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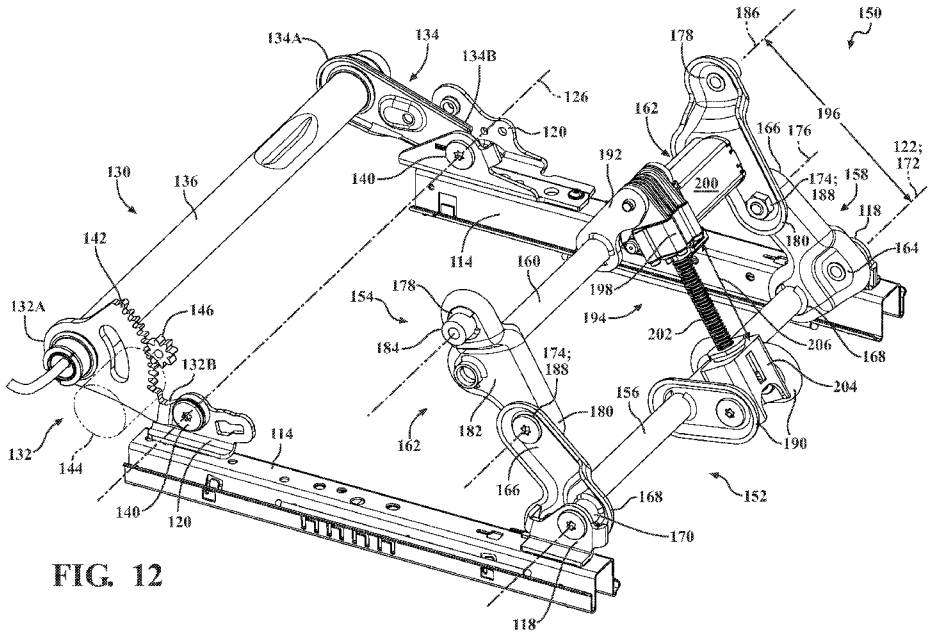

FIG. 12

(57) Abstract: A seat assembly for use in a vehicle and having a seat cushion and a cushion tilt module (150). The seat assembly includes a cushion frame and a pair of front mounts (118). The cushion tilt module (150) is coupled between the front mounts (118) and the cushion frame. The cushion tilt module (150) includes a first tilt member (152) having a pair of first tilt links (158) pivotably coupled to the pair of front mounts (118). The cushion tilt module (150) further includes a second tilt member (154) having a pair of second tilt links (162) pivotably coupled to the cushion frame and to the pair of first tilt links (158). A tilt actuator (194) is operably coupled between the first tilt link and the second tilt link to pivot the first tilt member (152) relative to the second tilt member (154) and selectively tilt the cushion frame between an upright position and a tilted position.

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CUSHION TILT MODULE FOR SEAT WITH ULTRA COMFORT POSITION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The subject patent application claims priority to, and all the benefits of, U.S. Provisional Application 63/472,068, filed on June 9, 2023, the entire contents of which are incorporated by reference herein.

FIELD AND BACKGROUND OF THE INVENTION

[0002] The present invention relates to a seat assembly for use in an automotive vehicle. More particularly, the invention relates to a tilt module for a seat cushion and a seat assembly having the tilt module. The tilt module is operably coupled to the seat cushion and configured to selectively tilt the seat cushion between an upright position and a tilted ultra comfort position.

DESCRIPTION OF RELATED ART

[0003] Automotive vehicles typically include one or more seat assemblies having a seat cushion and a seat back for supporting a passenger above a vehicle floor. It is commonly known for certain seat assemblies to include a height adjustment mechanism that may be operated to raise and lower the seat cushion to accommodate users of varying stature and to improve ergonomics. Additionally, some seat assemblies may further include a seat cushion tilt function to adjust the angle of the seat cushion relative to the vehicle floor.

[0004] It is also commonly known that front row seats and rear row seats vary in core seat structures. Further, the core seat structures vary between different manufacturers and vary based on functions included within the seat assemblies. For example, modifications may be required to the core seat structures in order to integrate the height adjustment mechanism and the cushion tilt function within the seat assembly when the seat assembly is constructed. Further, a variety of components may be required in order to add the height adjustment mechanism and the cushion tilt function to a range of different core seat structures, including for front row seats and rear row seats.

