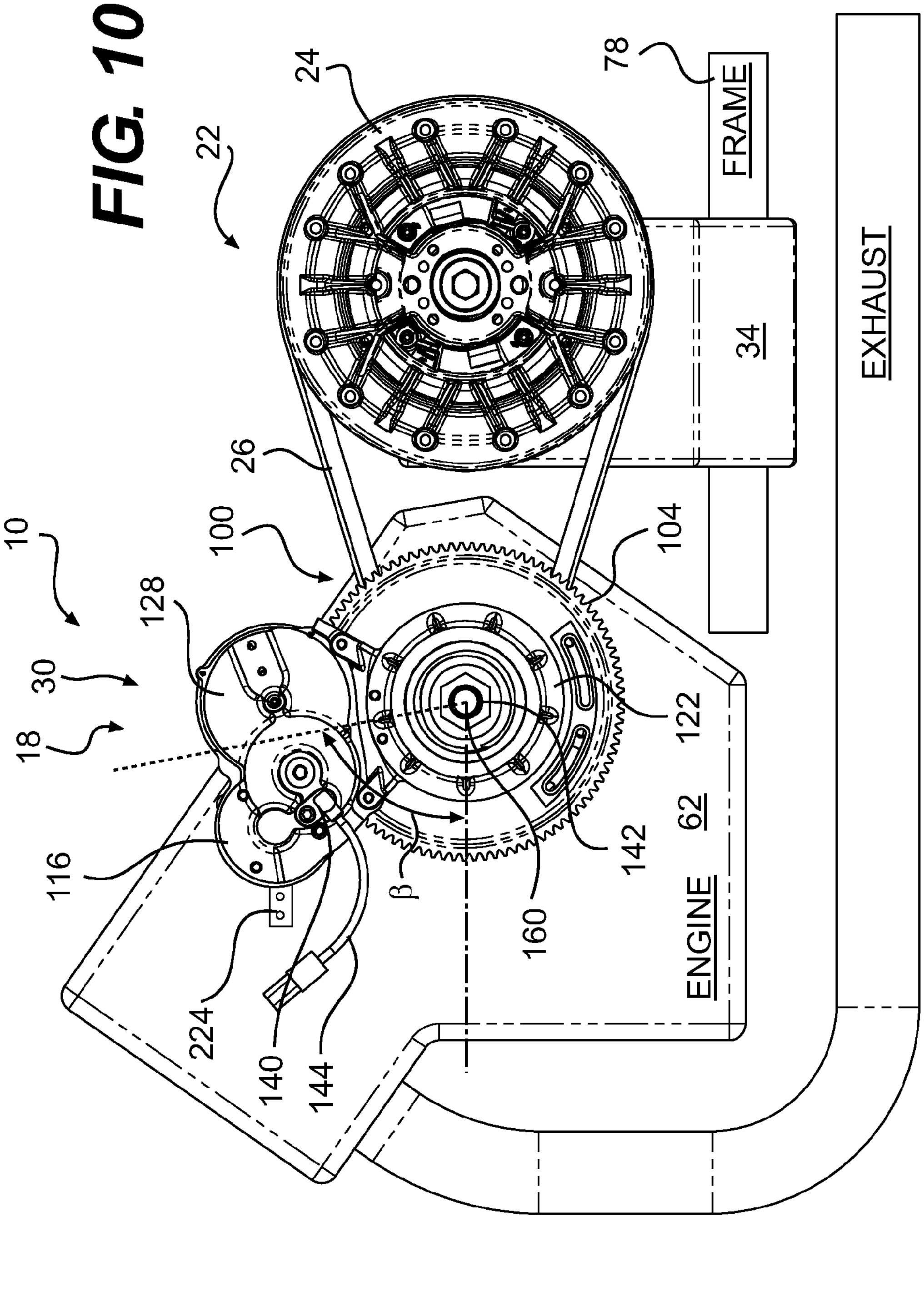

10
18
30
128
100
26
24
22
78
FRAME
34
EXHAUST
104
122
142
62
ENGINE
160
β
116
224
140
144

FIG. 10

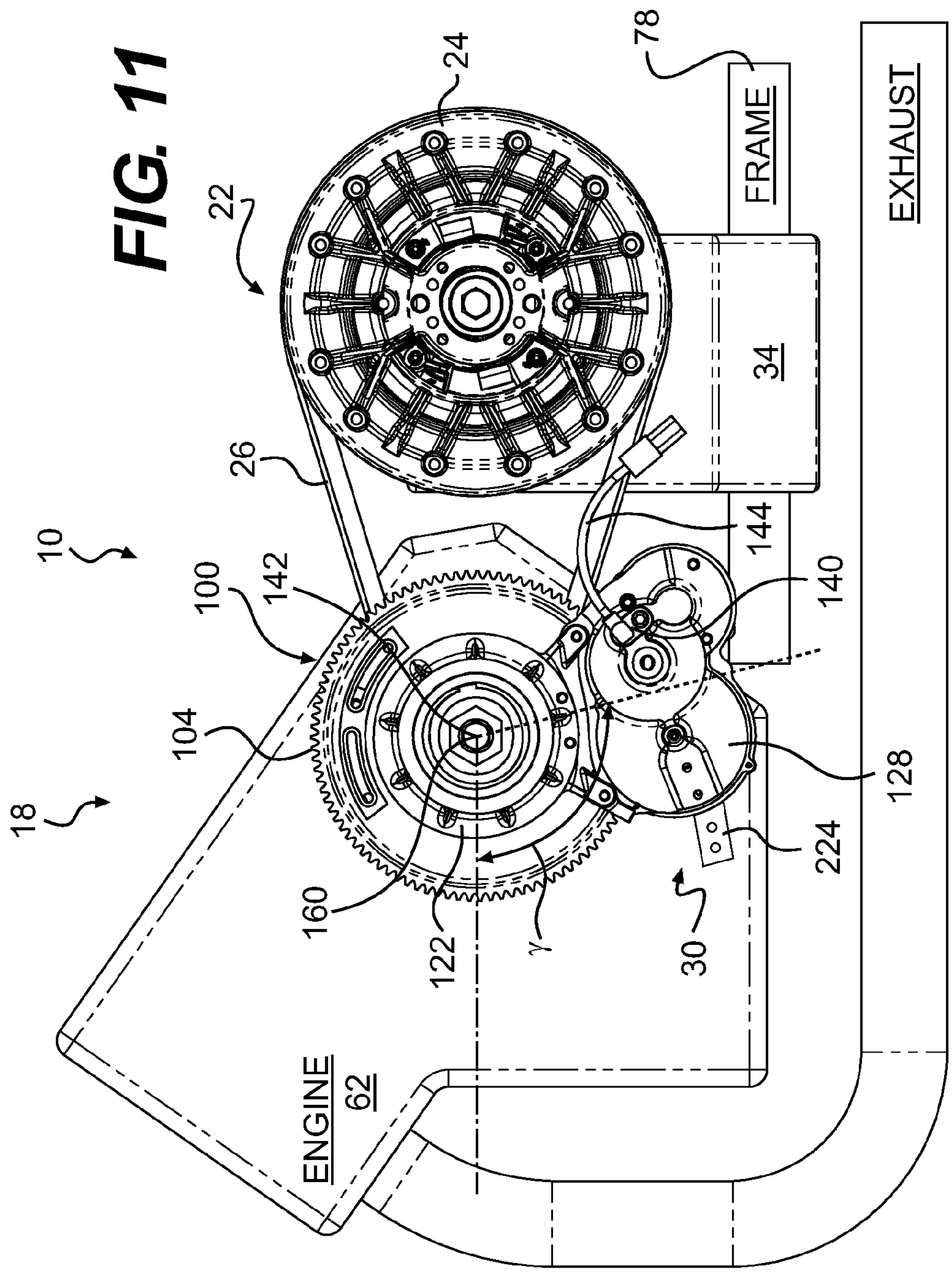

10
18
22
24
26
30
34
78
100
104
122
128
140
142
144
160
224
γ
ENGINE
62
FRAME
EXHAUST

FIG. 11

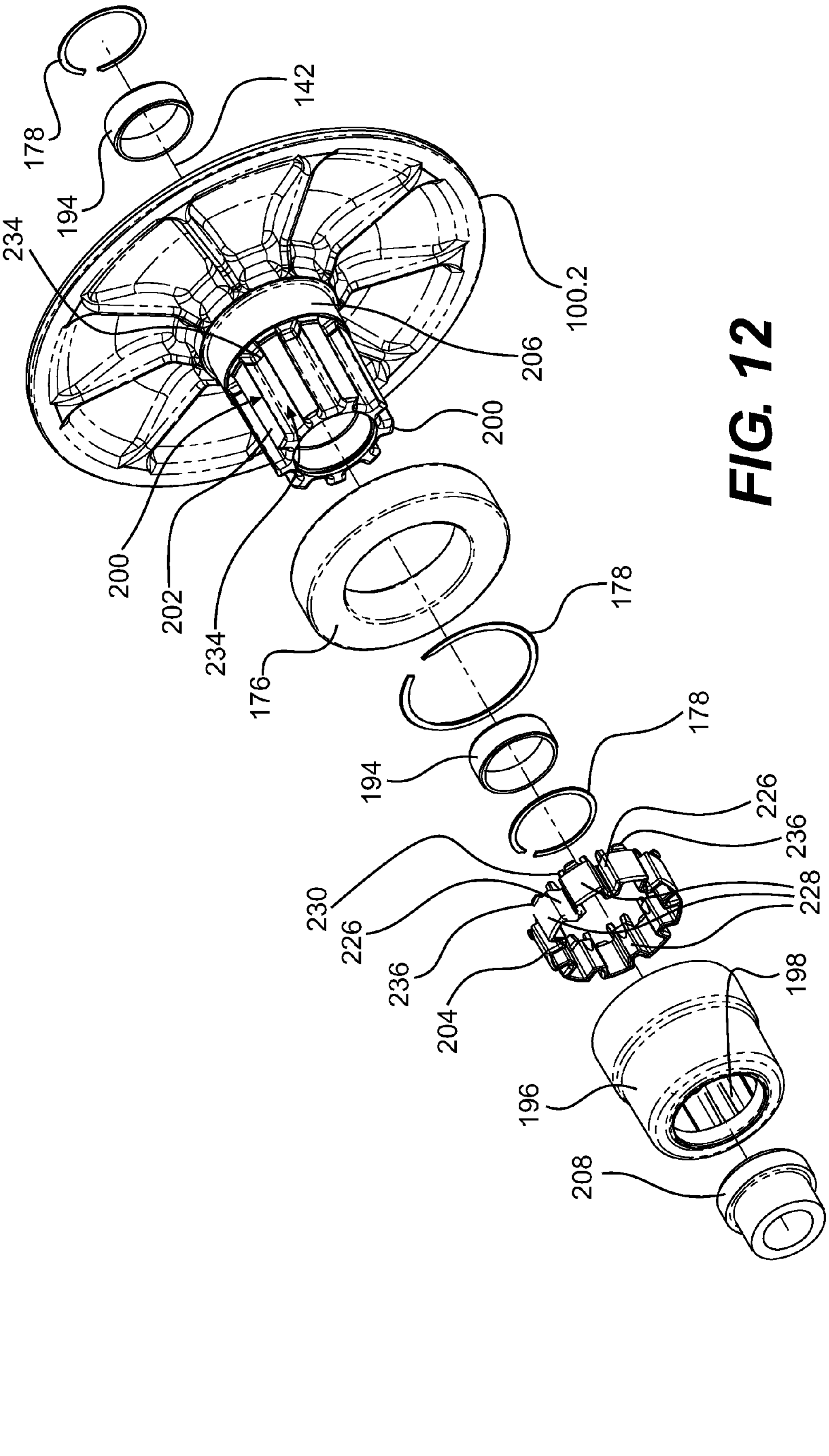

178
142
194
234
100.2
206
200
200
202
234
176
178
194
178
226
236
230
226
228
236
204
198
196
208

FIG. 12

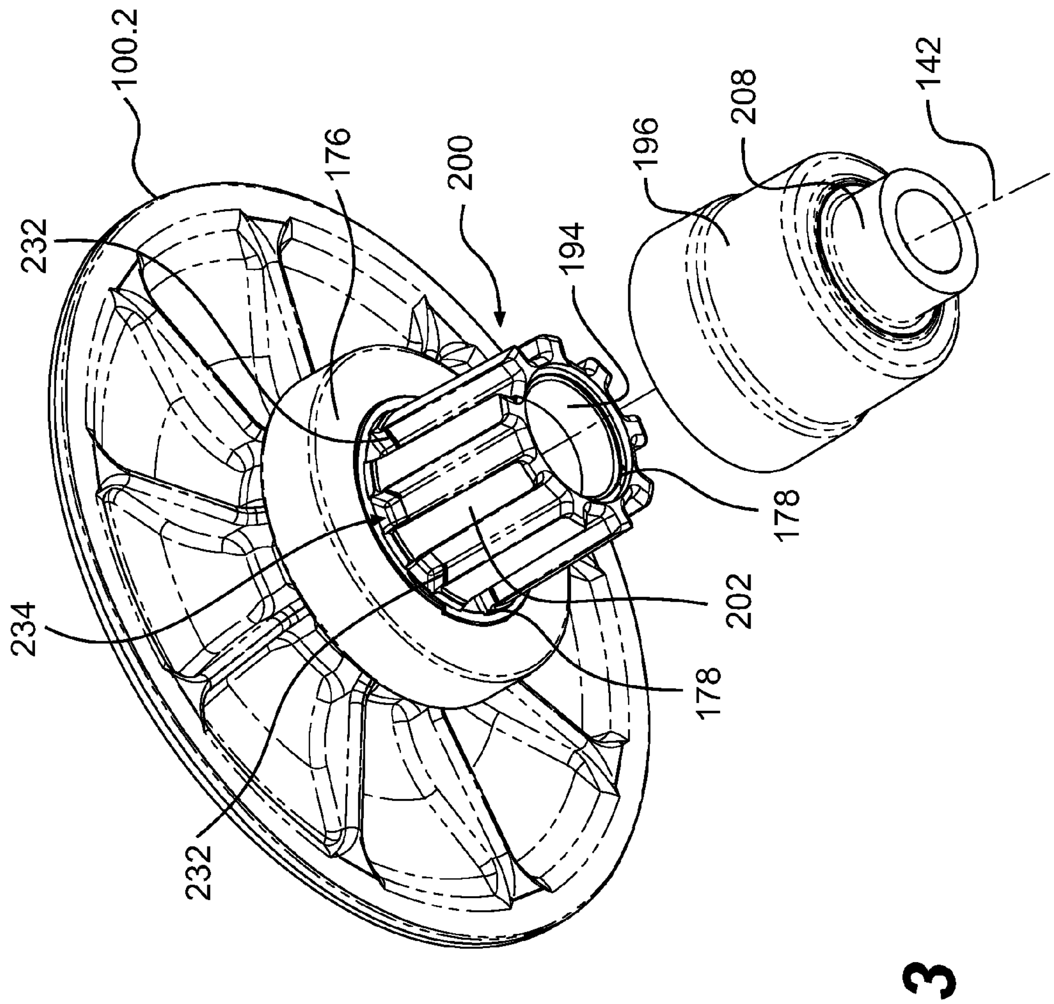



FIG. 13

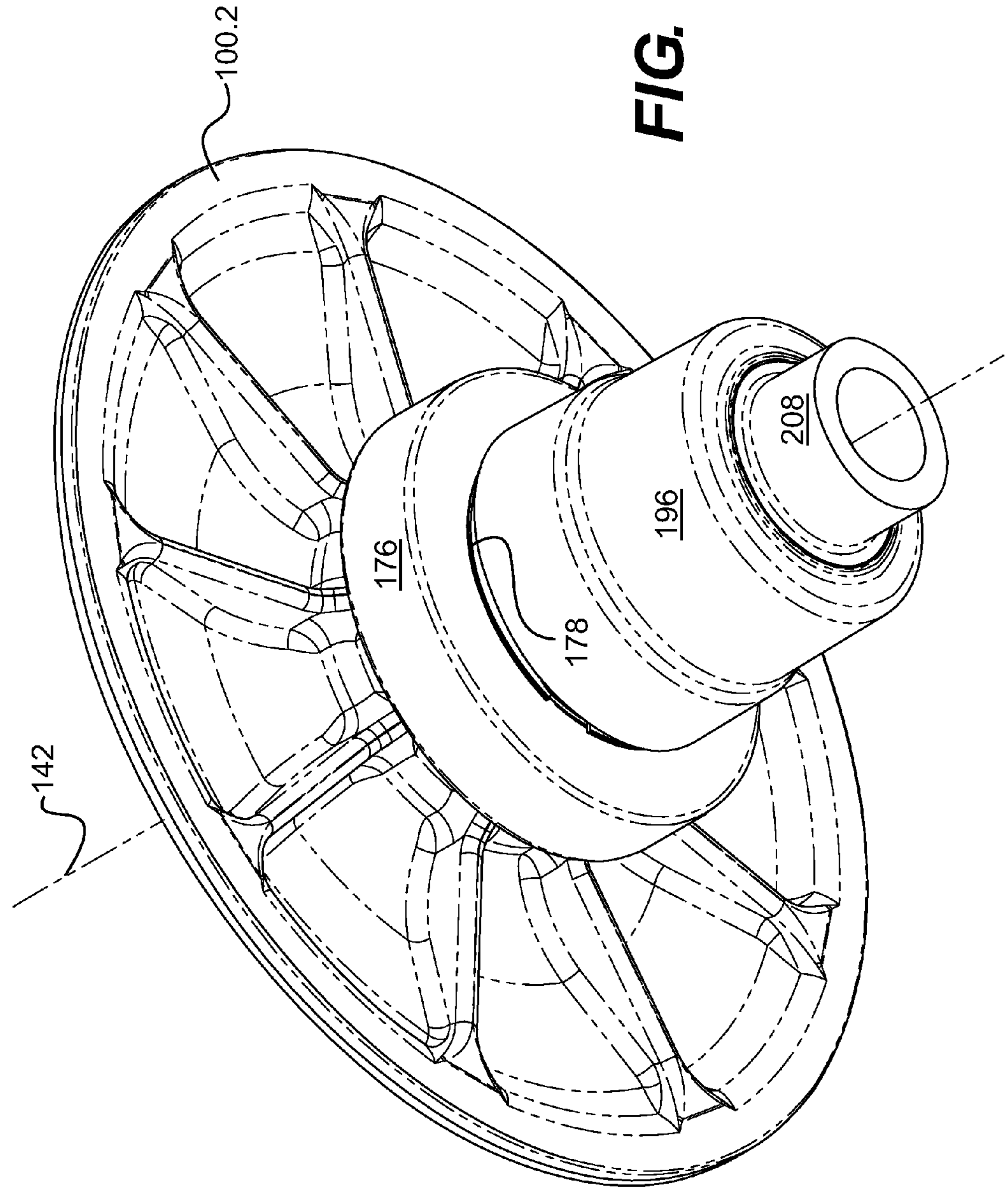
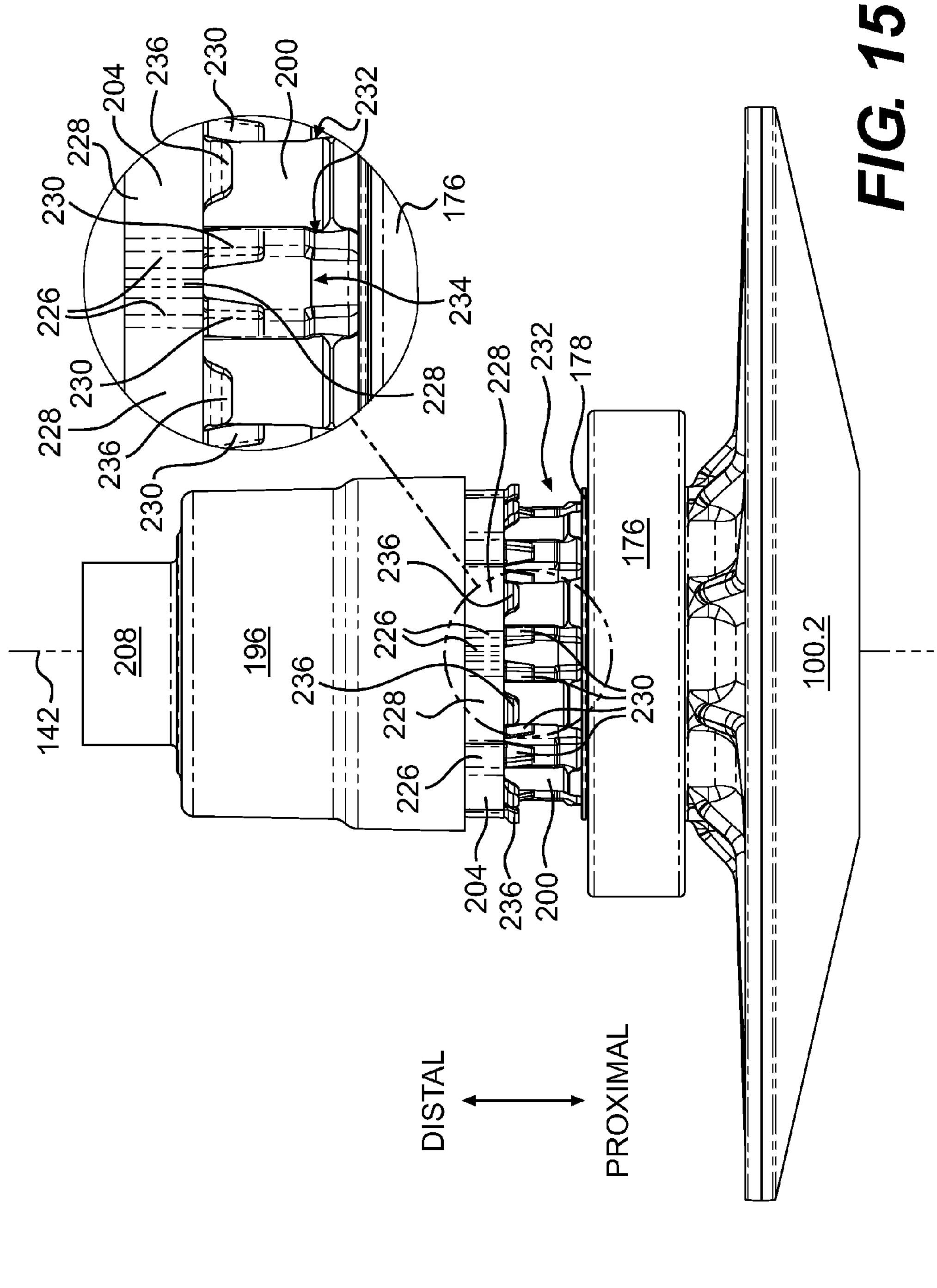
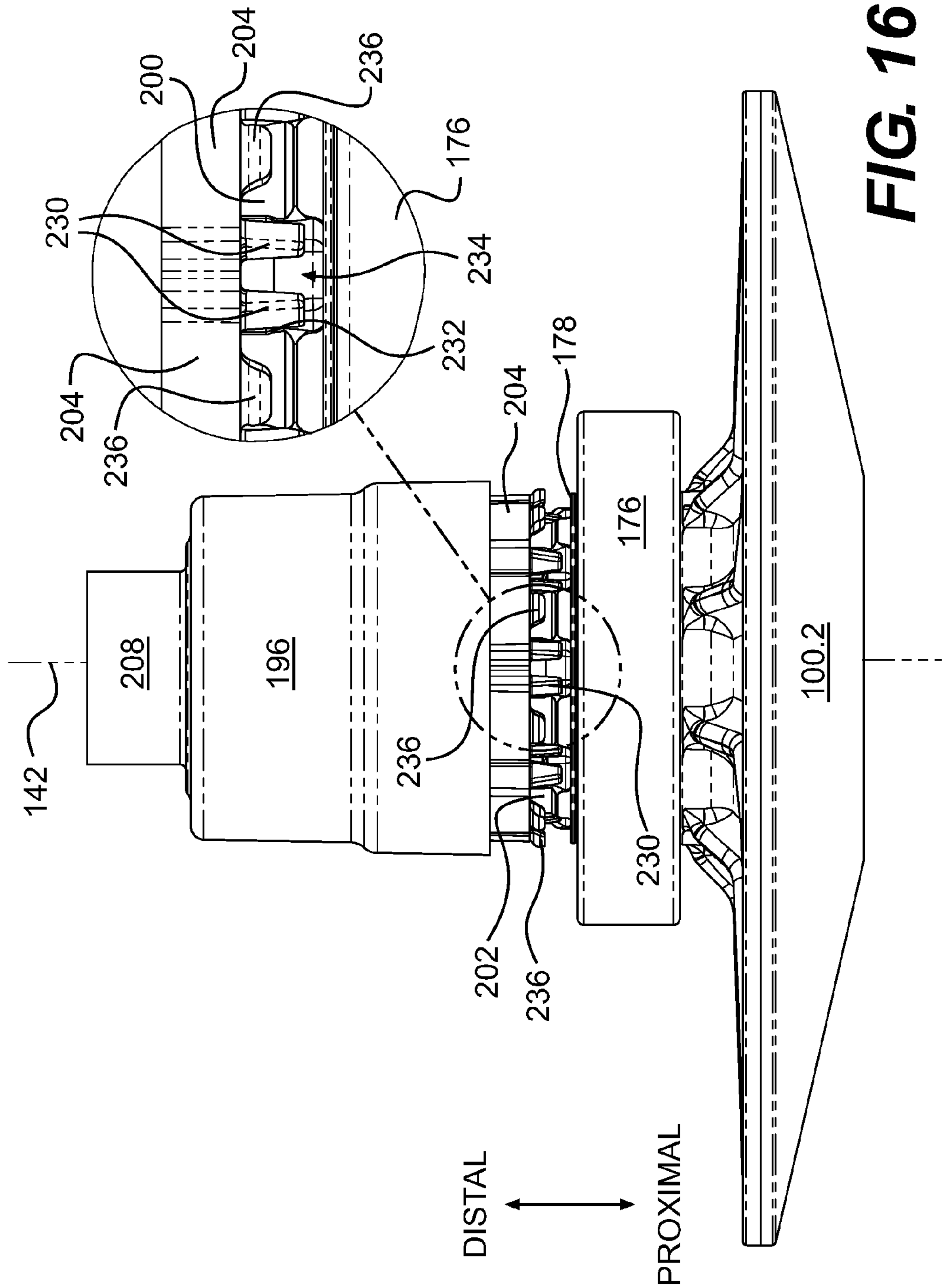