[0005] Increasingly, vehicle occupants are spending more time waiting in the vehicle while parked, such as resting while charging an electric vehicle, and the like. It is desirable for the vehicle seat to adjust into more relaxed positions to enhance occupant comfort while not driving. Further, it is desirable to add the height adjustment mechanism and the cushion tilt function to the seat assembly with minimal modifications to the existing core structure of the seat assembly. In

addition, it is desirable to add the height adjustment mechanism and the cushion tilt function to existing front row seat assemblies and rear row seat assemblies.

SUMMARY OF THE INVENTION

[0006] In one embodiment, a cushion tilt module for use with a seat assembly in a vehicle is provided. The seat assembly includes a seat cushion, a pair of front mounts, a pair of rear mounts, and a pair of rear links coupling the seat cushion to the pair of rear mounts. The cushion tilt module includes a first tilt member, a second tilt member, a first actuator mount, a second actuator mount, and a tilt actuator. The first tilt member has a first transverse rod and a pair of first tilt links coupled to the first transverse rod. The pair of first tilt links are pivotably coupled to the pair of front mounts. The second tilt member has a second transverse rod and a pair of second tilt links coupled to the second transverse rod. The pair of second tilt links are pivotably coupled to the seat cushion and to the pair of first tilt links. The first actuator mount is coupled to the first tilt member and the second actuator mount is coupled to the second tilt member. The tilt actuator is pivotably coupled to the first actuator mount and the second actuator mount, and is movable between a retracted position and an extended position to pivot the first tilt member relative to the second tilt member between a collapsed configuration and an expended configuration. Pivoting of the first tilt member and the second tilt member between the collapsed configuration and the expanded configuration is configured to selectively tilt the seat cushion between an upright position and a tilted position.

[0007] In another embodiment, a seat assembly for use in a vehicle is provided. The seat assembly includes a cushion frame, a pair of front mounts, a pair of rear mounts, and a pair of rear links each pivotably coupled to one of the rear mounts and to the cushion frame. The seat assembly further includes a cushion tilt module coupled between the front mounts and the cushion frame. The cushion tilt module includes a first tilt member, a second tilt member, a first actuator mount, a second actuator mount, and a tilt actuator. The first tilt member has a first transverse rod and a pair of first tilt links coupled to the first transverse rod. The pair of first tilt links are pivotably coupled to the pair of front mounts. The second tilt member has a second transverse rod and a pair of second tilt links coupled to the second transverse rod. The pair of second tilt links are pivotably coupled to the cushion frame and to the pair of first tilt links. The first actuator mount is coupled to the first tilt member and the second actuator mount is coupled to the second tilt member. The tilt actuator is pivotably coupled to the first actuator mount and the second actuator mount, and is movable between a retracted position and an extended position to pivot the first tilt member

relative to the second tilt member between a collapsed configuration and an expended configuration. Pivoting of the first tilt member and the second tilt member between the collapsed configuration and the expanded configuration is configured to selectively tilt the cushion frame between an upright position and a tilted position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Advantages of the present disclosure will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings.

[0009] FIG. 1 is an environmental view of a seat assembly in an ultra comfort position, the seat assembly includes a seat back and a seat cushion.

[0010] FIG. 2 is a top side perspective view of a portion of the seat assembly of FIG. 1 positioned at an intermediate height and showing a seat cushion assembly including a cushion tilt module.

[0011] FIG. 3 is a bottom side perspective view of the seat assembly of FIG. 2 showing the seat cushion assembly and the cushion tilt module.

[0012] FIG. 4 is a partially exploded view of the seat cushion assembly and the cushion tilt module of FIG. 2.

[0013] FIG. 5 is a side view of the seat cushion assembly and the cushion tilt module showing the seat cushion assembly positioned at a lowered height and the cushion tilt module in an upright position.

[0014] FIG. 6 is a side view of the seat cushion assembly and the cushion tilt module of FIG. 5 showing the seat cushion assembly positioned at an intermediate height and the cushion tilt module in an upright position.

[0015] FIG. 7 is a side view of the seat cushion assembly and the cushion tilt module of FIG. 5 showing the seat cushion assembly positioned at a raised height and the cushion tilt module in an upright position.

[0016] FIG. 8 is a side view of the seat cushion assembly and the cushion tilt module of FIG. 5 showing the seat cushion assembly positioned at a lowered height and the cushion tilt module in a tilted position.

[0017] FIG. 9 is a side view of the seat cushion assembly and the cushion tilt module of FIG. 5 showing the seat cushion assembly positioned at the intermediate height and the cushion tilt module in a tilted position.

[0018] FIG. 10 is a side view of the seat cushion assembly and the cushion tilt module of FIG. 5 showing the seat cushion assembly positioned at raised height and the cushion tilt module in a tilted position.

[0019] FIG. 11 is a simplified perspective view of the seat assembly of FIG. 2 showing a cushion height module in an intermediate position, an upper track assembly, and the cushion tilt module in the upright position.

[0020] FIG. 12 is a perspective view of the cushion height module, the upper track assembly, and the cushion tilt module of FIG. 11, with the cushion height module in an intermediate position and the cushion tilt module in the tilted position.

[0021] FIG. 13 is an exploded view of the cushion tilt module of FIG. 12.

DETAILED DESCRIPTION OF THE INVENTION

[0022] A seat assembly 100 for use in an automotive vehicle is shown in FIG. 1. The seat assembly 100 includes a seat cushion 102 and a seat back 104 pivotally coupled to the seat cushion 102. The seat back 104 may pivot between an upright seating position, a plurality of reclined seating positions, and a fold flat position overlapping the seat cushion 102, as is commonly known in the art. The seat cushion 102 may include a front cushion frame 106 pivotably coupled to a rear cushion frame 108 by opposing cushion pivots 110. The seat assembly 100 may further include a track assembly 112 comprising opposing upper tracks 114 slidably coupled to respective lower tracks 116 and configured to reposition the seat assembly 100 in a forward direction and a rearward direction along the lower tracks 116. The seat assembly 100 further includes a pair of front mounts 118 and a pair of rear mounts 120. As shown in FIGS. 2 and 4, each of the front mounts 118 is coupled to a respective one of the upper tracks 114 proximate to a front portion of the upper tracks 114. The front mounts 118 are generally L-shaped having a base portion coupled to an upper side of the upper tracks 114 and an upright portion extending at a generally right angle from the base portion. The front mounts 118 are laterally spaced from each other in an opposing manner and a front mount axis 122 extends laterally between each of the front mounts 118. A mount hole 124 may be defined in each of the front mounts 118 and aligned with the front mount axis 122. Similarly, each of the rear mounts 120 is coupled to a respective one of the upper tracks 114

proximate to a rear portion of the upper tracks 114. The rear mounts 120 are generally L-shaped having a base portion coupled to an upper side of the upper tracks 114 and an upright portion extending at a generally right angle from the base portion. The rear mounts 120 are laterally spaced from each other in an opposing manner with a rear mount axis 126 extending laterally between each of the rear mounts 120. A mount hole 128 may be defined in each of the rear mounts 120 and aligned with the rear mount axis 126. It should be appreciated that the mount holes 124 in the front mounts 118 and the mount holes 128 in the rear mounts 120 may be implemented differently than shown and described herein. For example, the mount holes 124, 128 may be bosses or trunnions that are coupled to the respective front and rear mounts 118, 120 and arranged on the respective front and rear mount axes 122, 126.

[0023] The seat assembly 100 may further include a height actuator 130 assembled to the seat cushion 102 and configured to selectively adjust the height of the seat assembly 100 between a lowered height (FIG. 5) and a raised height (FIG. 7). As best shown in the partially exploded view of FIG. 4, the height actuator 130 includes a first rear link 132 and a second rear link 134 arranged on opposing ends of a height shaft 136. The first rear link 132 and the second rear link 134 are rotationally fixed to the height shaft 136 such that torque can be transferred between the first rear link 132 and the second rear link 134 via the height shaft 136. The height shaft 136 rotatably supports the rear cushion frame 108 to facilitate height adjustment of the seat cushion 102. Said differently, movement of the height actuator 130 between the lowered height and the raised height is transferred from the height shaft 136 to the seat cushion 102 through the rear cushion frame 108.