FIG. 14



DISTAL
PROXIMAL
142
208
196
100.2
176
178
232
228
236
226
230
204
200
234


FIG. 15



142
208
196
176
100.2
178
204
202
236
230
200
232
234
DISTAL
PROXIMAL


FIG. 16

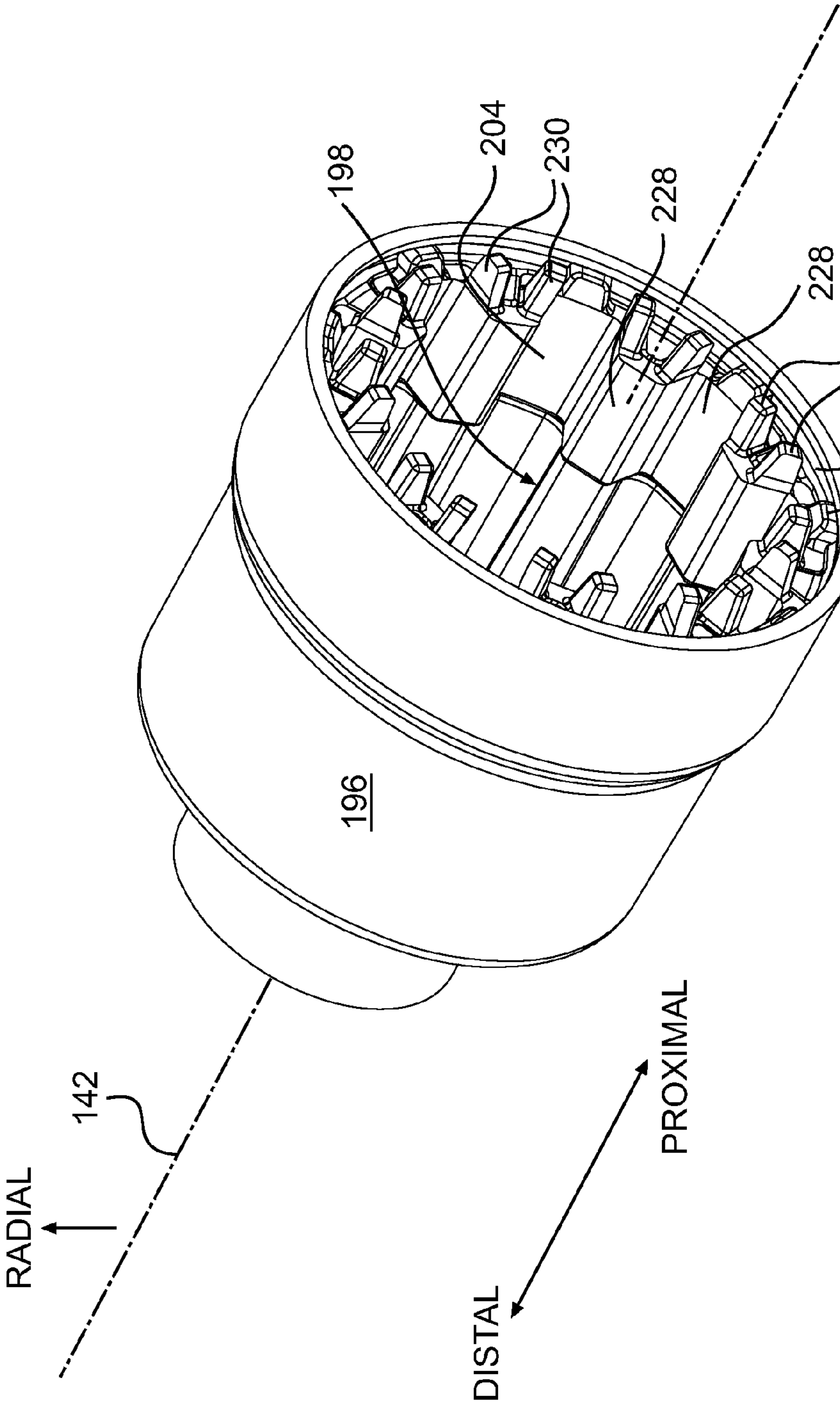

198
204
230
230
228
228
230
230
240
236
196
142
RADIAL
DISTAL
PROXIMAL

FIG. 17

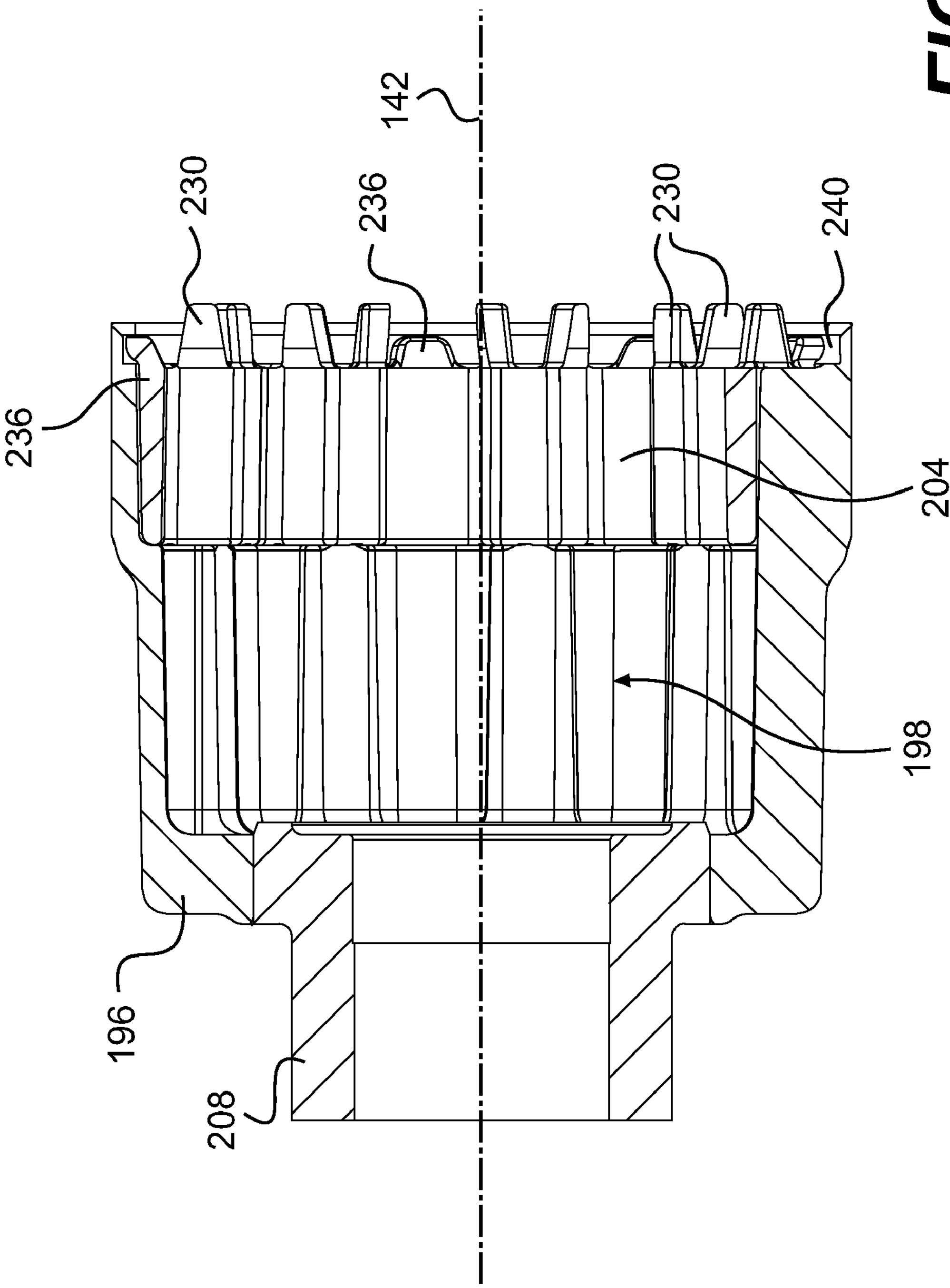



FIG. 18

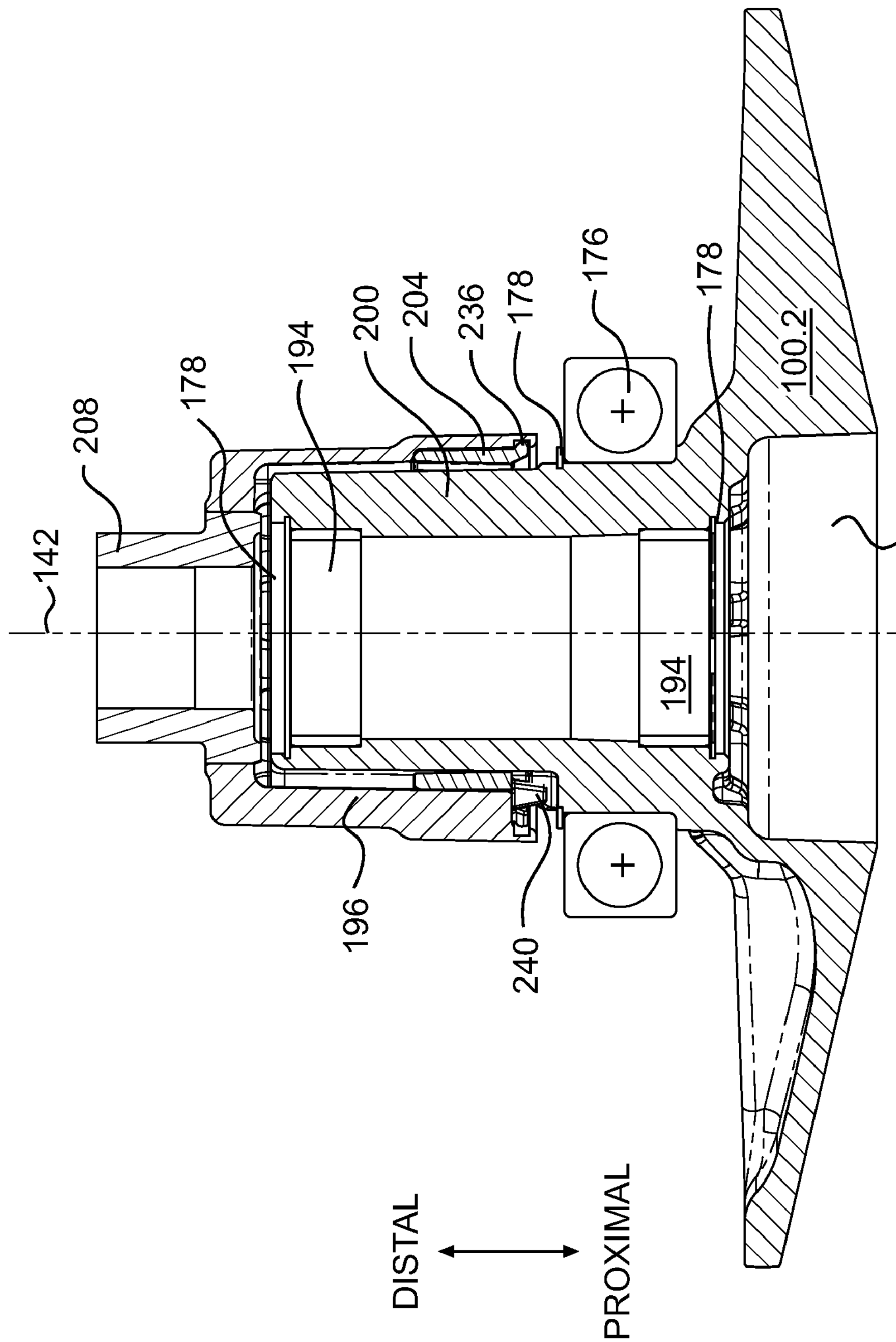

208
142
178
194
200
204
236
178
176
178
100.2
184
194
196
240
DISTAL
PROXIMAL

FIG. 19

# ELECTRONICALLY CONTROLLED CONTINUOUSLY VARIABLE TRANSMISSION WITH AXIALLY MOVABLE TORQUE TRANSMITTING MECHANISM

## CROSS-REFERENCE

**[0001]** The present United States patent application relates to and claims priority from U.S. provisional patent application No. 61/289,857, filed Dec. 23, 2009, entitled TORQUE LIMITING SYSTEM AND METHOD, Unites States provisional patent application No. 61/289,821, filed Dec. 23, 2009, entitled POLAR POSITIONNABLE CONTINUOUSLY VARIABLE TRANSMISSION, Unites States provisional patent application No. 61/289,834, filed Dec. 23, 2009, entitled GEAR SECURING MECHANISM, KIT AND METHOD THEREOF, and from Unites States provisional patent application No. 61/289,850, filed Dec. 23, 2009, entitled TORQUE TRANSMITTING COUPLING, which all three documents are incorporated herein by reference in their entirety.

## TECHNICAL FIELD

**[0002]** The technical field relates to electrically controlled continuously variable transmissions. More precisely, the present technical field relates to electrically controlled continuously variable transmissions including a torque transmitting system adapted to allow axial movements between continuously variable transmissions sheaves.

## BACKGROUND

**[0003]** Continuously variable transmissions (CVTs) are commonly used on a wide range of vehicles, such as small cars or trucks, snowmobiles, golf carts, scooters, all-terrain vehicles (ATV), etc. They often comprise a driving pulley mechanically connected to a motor, a driven pulley mechanically connected to wheels or caterpillars, possibly through another mechanical device such as a gearbox, a drive train and a trapezoidal drivebelt transmitting torque between the driving pulley and the driven pulley. A CVT changes the ratio within certain limits as required by the operating conditions to yield a desired motor rotational speed for a given driven pulley rotational speed, the latter being generally proportional to the vehicle speed. A CVT may be used with all kinds of motors, for instance internal combustion engines, electric motors, windmills, etc. CVTs can also be used with other machines that are not vehicles.

**[0004]** Each pulley of a CVT comprises two members having opposite conical surfaces, which members are called sheaves. One sheave, sometimes called "fixed sheave", can be rigidly connected to one end of a supporting shaft while the other sheave, sometimes called "movable sheave", can be free to slide and/or rotate with reference to the fixed sheave by means of bushings or the like. The conical surfaces of the sheaves apply an axial force on the drivebelt. Moving the sheaves axially relative to each other changes the drivebelt operating diameter, thus the ratio of the CVT.

**[0005]** In order to transmit the motor torque, an axial force has to be applied in the driving and the driven pulleys. These axial forces can be generated by a plurality of possible mechanisms or arrangements. In a legacy mechanical CVT, the axial force in the driving pulley is often generated using centrifugal weights, spring and ramps. In a legacy driven pulley, this force is often generated using cam surfaces and a spring.

**[0006]** Generally, at a low vehicle speed, the operating diameter of the drivebelt at the driving pulley is minimal and the operating diameter at the driven pulley is maximal. This is referred to as the minimum ratio or the minimum ratio condition since there is the minimum number of rotations or fraction of rotation of the driven pulley for each full rotation of the driving pulley.

**[0007]** As the vehicle speed increases, so does the driven pulley rotational speed. For a given operating condition, a certain motor rotational speed is desired, thus a desired ratio can be calculated. The CVT actuation mechanism is provided to set the CVT to the appropriate ratio.

**[0008]** Generally, when the rotational speed of the driving pulley increases, its movable sheave moves closer to the fixed sheave thereof under the effect of an actuation mechanism, for instance a centrifugal mechanism or another kind of actuation mechanism. This constrains the drivebelt to wind on a larger diameter at the driving pulley. The drivebelt then exerts a radial force on the sheaves of the driven pulley in addition to the tangential driving force by which the torque received from the motor is transmitted. This radial force urges the movable sheave of the driven pulley away from the fixed sheave thereof, thereby constraining the drivebelt to wind on a smaller diameter at the driven pulley. A return force, for instance a return force generated by a spring of the driven pulley and/or by another biasing mechanism, often counterbalances the radial force. It may also be counterbalanced by a force generated by the axial reaction of the torque applied by the drivebelt on the driven pulley, which force often results from the presence of a cam system and/or another biasing mechanism that tend(s) to move the movable sheave towards the fixed sheave as the torque increases. A cam system may comprise a plurality of ramp surfaces on which respective followers can be engaged. The followers can be sliding buttons or rollers, for instance. The set of ramp surfaces or the set of followers is attached to the movable sheave. The other set is directly or indirectly attached to the fixed sheave and is in a torque-transmitting engagement with the main shaft supporting the driven pulley. The closing effect of the cam system on the drivebelt tension is then somewhat proportional to the torque received from the motor.

**[0009]** Generally, at the maximum vehicle speed, the ratio is maximum as there is the maximum number of rotations or fraction of rotation of the driven pulley for each full rotation of the driving pulley.

**[0010]** When the vehicle speed decreases, the rotational speed of the driving pulley eventually decreases as well since the rotational speed of the motor will decrease at one point. Ultimately, there is a decrease of the winding diameter at the driving pulley and a decrease of the radial force exerted by the drivebelt on the sheaves of the driven pulley. The driven pulley is then allowed to have a larger winding diameter as the spring and/or another biasing mechanism move(s) its movable sheave closer the fixed sheave.