[0024] Each of the first rear link 132 and the second rear link 134 extend from a respective first end 132A, 134A coupled to the height shaft 136 to a respective second end 132B, 134B. The second end 132B, 134B of each of the first rear link 132 and the second rear link 134 defines a hole, which is configured to pivotably couple the respective rear link 132, 134 to the corresponding rear mount 120. More specifically, the second end 132B of the first rear link 132 defines a hole 138A, and the second end 134B of the second rear link 134 defines a hole 138B. The holes 138A, 138B facilitate pivotably coupling the height actuator 130 to the track assembly 112. To this end, the height actuator 130 further includes a shoulder bolt 140 disposed in each hole 138A, 138B and threadably coupled to the mount hole 128 of the corresponding rear mount 120. Each of the first rear link 132 and the second rear link 134 is pivotable about the rear mount axis 126 on the corresponding shoulder bolt 140. As mentioned above in connection with the rear mounts 120, the

holes 138A, 138B may be implemented differently than shown or described herein. For example, the shoulder bolt 140 may be disposed in the mount hole 128 of the rear mount 120 and threadably coupled to the corresponding rear link 132, 134. Other structures capable of facilitating a pivoting connection between the rear links 132, 134 and the rear mounts 120 are also contemplated.

[0025] With continued reference to FIG. 4, the first rear link 132 includes a gear portion 142 arranged between the first end 132A and the second end 132B. The gear portion 142 includes a series of gear teeth arranged on one side of the first rear link 132. The height actuator 130 further includes a height adjustment motor 144 coupled to the seat cushion 102 and having a rotatable output gear 146. The output gear 146 is engaged with the gear portion 142 of the first rear link 132 and configured to transfer torque from the height adjustment motor 144 to the first rear link 132. More specifically, the height adjustment motor 144 is coupled to the rear cushion frame 108 and arranged with the rotatable output gear 146 operably engaged with the gear portion 142 of the first rear link 132. As mentioned above, the first rear link 132, along with the second rear link 134 and the height shaft 136 are pivotable relative to the rear cushion frame 108. Since the output gear 146 is operably engaged with the gear portion 142 of the first rear link 132, rotation of the output gear 146 by the height adjustment motor 144 pivots the first rear link 132 relative to the rear cushion frame 108. Here, the height adjustment motor 144 is implemented as an electric motor. As will be discussed in further detail below, because the seat cushion 102 is operably coupled to the front mounts 118 by a cushion tilt module 150, pivoting the first rear links 132 effects height adjustment of the seat cushion 102.

[0026] As mentioned, the seat assembly 100 includes a cushion tilt module 150 operably coupled between the seat cushion 102 and the front mounts 118 and configured to selectively tilt the seat cushion 102 relative to the vehicle. Specifically, the cushion tilt module 150 is operable to tilt the seat cushion 102 between an ultra comfort position (FIG. 1) and an upright position (FIG. 2). To facilitate tilting of the seat cushion 102, the cushion tilt module 150 comprises a first tilt member 152 and a second tilt member 154. The first tilt member 152 is pivotably coupled to the front mounts 118 and the second tilt member 154, while the second tilt member 154 is also pivotably coupled to the seat cushion 102. Said differently, the first tilt member 152 and the second tilt member 154 are coupled to one another for pivoting movement between a collapsed configuration (FIG. 11) and an expanded configuration (FIG. 12). The pivoting movement of the first tilt member 152 and the second tilt member 154 between the collapsed configuration and the

expanded configuration is configured to selectively tilt the seat cushion 102 between the upright position and the ultra comfort position. As will be discussed in further detail below and in connection with FIGS. 5-10, the collapsed configuration of the tilt members 152, 154 corresponds to the upright position of the seat cushion 102 and the expanded configuration of the tilt members 152, 154 corresponds to the ultra comfort position.