**[0011]** Some CVTs are provided with an integrated clutch function. The clutch function can be on the drivebelt or be provided by a mechanism incorporated in the CVT. For instance, when the CVT has a clutch function on the drivebelt, the opposite walls of the fixed sheave and the movable sheave of the rotating driving pulley can be designed to be sufficiently apart that they are not in a driving engagement with the sides of the drivebelt. The drivebelt is then not moving and some models of driving pulleys have a bearing provided between the two sheaves. The outer race of such bearing supports the drivebelt when the driving pulley is in a disengaged position. Then, when the operating conditions are such that clutching is required, the actuation mechanism of the driving pulley moves the sheave walls closer relative to each other. The sheave walls eventually make contact with the sides of the drivebelt. At this point, an axial force is applied by the actuation mechanism on the drivebelt. The amount of torque transferred to the drivebelt is somewhat related to this axial force applied by the actuation mechanism. At one point, enough friction/force is generated between the sheave walls and the drivebelt to produce a significant force transfer between the driveshaft and the drivebelt, thereby causing torque from the motor to be transferred as a driving force on the drivebelt. This driving force is transferred to the driven pulley of the CVT.

**[0012]** Generally, torque applied on the drivebelt will result in vehicle acceleration at some point. The drivebelt will then accelerate in relation to vehicle speed. At start-up, the slippage between the driving pulley sheaves and the drivebelt is high, but decreases as the drivebelt accelerates, to the point where it becomes negligible and the driving pulley is considered fully engaged.

**[0013]** Electronically controlled CVTs are advantageous because they do not relate on the centrifugal force generated by the rotation of the sheaves like legacy CVT mechanical actuation mechanisms. In contrast, an electrically actuated CVT uses an electric motor and an adapted gearbox to set the CVT ratio. This provides the flexibility of using a specific CVT ratio in reaction of predetermined conditions regardless of the centrifugal force applied on the pulleys. Despite the advantages provided by an electronically controlled CVT, it is appreciated that the assembly of an electronically controlled CVT represents some challenges or benefits not encountered with legacy CVTs.

**[0014]** An electronically controlled CVT uses an assisting mechanism to manage the CVT ratio by changing the width of the driving pulley without solely relating on centrifugal forces. The assisting mechanism can be secured to the driving pulley preferably on the side opposed to the engine. The assisting mechanism can be operatively secured to the engine's drive axle without rotating therewith. At least a portion of the assisting mechanism moves along the engine's drive axle with the change in width between the driving pulley sheaves. This combined movement requires an adequate mechanical structure adapted to sustain fast repetitive movements under significant vibrations and mechanical loads.

**[0015]** Gears and axles are arranged in a complex layout where small volume and low weight are key. Other considerations also need to be kept into account. For instance, the CVT should be easy to assemble, inexpensive to produce and minimize the chances of errors during the assembly process. Moreover, vibrations and rattles should be kept to a minimum if not prevented. It is therefore desirable to have vibration-damping parts intervening between two CVT portions having relative axial movements therebetween.

**[0016]** Mechanical securing mechanisms, like splines, adapted to join drive parts together and allow relative longitudinal movements therebetween are generally made of steel and are significantly heavy. Moreover, splines are not intended to sustain repetitive relative movements between the joined parts and tend to wear rapidly in addition to be expensive to produce. Additionally, the design of components should consider a variety of criterions like the mechanical resistance, the weight, the method of assembly, and the material in addition to the effect on the cost of the assembled final component.

**[0017]** Moreover, CVTs are intended to be operatively installed in a variety of layouts. CVTs designed to be connected to an engine in a precise arrangement are adding undesired restrictions to their possible practical uses given the respective particularities of each application.

**[0018]** Therefore, a need has been felt for an improved assisted CVT over the prior art. It is therefore desirable to provide an assisted CVT having a structure providing relative movements between moveable parts of the CVT and capable of sustaining strong vibrations and mechanical stresses while inducing reduced or no backlash therebetween. Another need has been felt over the existing art for an assisted CVT adapted to be installed in a variety of positions to accommodate a plurality of operating layouts.

## SUMMARY

**[0019]** It is one aspect of the present invention to alleviate one or more of the drawbacks of the background art by addressing one or more of the existing needs in the art.

**[0020]** At least one embodiment of the present invention provides a slider member adapted to interconnect the two sheaves of a driving pulley of an electronically assisted CVT. The slider member being adapted to allow a longitudinal displacement between the two sheaves while preventing rotational difference therebetween.

**[0021]** At least one embodiment of the invention provides an assisting mechanism including a torque transmitting mechanism adapted to provide axial displacement capabilities to the two sides of a CVT drive sheave while transmitting rotational power therebetween while preventing noises and rattles.

**[0022]** At least one embodiment of the present invention provides an electronically assisted CVT provided with a driving pulley adapted to sufficiently distance its two sheaves to disengage the drivebelt therebetween.

**[0023]** At least one embodiment of the present invention provides an assisted CVT provided with a driving pulley adapted to sufficiently distance its two sheaves to disengage the drivebelt therebetween and also provided with a vibration reducing mechanism securing an axially movable drive sheave and reducing the sound therefrom when the drivebelt is disengaged from the driving pulley.

**[0024]** At least one embodiment of the present invention provides a toothed slider member coupling a rotatable moveable portion of the electronically assisted CVT while allowing a relative longitudinal movement therebetween.

**[0025]** At least one embodiment of the present invention provides a slider member having vibration-damping properties to couple the sides of a driving pulley sheave while allowing a relative longitudinal movement therebetween.

**[0026]** At least one embodiment of the present invention provides a slider member configured to provide a silent coupling of the two sheaves of a driving pulley while allowing a relative longitudinal movement therebetween.

**[0027]** At least one embodiment of the present invention provides a backlash free slider member having vibration-damping properties to couple two sheaves of a driving pulley while allowing a relative longitudinal movement therebetween.

**[0028]** At least one embodiment of the present invention provides a self-securing slider member adapted to limit movements thereon to a single side thereof such that only one side of the slider member is subject to relative movements thereon when operatively coupling two sheaves of a driving pulley.

**[0029]** At least one embodiment of the present invention provides a slider member providing discrete compression portions thereof adapted to be compressed by the rotational load transmitted between two sheaves of a driving pulley while allowing a relative longitudinal movement therebetween the two sheaves.

**[0030]** At least one embodiment of the present invention provides a slider member capable of being toolessly installed on an assisted CVT drive portion.

**[0031]** At least one embodiment of the present invention provides a slider member made of a light and self-lubricating material for coupling two sheaves of a driving pulley while allowing a relative longitudinal movement therebetween.

**[0032]** At least one embodiment of the present invention provides a kit comprising a replacement slider member for coupling two sheaves of a driving pulley while allowing a relative longitudinal movement therebetween

**[0033]** At least one embodiment of the present invention provides a star-shaped slider member.

**[0034]** At least one embodiment of the present invention provides a slider member having a plurality of teeth, each tooth defining a small variation of thickness to ensure a precise slide fit with an intervening slider member receptacle.

**[0035]** At least one embodiment of the present invention provides a slider member having alternate compression portions and junction portions thereof.

**[0036]** At least one embodiment of the present invention provides a slider member including a plurality of retaining legs axially extending therefrom.

**[0037]** At least one embodiment of the present invention provides a slider member having a diameter larger than a diameter of an engine's drive member to which it is concentrically and rotatably connected thereto.

**[0038]** At least one embodiment of the invention provides an assisting mechanism packaged in a module secured on the axial shaft of the CVT.

**[0039]** At least one embodiment of the invention presented herein secures the assisting mechanism in cantilever on an end of the driving pulley's axial shaft.

**[0040]** At least one embodiment of the present invention provides an electronically assisted CVT assisting mechanism secured in cantilever on a power drive of a power pack.

**[0041]** At least one embodiment of the present invention provides an electronically assisted CVT adapted to angularly position the assisting mechanism about a rotatable axial shaft of the electronically assisted CVT's driving pulley to facilitate the integration of the electronically assisted CVT on various engine/motor layouts.

**[0042]** At least one embodiment of the assisted CVT package polarly positionable about the axial shaft of an engine and securable at a plurality of angular positions thereof thus providing significant flexibility to use the assisting mechanism in various layouts.

**[0043]** At least one embodiment of the present invention provides an electronically assisted CVT adapted to angularly locate an assisting mechanism about an axial shaft of the electronically assisted CVT to facilitate the installation of the electronically assisted CVT on specific engine/motor layouts, the assisting mechanism being adapted to be secured at any angle (360 degree) about the axial shaft of the electronically assisted CVT driving pulley.

**[0044]** At least one embodiment of the present invention provides an assisted CVT with an electric actuation motor having a rotation axis disposed parallel with the electronically assisted CVT's driving pulley axis to minimize the size of the electronically assisted CVT actuation package extending outside the periphery of the electronically assisted CVT's driving pulley.

**[0045]** At least one embodiment of the present invention provides an assisted CVT with an electrical actuation motor and a set of motion transfer gears having rotatable axes parallel with the electronically assisted CVT rotational axial shaft to minimize the size of the electronically assisted CVT actuation package extending outside the periphery of the sheaves of the driving pulley.

**[0046]** At least one embodiment of the present invention provides an electric actuation motor having a rotational axis parallel with the driving pulley axis and located outside the periphery of the driving pulley and extending through a plane defined by an axially movable sheave orthogonal to the rotation axis of the sheave.

**[0047]** At least one embodiment of the present invention provides a CVT assisting mechanism secured in cantilever at a distal end of a power drive of a power pack and provided with a retaining member preventing rotation of the assisting mechanism with the rotation of the power drive.

**[0048]** At least one embodiment of the present invention provides a retaining member adapted to secure the assisting mechanism of an electronically assisted CVT at a desired angle about the rotation axis of the electronically assisted CVT driving pulley.

**[0049]** At least one embodiment of the present invention provides an assisting mechanism adapted to be rotatably secured to a power drive of an electronically assisted CVT and polarly fixedly secured thereabout the powered drive axis with a retaining member disposed in tension or in compression therebetween.

**[0050]** At least one embodiment of the present invention provides an electronically controlled CVT driving pulley comprising a pair of opposed sheaves adapted to rotate about a driving pulley rotation axis, one of the sheaves including an axial protrusion including a series of teeth cooperating with an axial bearing mechanism providing a relative axial displacement between the opposed sheaves and to transmit a torque between the opposed sheaves.

**[0051]** At least one embodiment of the present invention provides a method for transmitting a torque between two opposed sheaves of an electronically controlled CVT, the method comprising rotating one of the opposed sheaves; rotating a slider member receptacle with the one of the opposed sheaves, the slider member receptacle engaging a slider member; and transmitting the torque to the other opposed sheave via the slider member.

**[0052]** An electronically assisted CVT assisting mechanism adapted to be secured in cantilever to a power drive, the assisting mechanism comprising: a chassis; an actuation motor secured to the chassis; and a main actuation gear operatively secured to a first threaded portion and drivably connected to the actuation motor, the first threaded portion being threadedly connected to a second threaded portion to transfer a rotation of the main actuation gear to a corresponding axial translation of an axially movable sheave, the assisting mechanism being adapted to be polarly positioned about a rotation axis of the axially movable sheave such that the assisting mechanism could be secured at various angle about the rotation axis of the axially movable sheave to be installed in a variety of different layouts. Other objects, aspects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

**[0053]** Other embodiments, objects, aspects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

**[0054]** Additional and/or alternative advantages and salient features of the invention will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings, disclose preferred embodiments of the invention.