[0027] Turning to the exploded view of the cushion tilt module 150 shown in FIG. 13, each of the tilt members 152, 154 includes a pair of tilt links 158, 162 and a transverse rod 156, 160. More specifically, the first tilt member 152 includes first transverse rod 156 and a pair of first tilt links 158 coupled to opposing ends of the first transverse rod 156 and the second tilt member 154 includes a second transverse rod 160 and a pair of second tilt links 162 coupled to opposing ends of the second transverse rod 162. Each of the pair of first tilt links 158 is formed from a stamped body and includes a rail flange 164, a tilt flange 166, and a rod flange 168. The rail flange 164 of each of the pair of first tilt links 158 may be laterally offset from the tilt flange 166 and the rod flange 168 and includes a mounting boss 170 aligned with the mounting boss 170 of the opposing first tilt link 158 such that the mounting bosses 170 of both first tilt links 158 cooperate to define a mount axis 172. Additionally, the tilt flange 166 of each of the pair of first tilt links 158 defines a pivot hole 174 aligned with the pivot hole 174 of the opposing first tilt link 158 such that the pivot holes 174 of both of the first tilt links 158 cooperate to define a pivot axis 176. The first transverse rod 156 is coupled to the rod flange 168 of each of the pair of first tilt links 158 and rotationally fixed thereto to facilitate the transfer of torque between the first transverse rod 156 and the first tilt links 158. Similarly, each of the pair of second tilt links 162 is formed from a stamped body and includes a cushion flange 178, a tilt flange 180, and a rod flange 182. The cushion flange 178 of each of the pair of second tilt links 162 may be laterally offset from the tilt flange 180 and the rod flange 182 and includes a mounting boss 184 aligned with the mounting boss 184 of the opposing second tilt link 162 such that the mounting bosses 184 of both second tilt links 162 cooperate to define a frame axis 186. Additionally, the tilt flange 180 of each of the pair of second tilt links 162 defines a pivot hole 188 aligned with the pivot hole 188 of the opposing second tilt link 162. The pivot holes 188 of the second tilt links 162 are pivotably coupled to the pivot holes 174 of the first tilt links 158 to facilitate pivoting movement about the pivot axis 176. The second transverse rod 160 is coupled to the rod flange 182 of each of the pair of second tilt links 162 and rotationally fixed thereto to facilitate the transfer of torque between the second

transverse rod 160 and the second tilt links 162. In the embodiment illustrated herein, the first and second tilt links 158, 162 are welded to the respective first and second transverse rods 156, 160, however other coupling methods are contemplated, such as a splined or keyed interface. Furthermore, it should be appreciated that the first and second tilt links 158, 162 may be formed by a process or processes other than stamping, such as casting, forging, injection molding, and the like.

[0028] The cushion tilt module 150 further includes a first actuator mount 190 and a second actuator mount 192. The first actuator mount 190 is coupled to the first tilt member 152 and the second actuator mount 192 is coupled to the second tilt member 154. More specifically, the first actuator mount 190 is coupled to the first transverse rod 156 and rotationally fixed thereto to facilitate torque transfer. In the embodiment illustrated herein, the first actuator mount 190 includes two mount arms that are aligned and laterally spaced from one another along the first transverse rod 156. The mount arms of the first actuator mount 190 each define an opening spaced from the first transverse rod 156 and are configured to receive a fastener. The second actuator mount 192 is coupled to the second transverse rod 160 and rotationally fixed thereto to facilitate torque transfer. The second actuator mount 192 includes two mount arms that are aligned and laterally spaced from one another along the second transverse rod 160. The mount arms of the second actuator mount 192 each define an opening spaced from the second transverse rod 160 and are configured to receive a fastener.

[0029] Referring to FIGS. 11-13, the cushion tilt module 150 further includes a tilt actuator 194 pivotably coupled to the first actuator mount 190 and the second actuator mount 192. The tilt actuator 194 is arranged laterally between each opposing pair of first and second tilt links 158, 162. The tilt actuator 194 is movable between a retracted position (FIG. 11) and an extended position (FIG. 12) to pivot the first tilt member 152 relative to the second tilt member 154 between the collapsed configuration and the expanded configuration. The collapsed configuration and the expanded configuration of the tilt members 152, 154 can be characterized by a distance 196 defined between the frame axis 186 and the mount axis 172. When the tilt members 152, 154 are in the collapsed configuration the distance 196 between the frame axis 186 and the mount axis 172 is less than when the tilt members 152, 154 are in the expanded configuration. Said differently, the frame axis 186 is nearer to the mount axis 172 when the tilt members 152, 154 are in the collapsed configuration than when the tilt members 152, 154 are in the expanded configuration. The tilt

actuator 194 controls the relative position of the first tilt member 152 and the second tilt member 154. Movement of the tilt actuator 194 from the retracted position to the extended position moves the tilt members 152, 154 from the collapsed configuration to the expanded configuration. Likewise, movement of the tilt actuator 194 from the extended position to the retracted position moves the tilt members 152, 154 from the expanded configuration to the collapsed configuration.

[0030] The embodiment of the tilt actuator 194 illustrated herein further includes a motor assembly 198 coupled to the second actuator mount 192 of the second tilt member 154. The motor assembly 198 includes a tilt motor 200 operably coupled to a lead screw 202. The tilt actuator 194 further includes a lead nut 204 coupled to the first actuator mount 190 of the first tilt member 152 and operably engaged with the lead screw 202. The tilt motor 200 rotates the lead screw 202 to axially translate the lead nut 204 along the length of the lead screw 202 to move the tilt actuator 194 between the extended position and the retracted position. The tilt motor 200 may be an electric motor powered by the vehicle, however other embodiments (not shown) of the tilt actuator 194 may be configured differently.

[0031] The positions of the tilt actuator 194 are defined by a length of the tilt actuator 194, which corresponds to the distance 206 between the motor assembly 198 and the lead nut 204. In the retracted position the tilt actuator 194 has a first length and in the extended position the tilt actuator 194 has a second length, where the second length is greater than the first length. Said differently, the distance 206 between the motor assembly 198 and the lead nut 204 is greater when the tilt actuator 194 is in the extended position than when the tilt actuator 194 is in the retracted position. It should be appreciated that the tilt actuator 194 may be arranged differently than described herein. For example, the tilt actuator 194 may be configured with the motor assembly 198 coupled to the first actuator mount 190 and the lead nut coupled to the second actuator mount 192. Alternatively, the lead screw 202 and the lead nut 204 may be arranged such that the motor assembly 198 includes the lead nut 204 operably coupled to the tilt motor 200 while the lead screw 202 is coupled to the first actuator mount 190.

[0032] Turning now to FIGS. 5-10, several exemplary positions and configurations of the seat cushion 102 are shown illustrating operation of the seat assembly 100. Specifically, the seat cushion 102 is shown at the lowered height (FIGS. 5 and 8), an intermediate height (FIGS. 6 and 9), and the raised height (FIGS. 7 and 10). Additionally, the seat cushion 102 is shown in the upright position (FIGS. 5-7) and the ultra comfort position (FIGS. 8-10). In FIG. 5, the seat cushion

102 is shown at the lowered height and in the upright position. Here, the height adjustment motor 144 has been operated to pivot the rear links 132, 134 in a counterclockwise direction and move the height actuator 130 to reduce the distance between the seat cushion 102 and the track assembly 112. Additionally, the tilt motor 200 has been operated to move the tilt actuator 194 into the retracted position and pivot the first and second tilt members 152, 154 into the collapsed configuration to position the seat cushion in a general level position.

[0033] In FIG. 6, the seat cushion 102 is shown at an intermediate height between the lowered height and the raised height and in the upright position. Here, the height adjustment motor 144 has been operated to pivot the rear links 132, 134 in a clockwise direction and move the height actuator 130 to increase the distance between the seat cushion 102 and the track assembly 112 relative to the lowered position. As described above, the output gear 146 attached to the height adjustment motor 144 rotates when the height adjustment motor 144 is operated and causes a corresponding movement of the gear portion 142 of the first rear link 132. The first and second rear links 132, 134 pivot simultaneously about the rear mount axis 126, which causes the height shaft 136 to lift the seat cushion 102. The seat cushion 102, the rear links 132, 134, the upper tracks 114, and the cushion tilt module 150 cooperate to form a linkage such that pivoting movement of the rear links 132, 134 causes coordinated movement of the seat cushion 102 and the cushion tilt module 150.