## BRIEF DESCRIPTION OF THE FIGURES

**[0055]** FIG. **1** shows a schematic illustration of a top plan view of a wheeled vehicle with an electronically controlled CVT thereon in accordance with an embodiment of the present invention;

**[0056]** FIG. **2** is a magnified isometric view of a drive portion of the electronically controlled CVT in accordance with an embodiment of the present invention;

**[0057]** FIG. **3** is an alternate magnified isometric view of the drive portion of FIG. **2** in accordance with an embodiment of the present invention;

**[0058]** FIG. **4** is a section view of the drive portion illustrated on FIG. **2** and FIG. **3** where the sheaves are not in contact with the drivebelt and in accordance with an embodiment of the present invention;

**[0059]** FIG. **5** is a section view of the drive portion illustrated on FIG. **2** and FIG. **3** where the sheaves are in contact with the drivebelt and in accordance with an embodiment of the present invention;

**[0060]** FIG. **6** is a semi-exploded dimetric view of the drive portion of the electronically controlled CVT of FIGS. **2**, **3**, **4** and **5** in accordance with an embodiment of the present invention;

**[0061]** FIG. **7** is an alternate semi-exploded dimetric view of the drive portion of the electronically controlled CVT of FIGS. **2**, **3**, **4** and **5** in accordance with an embodiment of the present invention;

**[0062]** FIG. **8** is an exploded dimetric view of the drive portion of the electronically controlled CVT of FIGS. **2**, **3**, **4** and **5** in accordance with an embodiment of the present invention;

**[0063]** FIG. **9** is a side elevational view of an illustrative assembly of an assisting mechanism of the drive portion of the electronically controlled CVT of FIGS. **2**, **3**, **4** and **5** on an engine in accordance with an embodiment of the present invention;

**[0064]** FIG. **10** is a side elevational view of an alternate illustrative assembly of an assisting mechanism of the drive portion of the electronically controlled CVT of FIGS. **2**, **3**, **4** and **5** on an engine in accordance with an embodiment of the present invention;

**[0065]** FIG. **11** is a side elevational view of an another illustrative assembly of an assisting mechanism of the drive portion of the electronically controlled CVT of FIGS. **2**, **3**, **4** and **5** on an engine in accordance with an embodiment of the present invention;

**[0066]** FIG. **12** is an isometric exploded view of a portion of the axially moveable sheave and slider member receptacle in accordance with an embodiment of the present invention;

**[0067]** FIG. **13** is an isometric semi-exploded view of a portion of the axially moveable sheave and slider member receptacle in accordance with an embodiment of the present invention;

**[0068]** FIG. **14** is an isometric view of a portion of a sub-assembly of the axially moveable sheave and slider member receptacle in accordance with an embodiment of the present invention;

**[0069]** FIG. **15** is a top plan view of a sub-assembly of the axially moveable sheave with the slider member receptacle slightly axially displaced in accordance with an embodiment of the present invention;

**[0070]** FIG. **16** is a top plan view of a sub-assembly of the axially moveable sheave with the slider member receptacle slightly axially displaced in accordance with an embodiment of the present invention;

**[0071]** FIG. **17** is an isometric view of a slider member receptacle with a slider member therein in accordance with an embodiment of the present invention;

**[0072]** FIG. **18** is an section view of a slider member receptacle with a slider member therein in accordance with an embodiment of the present invention; and

**[0073]** FIG. **19** is an illustrative sectional view of a portion of a sub-assembly of the axially moveable sheave in accordance with an embodiment of the present invention.

## DETAILED DESCRIPTION

**[0074]** The present invention is now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It may be evident, however, that the present invention may be practiced without these specific details. In other instances, well-known structures and devices are shown in block diagram form in order to facilitate describing the present invention.

**[0075]** In respect with an embodiment of the invention, FIG. **1** illustrates an electronically controlled CVT **10** disposed in an exemplary vehicle **14**. The CVT **10** includes a drive portion **18** and a driven portion **22** interconnected therebetween with a drivebelt **26**. The drive portion **18** is provided with a CVT assisting mechanism **30** adapted to set the operating ratio of the CVT **10**. In the present embodiment, the driven portion **22** is secured to an optional gearbox **34** to transmit rotational power to the drive mechanism **38** of the vehicle **14**. The gearbox **34** is not required if the driven portion **22** of the CVT **10** already rotates at a desired output speed.

**[0076]** The vehicle **14** schematically illustrated on FIG. **1** is equipped with four wheels **42** like an off-road vehicle (e.g.

all-terrain vehicle . . . ) or a road vehicle (e.g. car, golf cart . . . ). Although it is not hereby illustrated, the vehicle **14** could also be a snowmobile, a scooter, a motorcycle, an industrial vehicle or any other devices without departing from the scope of the present invention.

**[0077]** The illustrated vehicle **14** has suspension arms **46** with interconnected springs **50** and dampers **54**. The drive mechanism **38** of the vehicle **14** includes a primary drive shaft **58** operatively connected between an engine **62** and a differential **66**, and a pair of drive axles **70** operatively interconnected with the wheels **42**. The illustrated vehicle **14** is equipped with a rear wheel drive system. It is understood that the present invention applied to a front wheel drive vehicle **14** or a four-wheel drive vehicle **14** would work in a similar fashion and is encompassed by the present explanations. Also, we use the term "wheel" throughout the present description although the present invention does not solely relate to wheeled vehicles but to all vehicle having ground-contacting members intended to support and propel the vehicle **14**. Each wheel **42** supports a chassis **78** with interconnected suspension arms **46**, springs **50** and dampers **54**. The front pair of wheels **82** is interconnected with a front torsion bar **86** pivotably secured to the chassis **78** while the rear pair of wheels **90** is interconnected with a rear torsion bar **94** also pivotably secured to the chassis **78**. The torsion bars **86** and **94** are torsioned or twisted when the vehicle **14** is subject to roll.

**[0078]** FIG. **2** and FIG. **3** illustrate in more details the drive portion **18** of the CVT **10**. The drive portion **18** of the CVT **10** comprises drive pulley including a pair of opposed drive sheaves **100**, a main actuation gear **104**, a frame **108**, a gearbox **112** and an electric actuation motor **116**. In the present embodiment, the assisting mechanism **30** is a compact layout cooperating with the drive sheaves **100** and removably secured to a power drive **120** of the engine **62** (i.e. an internal combustion engine, an electric motor not shown in FIG. **2**). The electric actuation motor **116** is secured to the frame **108** and adapted to rotate a plurality of operatively interconnected gears housed in the gearbox **112** to ultimately rotate the main actuation gear **104** at a desired speed.

**[0079]** The frame **108** of the assisting mechanism **30** of the present embodiment consists of two frame portions **124**, **128** and a support portion **122** secured thereto. The frame **108** is adapted to receive and secure the electric actuation motor **116** thereon. The frame **108** is also configured to enclose a set of gears **132** therein acting as an actuation gearbox **112** to obtain the desired ratio between the electric actuation motor **116** and the main actuation gear **104**. A sensor **140** is attached to the frame **108** to sense the position of the set of gears **132** to monitor their position. The sensor **140** is provided with a connecting wire **144** connectable to a wires harness (not shown) to communicate with a control module (not shown). The frame **108** is illustratively made of a light and strong material like aluminum in the presented embodiment.

**[0080]** The opposed drive sheaves **100** are concentrically secured to the power drive **120** of the engine **62** and adapted to rotate with the power drive **120** about a drive axis **142**. The opposed sheaves **100** of the illustrated embodiment includes an axially fixed sheave **100.1** and an axially moveable sheave **100.2** as shown in FIG. **2** and FIG. **3**. An alternate embodiment could have a design that moves the sheave **100.1** that is proximally disposed in respect with the engine **62** and keep the other sheave **100.2** longitudinally fixed. As best seen in FIG. **3**, the fixed sheave **100.1** is equipped with a series of radial blades **146** adapted to act as an air pump to move air around the CVT **10**.

**[0081]** The present embodiment illustrates that the main actuation gear **104** is secured on a female threaded body **148** (visible in FIG. **4** and FIG. **5**) that, upon rotation, transforms the rotation of the main actuation gear **104** into a precise axial movement that impacts the axial distance between the sheaves **100**. It is the axial position of the axially moveable sheave **100.2** (distal in respect with the engine **62**) that changes while the fixed sheave **100.1** remains axially at the same position. Any rotation of the electric actuation motor **116** is therefore transformed into a change in distance between both sheaves **100.1**, **100.2** of the drive pulley **100** to alter the transmission ratio of the CVT **10**. As a skilled reader can understand, the axially moveable sheave **100.2** of another embodiment could remain longitudinally fixed while it is the other sheave **100.1**, proximal to the engine **62**, that longitudinally moves.

**[0082]** The drive portion **18** of the embodied CVT is secured in cantilever on the power drive **30** as it can be seen in FIG. **4**. It can be appreciated from FIG. **4** that the drive portion **18** is adapted to be secured to the power drive **120** with a cooperating self-centering female taper socket **156** and a long fastener **160** going through the drive portion **18**, concentrically with the center of the pair of sheaves **100**.

**[0083]** As it is better seen in FIG. **4**, the electric actuation motor **116** is operatively connected to the gearbox **112** (not visible in FIG. **4** but is shown in FIG. **3** among other figures) that, itself, is operatively connected to the main actuation gear **104** via an elongated gear **152**. The elongated gear **152** is provided with rather long teeth thereof to accommodate a complete teeth-engaging axial displacement **154** thereon of the main actuation gear **104** that longitudinally moves along with the axially moveable sheave **100.2**.

**[0084]** FIG. **4** illustrates the configuration where the sheaves **100** are disposed at their maximum distance therebetween. The main actuation gear **104** is thus distally contacting the elongated gear **152**. In contrast, FIG. **5** illustrates the same CVT **10** in a configuration where the sheaves **100** are disposed at their closest distance therebetween; it is possible to appreciate that the main actuation gear **104** contacts the elongated gear **152** on the proximal side.

**[0085]** One can see from FIG. **4** that the main actuation gear **104** is removably secured to a female threaded body **148** rotated thereby upon actuation of the electric actuation motor **116**. The female threaded body **148** engages a counterpart male threaded body **164**, which is secured to the frame **108**, to create a threaded interface **168** therebetween. A rotational movement of the female threaded body **148** is therefore transformed into an axial movement due to the threaded interface **168**. The female threaded body **148** experiences the entire axial displacement because the male threaded body **164** does not longitudinally move relatively to the frame **108** and the axial shaft **172**. This axial displacement of the female threaded body **148** is communicated by the main actuation gear **104**, which is rotated by the elongated gear **152**. In other words, the electric actuation motor **116**, fixedly connected to the frame **108**, can apply a controlled rotational displacement of the main actuation gear **104** to axially move the axially moveable sheave **100.2** via the threaded interface **168**.