[0034] Turning to FIG. 7, the seat cushion 102 is shown at the raised height and the upright position. Compared to the intermediate height (FIG. 6), the height adjustment motor 144 has been operated to further pivot the rear links 132, 134 in a clockwise direction and move the height actuator 130 to further increase the distance between the seat cushion 102 and the track assembly 112. Because the tilt actuator 194 controls the position of the first tilt member 152 relative to the second tilt member 154, the cushion tilt module 150 pivots about the front mount axis 122 as a solid body. As the height actuator 130 pivots relative to the rear mount axis 126, the cushion tilt module 150 pivots simultaneously relative to the mount axis 172, which lifts the seat cushion 102. When the first tilt member 152 is coupled to the front mounts 118, the mount axis 172 and the front mount axis 122 are aligned coaxially with one another.

[0035] As mentioned above, in FIGS. 8-10, the seat cushion 102 is shown in the ultra comfort position. Specifically, in FIG. 8, the seat cushion 102 is shown at the lowered height and the cushion tilt module 150 is shown tilting the seat cushion 102 rearward (i.e., lowering the rear cushion frame 108 and raising the front cushion frame 106). Here, the motor assembly 198 of the

tilt actuator 194 is operated to move the tilt actuator 194 into the extended position, which moves the first tilt member 152 and the second tilt member 154 relative to one another from the collapsed configuration to the expanded configuration. In the expanded configuration, the distance 196 between the frame axis 186 and the mount axis 172 is increased relative to the collapsed configuration, which effectively lengthens the cushion tilt module 150 relative to the rear links 132, 134, causing the front cushion frame 106 to move upwards and away from the track assembly 112.

[0036] In FIGS. 9 and 10, the seat cushion 102 is shown in the ultra comfort position at the intermediate height (FIG. 9) and at the raised height (FIG. 10). As with above, the height adjustment motor 144 has been operated to pivot the rear links 132, 134 in a clockwise direction and move the height actuator 130 to increase the distance between the seat cushion 102 and the track assembly 112 relative to the lowered position. It should be appreciated that the intermediate height and the raised height are exemplary positions of the seat cushion 102 and are not intended to be limiting or to define discrete positions of the height actuator 130 and the seat cushion 102. Similarly, the upright position and the ultra comfort position are not intended to be limiting and the cushion tilt module 150 may be operated so as to place the seat cushion 102 in an intermediate position (not shown) between the upright position and the ultra comfort position illustrated herein.

[0037] Several instances have been discussed in the foregoing description. However, the embodiments discussed herein are not intended to be exhaustive or limit the disclosure to any particular form. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the scope of the disclosure. The terminology that has been used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations are possible in light of the above teachings and the disclosure may be practiced otherwise than as specifically described.

CLAIMS

What is claimed is:

1. A cushion tilt module for use with a seat assembly for a vehicle, the seat assembly including a seat cushion, a pair of front mounts, a pair of rear mounts, and a pair of rear links coupling the seat cushion to the pair of rear mounts, the cushion tilt module comprising:

a first tilt member having a first transverse rod and a pair of first tilt links coupled to the first transverse rod, wherein the pair of first tilt links are pivotably coupled to the pair of front mounts;

a second tilt member having a second transverse rod and a pair of second tilt links coupled to the second transverse rod, wherein the pair of second tilt links are pivotably coupled to the seat cushion and to the pair of first tilt links;

a first actuator mount coupled to the first tilt member;

a second actuator mount coupled to the second tilt member;

a tilt actuator pivotably coupled to the first actuator mount and the second actuator mount, wherein the tilt actuator is movable between a retracted position and an extended position to pivot the first tilt member relative to the second tilt member between a collapsed configuration and an expended configuration; and

wherein pivoting of the first tilt member and the second tilt member between the collapsed configuration and the expanded configuration is configured to selectively tilt the seat cushion between an upright position and a tilted position.

2. The cushion tilt module of claim 1, wherein the tilt actuator includes an electric motor, and wherein the tilt actuator has a first length corresponding to the retracted position and a second length corresponding to the extended position, and wherein the second length is greater than the first length.

3. The cushion tilt module of claim 2, wherein the tilt actuator further includes a lead screw and a lead nut, and wherein operation of the electric motor rotates the lead screw to translate the lead nut along the lead screw.

4. The cushion tilt module of claim 3, wherein the electric motor and the lead screw are operably coupled to the second actuator mount and the lead nut is operably coupled to the first actuator mount.