**[0086]** Still referring to FIG. **4**, the assisting mechanism **30** is supported by the distal end of the rotating axial shaft **172**. A pair of intervening support bearings **176** allows rotational movements between the assisting mechanism **30** and the axial shaft **172**. The pair of support bearings **176** also allows the assisting mechanism **30** to be angularly secured about the axial shaft **172** when the electronically controlled CVT **10** is positioned and secured in its final operative layout.

**[0087]** The elongated gear **152**, well illustrated in FIG. **4** and in FIG. **5**, is elongated because it is operatively engaging the axially moveable main actuation gear **104**. The elongated gear **152** is longitudinally fixedly positioned in respect with the distal end of the axial shaft **172** and has an effective length **154** that corresponds with the axial displacement of the main actuation gear **104** that is at least as long as the maximum operating axial distance variation between both sheave **100**.

**[0088]** In reference with FIG. **2** through FIG. **5**, the axis **188** of the elongated gear **152** is parallel with the drive axis **142**. The elongated gear **152** extends outside the periphery of the axially moveable sheave **100.2** and is driven by the main actuation gear **104** that has a diameter that is larger than the diameter of the axially moveable sheave **100.2**. The rotation axis **192** of the electric actuation motor **116** is parallel with the drive axis **142**. Similarly, the electric actuation motor **116** extends outside the periphery of the axially moveable sheave **100.2**.

**[0089]** Still referring to FIG. **4** and FIG. **5** where is illustrated a neutral bearing **180** disposed on the axial shaft **172** between the sheaves **100**. A cavity **184** is formed in the axially moveable sheave **100.2** to receive the neutral bearing **180** therein when both sheaves **100** are closer to engage and rotate the drive belt **26** on a larger operating diameter. The neutral bearing **180** supports the drive belt **26** and prevents it to friction the rotating axial shaft **172** when both sheaves **100** are distanced enough from each other by the assisting mechanism **30** to disengage the sides of the drive belt **26** from the sheaves **100**. The CVT is in the "neutral" position (meaning the belt **26** is not driven by the drive pulley **100**) when the drive belt **26** is laterally uncompressed between the sheaves **100**. The sheaves **100** continue to rotate with the power drive **120** when the CVT is in the "neutral" position. The axially moveable sheave **100.2** is coupled to the axially fixed sheave **100.1** by the axial shaft **172** and rotates when the CVT is in the "neutral" position. Reducing the distance between both sheaves **100** with the assisting mechanism **30** reengages the drive belt **26**. The friction between the drive belt **26** and both sheaves **100** progressively engages the drive belt **26** until the drive belt **26** is propelled by the rotating sheaves **100**. Put differently, the electronically controlled CVT **10** in accordance with the present embodiment is equipped with a disengagement mechanism. The disengagement mechanism is not a centrifugal clutch as commonly used in legacy CVTs. Disengagement is produced by managing the distance between the sheaves **100** of the drive pulley with the assisting mechanism **30** to a point where the drivebelt **26** does not operatively contact the sheaves **100** nor the axial shaft **172** and freely rests on the neutral bearing **180**. Reengagement of the drivebelt **26** is managed by the assisting mechanism **30** by reducing the distance between the sheaves **100** to contact and move the drive belt **26** to rotate the driven portion **22**.

**[0090]** FIG. **6** and FIG. **7** depict a semi-exploded drive portion **18**. The axially fixed sheave **100.1** (left) is adapted to receive the axially moveable sheave **100.2** (right) on the axial shaft **172**. The hollowed axial shaft **172** is sized and designed to receive the long fastener **160** therein to secure the assembly to the power drive **120** of the engine **62**.

**[0091]** Turning now to FIG. **8** illustrating in more details an embodiment of the present invention. The exploded view of the drive portion **18** of the CVT **10** depicted in FIG. **8** teaches in further details how the drive portion **18** is assembled. Beginning with the fixed sheave **100.1**, from which extends the axial shaft **172** to which is assembled thereon the axially moveable sheave **100.2**. The main actuation gear **104** is fixedly secured to the female threaded body **148** that is adapted to cooperate with corresponding male threaded body **164**. The male threaded body **164** is secured to the support portion **122** and acts as an abutment when the female threaded body **148** is screwed thereon moving axially following the threads of the threaded interface **168** created thereby. The longitudinal displacement of the female threaded body **148** moves both the main actuation gear **104** and the axially moveable sheave **100.2**. Bearings **176** intervene between the female threaded body **148** and the axially moveable sheave **100.2** to prevent the main actuation gear **104** to rotate with the sheaves **100** and the axial shaft **172**. The male threaded body **164** and the female threaded body **148** could be inverted, if properly designed, such that the male threaded body **164** receives the main actuation gear **104** thereon.

**[0092]** An intervening slider member receptacle **196** is provided to support the distal end of the axial shaft **172** and to support thereon the support portion **122** of the assisting mechanism **30**. The slider member receptacle **196** also slideably receives therein the shaped protruding end **200** of the axially moveable sheave **100.2** and supports thereon its associated main actuation gear **104**. The cylindrical external shape of the slider member receptacle **196** is sized and designed to fit in corresponding opening in the support portion **122** and to accommodate a slider member **204** therein. The slider member **204** intervening between the internally located distal protruding end **200** of the axially moveable sheave **100.2** and the internal shape of the slider member receptacle **196**. The slider member **204** has a shape adapted to transmit rotational movement while allowing a smooth axial movement between the distal end of the axially moveable sheave **100.2** and the slider member receptacle **196**. The slider member **204** also acts as a vibration damper between the two components thus preventing or reducing possible rattles. Additionally, a bearing-receiving unit **208** is concentrically mounted at the distal end of the slider member receptacle **196** to support the distal end of the rotating assembly by rotatably engaging a bearing **176** secured in the fixed male threaded body **164**.

**[0093]** Still in FIG. **8**, the elongated gear **152** is associated with an adjacent larger gear **212** and other gears **132** to further change the gear ratio. Complementary gears **216** and **220** are arranged to provide a proper teeth-moving frequency for the sensor **140** to sense. The sensor **140** senses when each teeth of the gear **220** passes nearby and changes state and/or sends a signal thereof to a control system (not shown) monitoring and managing the assisting mechanism **30**.

**[0094]** One advantage of the assisting mechanism **30** is it can be secured in one piece at the end of an axial shaft **172**. Referring now to FIG. **9** through FIG. **11** where it can be appreciated the assisting mechanism **30** could be secured to various polar locations about the driving pulley axis **142**. The assisting mechanism **30** is located in FIG. **9** to the left of the driving pulley **100** at an angle a in respect with the horizontal. In contrast, the assisting mechanism **30** is respectively located upward at an angle β in FIG. **10** and downward at an angle γ in FIG. **11**. In the illustrated embodiments, the assisting mechanism **30** is secured into position with a retaining member **224**. The retaining member **224** is either arranged to work in tension or in compression. Both configurations are illustrated in FIG. **9**. Generally, a single retaining member **224** is sufficient to resist drag torque in assisting mechanism **30** bearings **176** about the rotatable axial shaft **172**. The retaining member **224** of one embodiment is a rigid bracket illustratively made of aluminum or steel. The retaining member **224** could alternatively be a bracket made of a flexible material illustratively made of plastic or rubber and adapted to allow some relative movement between the assisting mechanism **30** and the engine **62**.

**[0095]** The retaining member **224** is preferably mounted to the engine **62** to limit the rotational relative movement between the assisting mechanism **30** and the structure to which it is connected to while allowing free rotation of the axial shaft **172**. It is possible to secure the retaining member **224** on another portion of the vehicle **14**, like, for example, the frame **78** of the vehicle **14**.

**[0096]** The assisting mechanism **30** of embodiments of the present invention is secured in cantilever to an axial shaft **172** of a CVT **10**. This provides significant possibilities to retrofit the assisting mechanism **30** to a variety of CVTs. The retaining member **224** of an embodiment prevents against rotation of the assisting mechanism **30** with the rotating axial shaft **172** without applying additional stresses to the axial shaft **172** and the power drive **120**. A more rigid retaining member **224** would likely induce additional undesirable stresses to the axial shaft **172** and the power drive **120** because it is a hyperstatic assembly. (A hyperstatic assembly is a non-isostatic assembly like, for example, a chair with four legs. The chair would be stable with three legs, even with reasonably different lengths. The fourth leg, if it is not exactly at the proper length, would induce stress in the chair if all legs are secured to the ground.)

**[0097]** In another embodiment, the retaining member **224** is either integrated in the engine **62**, the frame **78** or built in another part of the assisting mechanism **30**. The frame **78** could, for instance, have a shape suitable to be directly secured to a nearby structure in order to prevent the assisting mechanism **30** to rotate or pivot about the driving pulley axis **142**. Put differently, in accordance with at least one embodiment of the invention, the retaining member **224** is a retaining portion built in another part of the assisting mechanism **30**, the engine **62** or the vehicle **14**.

**[0098]** The compact layout of the assisting mechanism **30** of the present embodiment facilitates its location nearby the driving pulley axis **142**. The assisting mechanism **30** is capable of being secured at any angle about the driving pulley axis **142**.

**[0099]** The electric motor **116** and the elongated gear **152** are located on the assisting mechanism **30** to create a very compact assisting mechanism **30** layout. As it is illustrated in FIG. **4** and FIG. **5**, the elongated gear **152** can extend in the plane defined by the axially moveable shave **100.2**. The electric motor **116** (not visible in FIG. **5** and FIG. **6**) also extends within the plane defined by the axially moveable sheave **100.2**. The axis of the electric motor **116** is substantially parallel with the axis **188** of the elongated gear **152**. The electric motor **116** can alternatively be disposed in the opposite direction, keeping its rotational axis at the same place while distally extending from the sheaves **100**. In so doing, the electric motor **116** is further away from the drive belt **26** and the assisting mechanism **30** could be located even closer to the drive sheaves **100**.

**[0100]** FIG. **12** through FIG. **14** illustrates a magnified exploded view of the axially movable sheave **100.2** of the CVT driving pulley. The axially movable sheave **100.2** is configured to be mounted on the axial shaft **172** (not visible on FIG. **13** but visible on FIG. **7**) extending from the axially fixed sheave **100.1**. The axially movable sheave **100.2** is provided with a protruding end **200** on its distal side thereof. The protruding end **200** includes a series of radially elongated teeth **202** and each tooth **202** has a profile adapted to operatively cooperate with a corresponding internal toothed shape of the slider member **204**.

**[0101]** The protruding end **200** also defines a bearing area **206** sized and designed to receive the support bearing **176** thereon. The support bearing **176** rotatably receives the female threaded body **148** thereon (not visible on FIG. **12** through FIG. **14**). In turn, the female threaded body **148** is configured to accommodate thereon the main actuation gear **104** (not visible on FIG. **12** through FIG. **14**) to also axially secure the axially movable sheave **100.2**. A circlip **178** further secures the support bearing **176** to the protruding end **200** in the present embodiment.

**[0102]** The series of radially elongated teeth **202** of the protruding end **200** are sized and designed to be inserted in the slider member **204** that it is sized and designed to be inserted in the slider member receptacle **196**. The slider member receptacle **196** is internally provided with a corresponding series of internal teeth **198** adapted to mate with the external shape of the slider member **204**. This arrangement of parts prevents relative rotation between the slider member receptacle **196**, the intervening slider member **204** and the elongated teeth **202** of the protruding end **200** from the axially movable sheave **100.2**.

**[0103]** While the slider member **204** bears the rotational load and the vibrations between the protruding end **200** and the slider member receptacle **196**, a pair of bearing members **194** is respectively disposed on each opposite axial side, inside the protruding end **200**. The pair of slider members **194** bears the radial loads between the protruding end **200** and the axial shaft **172** (not visible on these figures but visible on FIG. **6** among other). The slider members **194** are secured in the axial bore of the protruding end **200** and further secured with a circlip **178** to prevent any undesirable axial extraction.

**[0104]** The final mechanical assembly, which can be appreciated in FIG. **14**, allows the series of radially elongated teeth **202** to mate with the corresponding internal teeth **198** of the slider member **196** and the exterior shape of the slider member **204** to mate with the series of corresponding internal teeth **198** of the slider member receptacle **196**. Once assembled, the axially movable sheave **100.2** is rotatably secured to the slider member receptacle **196**, via the slider member **204**, while remaining free to move axially thereof. The slider member receptacle **196**, via the bearing-receiving unit **208**, engages a support bearing **176** (not illustrated on FIG. **14** but visible in FIG. **7**) to support the distal end of the protruding end **200**. No axial movement occurs between the slider member receptacle **196**, the bearing-receiving unit **208** assembly and the support portion **122** assembly.

**[0105]** It can be appreciated that the slider member **204** is preferably made of plastic material. A compression resistant and somewhat lubricating plastic would be beneficial to the assembly. The shape of the slider member **204** is also designed to avoid any unnecessary material to lighten the rotatable assembly. The slider member **204** defines a series of radially positioned compression portions **226** (best seen on

FIG. **12**) adapted to intervene between each tooth of the series of radially elongated teeth **202** and counterpart opposed teeth of the series of internal teeth **198** included inside the slider member receptacle **196**. Therefore, the rotational force generated between cooperative teeth **198** and **202** is transmitted via a respective compression portion **226** when the axially movable sheave **100.2** rotates with the axially fixed sheave **100.1**.

**[0106]** Each compression portion **226** is connected to juxtaposed compression portions **226** via an intervening junction portion **228**. Junction portions **228** are preferably made with less material since they are not compressed and less mechanically solicited when the axially movable sheave **100.2** rotates and rotatably drives the slider member receptacle **196**. A suite of alternate compression portions **226** and junction portions **228** are forming the slider member **204**.

**[0107]** Compression portions **226** are disposed radially in respect with the drive axis **142** and therefore follow the radial surfaces of the teeth **198**, **202**. In contrast, the junction portions **228** proximally and distally alternate between two adjacent compression portions **226**, to follow the interstitial gap between the cooperating teeth **198**, **202**.

**[0108]** Referring now to FIG. **12** and FIG. **15** through FIG. **17** where it can be appreciated that the slider member **204** comprises a number of anti-backlash and/or anti-rattle features to prevent any undesirable play between the cooperating teeth **198**, **202** that could generate undesirable noise and/or rattles when the electrically controlled CVT **10** is in operation. One anti-backlash feature is a series of legs **230** axially extending from each junction portion **228** of the slider member **204**. Each pair of legs **230** simultaneously contacts both radial sides of a corresponding axially elongated tooth **202** of the protruding end **200**. Each pair of legs **230** slides along its related elongated teeth **202** to help prevent any mechanical play. Each pair of legs **230** is further press fitted on the elongated teeth **202** when it reaches a wider elongated teeth axial root **232** to even further prevent any undesirable play therebetween. The pair of legs **230** is pushed apart by the wider root **232** portions of the radially elongated teeth **202** and a non-permanent press fit is provided therebetween.

**[0109]** A series of valleys **234** is defined between adjacent elongated teeth **202**. The proximal axial portion of the valley **234** is provided with a progressively shallower region where the valley **234** radially raises such that each leg **230** is also radially distally pressured to further secure the slider member **204** to the protruding end **200**. In other words, the elongated teeth **202** radially and tangentially pressures each leg **230** when the slider member **204** is pushed toward the root **232** of the elongated teeth **202**. The sort of press fit occurring against the series of radially elongated teeth **202** helps preventing relative movements and backlashes with the slider member **204**. It also helps to secure the assembly and make sure that, when the slider member receptacle **196** axially moves in respect with the radially elongated teeth **202**, the only efficient bearing area is between the protruding end **200** and the slider member **204**. It is encompassed by the present invention that the opposite bearing arrangement is also a practical workable embodiment.

**[0110]** It can be appreciated from the illustrated embodiment that the driving sheave **100** is open and does not contact the drive belt **26** when the protruding end **200** is profoundly inserted in the slider member receptacle **196**. In other words, the CVT is at the neutral position. This is where the two sheaves **100.1** and **100.2** are the most likely to vibrate because they are freely rotating without transmitting power, more subject to the engine's **62** speed and/or torque variations and further because they are not interconnected by the drivebelt **26** applying pressure thereof. This sensitive position of the axially movable sheave **100.2** is also where the legs **230** of the slider member **204** are contacting the wider root **232** thus establishing a stronger contact with the elongated teeth **202** to prevent any play thereof.

**[0111]** The anti-backlash features of the present embodiment also include a series of axial stems **236** that can additionally be appreciated on the figures. Axial stems **236** are disposed on the proximal axial side of each radial and distal junction portion **228** of the slider member **204** to further secure the slider member **204** in the slider member receptacle **196**. Axial stems **236** make sure the slider member **204** is firmly secured in the slider member receptacle **196** by engaging the groove (or the slot **240**) located on the proximal side of the internal wall portion of the slider member receptacle **196** (best seen in FIG. **17** through FIG. **19**).

**[0112]** A skilled reader will appreciate that the slider member **204** is slidably and removably secured to the series of radial elongated teeth **202** and provides a backlashless fit thereof. Therefore, the rotational movement of the axially fixed sheave **100.1** is communicated to the slider member receptacle **196** that rotates the axially movable sheave **100.2** while a relative axial movement therebetween is allowed to set the distance between both sheaves **100.1**, **100.2** of the driving pulley when the CVT assisting mechanism **30** adjust the electronically assisted CVT **10** ratio.

**[0113]** The description and the drawings that are presented above are meant to be illustrative of the present invention. They are not meant to be limiting of the scope of the present invention. Modifications to the embodiments described may be made without departing from the present invention, the scope of which is defined by the following claims:

What is claimed is:

**1**. An electronically controlled CVT driving pulley comprising a pair of opposed sheaves adapted to rotate about a driving pulley rotation axis, one of the sheaves including an axial protrusion including a series of teeth cooperating with an axial bearing mechanism providing a relative axial displacement between the opposed sheaves and to transmit a torque between the opposed sheaves.

**2**. The electronically controlled CVT driving pulley of claim **1**, wherein the axial bearing mechanism further comprises a slider member for transmitting the torque between the opposed sheaves and guiding the axial displacement of the sheave.

**3**. The electronically controlled CVT driving pulley of claim **2**, wherein the slider member is axially disposed between two support bearings.

**4**. The electronically controlled CVT driving pulley of claim **2**, wherein the slider member further includes a series of compression portions and intervening junction portions, the compression portions being adapted to reduce rotational vibrations provided by fluctuations of the torque.

**5**. The electronically controlled CVT driving pulley of claim **2**, wherein the slider members includes rattle-preventing elements.

**6**. The electronically controlled CVT driving pulley of claim **5**, wherein the rattle-preventing elements are a series of legs adapted to respectively contact the series of teeth.

**7**. The electronically controlled CVT driving pulley of claim **2**, wherein the axial bearing mechanism includes a slider member receptacle provided with an internal series of axial teeth sized and designed to rotatably engage the slider member.

**8**. The electronically controlled CVT driving pulley of claim **7**, wherein the slider member is adapted to be secured to the slider member receptacle.

**9**. The electronically controlled CVT driving pulley of claim **8**, wherein the axial displacement between the sheaves is provided by a threaded interface radially and distally disposed in respect with the slider member receptacle.

**10**. The electronically controlled CVT driving pulley of claim **9**, wherein the threaded interface includes a male threaded portion and a female threaded portion, one of the threaded portions operatively supporting a main actuation gear axially disposed between the axial bearing mechanism and the pair of sheaves.

**11**. The electronically controlled CVT driving pulley of claim **7**, wherein the slider member receptacle is rotatably secured to a pulley.

**12**. The electronically controlled CVT driving pulley of claim **1**, wherein the axial protrusion is hollowed and is adapted to receive therein an axial shaft, the axial protrusion further including at least one bearing member intervening between the hollowed axial protrusion and the axial shaft.

**13**. The electronically controlled CVT driving pulley of claim **1**, wherein the electronically assisted CVT manages the displacement between the opposed sheaves with an electric motor and an intervening set of gears and wherein the intervening set of gears are substantially radially superposing the slider member.

**14**. A method for transmitting a torque between two opposed sheaves of an electronically controlled CVT, the method comprising:

rotating one of the opposed sheaves;

rotating a slider member receptacle with the one of the opposed sheaves, the slider member receptacle engaging a slider member; and

transmitting the torque to the other opposed sheave via the slider member.

**15**. The method for transmitting a torque of claim **14**, the method further comprising:

actuating a motor to rotate a main actuation gear;

rotating a threaded body with the main actuation gear;

transforming the rotation of the threaded body into a axial displacement thereof; and

axially displacing the other opposed sheaves with the axial displacement of the threaded body.

**16**. The method for transmitting a torque of claim **14**, wherein the other opposed sheave comprises a protruding end and wherein the slider member engages the protruding end to transmit torque thereto.

**17**. An electronically assisted CVT assisting mechanism adapted to be secured in cantilever to a power drive, the assisting mechanism comprising:

a chassis;

an actuation motor secured to the chassis; and

a main actuation gear operatively secured to a first threaded portion and drivably connected to the actuation motor, the first threaded portion being threadedly connected to a second threaded portion to transfer a rotation of the main actuation gear to a corresponding axial translation of an axially movable sheave, the assisting mechanism being adapted to be polarly positioned about a rotation axis of the axially movable sheave such that the assisting mechanism could be secured at various angle about the rotation axis of the axially movable sheave to be installed in a variety of different layouts.

**18**. The electronically assisted CVT assisting mechanism of claim **17**, further comprising a retaining member configured to polarly secure the assisting mechanism, the retaining member preventing the assisting mechanism to rotate or pivot about the rotation axis of the axially movable sheave.

**19**. The electronically assisted CVT assisting mechanism of claim **17**, wherein the retaining member is part of the chassis and is adapted to connect a motor.

**20**. The electronically assisted CVT assisting mechanism of claim **17**, wherein the assisting mechanism includes a slider member therein.

* * * * *