5. The cushion tilt module of claim 1, wherein the tilt actuator is arranged between the pair of first tilt links.

6. The cushion tilt module of claim 1, wherein the pair of first tilt links is rotationally fixed to the first transverse rod.

7. The cushion tilt module of claim 6, wherein the first actuator mount is rotationally fixed to the first transverse rod.

8. The cushion tilt module of claim 7, wherein the pair of second tilt links is rotationally fixed to the second transverse rod.

9. The cushion tilt module of claim 8, wherein the second actuator mount is rotationally fixed to the second transverse rod.

10. The cushion tilt module of claim 1, wherein the pair of first tilt links defines a mount axis and a pivot axis, and wherein the pair of second tilt links defines a frame axis and are pivotably coupled to the first tilt links on the pivot axis, and wherein a distance between the mount axis and the frame axis when the first tilt member is in the collapsed configuration is less than the distance between the mount axis and the frame axis when the first tilt member is in the expanded configuration.

11. A seat assembly for use in a vehicle, the seat assembly comprising:

a cushion frame;

a pair of front mounts;

a pair of rear mounts;

a pair of rear links each pivotably coupled to one of the rear mounts and to the cushion frame;

a cushion tilt module coupled between the front mounts and the cushion frame, the cushion tilt module comprising:

a first tilt member having a first transverse rod and a pair of first tilt links coupled to the first transverse rod, wherein the pair of first tilt links are pivotably coupled to the pair of front mounts;

a second tilt member having a second transverse rod and a pair of second tilt links coupled to the second transverse rod, wherein the pair of second tilt links are pivotably coupled to the cushion frame and to the pair of first tilt links;

a first actuator mount coupled to the first tilt member;

a second actuator mount coupled to the second tilt member;

a tilt actuator pivotably coupled to the first actuator mount and the second actuator mount, wherein the tilt actuator is movable between a retracted position and an extended position to pivot the first tilt member relative to the second tilt member between a collapsed configuration and an expended configuration; and

wherein pivoting of the first tilt member and the second tilt member between the collapsed configuration and the expanded configuration is configured to selectively tilt the cushion frame between an upright position and a tilted position.

12. The seat assembly of claim 11, wherein the tilt actuator includes an electric motor, and wherein the tilt actuator has a first length corresponding to the retracted position and a second length corresponding to the extended position, and wherein the second length is greater than the first length.

13. The seat assembly of claim 12, wherein the tilt actuator further includes a lead screw and a lead nut, and wherein operation of the electric motor rotates the lead screw to translate the lead nut along the lead screw.

14. The seat assembly of claim 13, wherein the electric motor and the lead screw are operably coupled to the second actuator mount and the lead nut is operably coupled to the first actuator mount.

15. The seat assembly of claim 11, wherein the tilt actuator is arranged between the pair of first tilt links.

16. The seat assembly of claim 11, wherein the pair of first tilt links are rotationally fixed to the first transverse rod and the pair of second tilt links are rotationally fixed to the second transverse rod.

17. The seat assembly of claim 16, wherein the first actuator mount is rotationally fixed to the first transverse rod and the second actuator mount is rotationally fixed to the second transverse rod.

18. The seat assembly of claim 11, wherein the pair of first tilt links defines a mount axis and a pivot axis, and wherein the pair of second tilt links defines a frame axis and are pivotably coupled to the first tilt links on the pivot axis, and wherein a distance between the mount axis and the frame axis when the first tilt member is in the collapsed configuration is less than the distance between the mount axis and the frame axis when the first tilt member is in the expanded configuration.

19. The seat assembly of claim 11, further comprising a height actuator operably coupled to one of the pair of rear links, wherein the height actuator is operable to move the cushion frame between a raised position and a lowered position.

20. The seat assembly of claim 19, wherein the height actuator includes an electric motor operably engaged with one of the pair of rear links and configured to pivot the pair of rear links.

21. The seat assembly of claim 11, further comprising a pair of track assemblies, each track assembly having an upper track and a lower track, wherein each of the pair of front mounts is coupled to one of the upper tracks and each of the pair of rear mounts is coupled to one of the upper tracks.

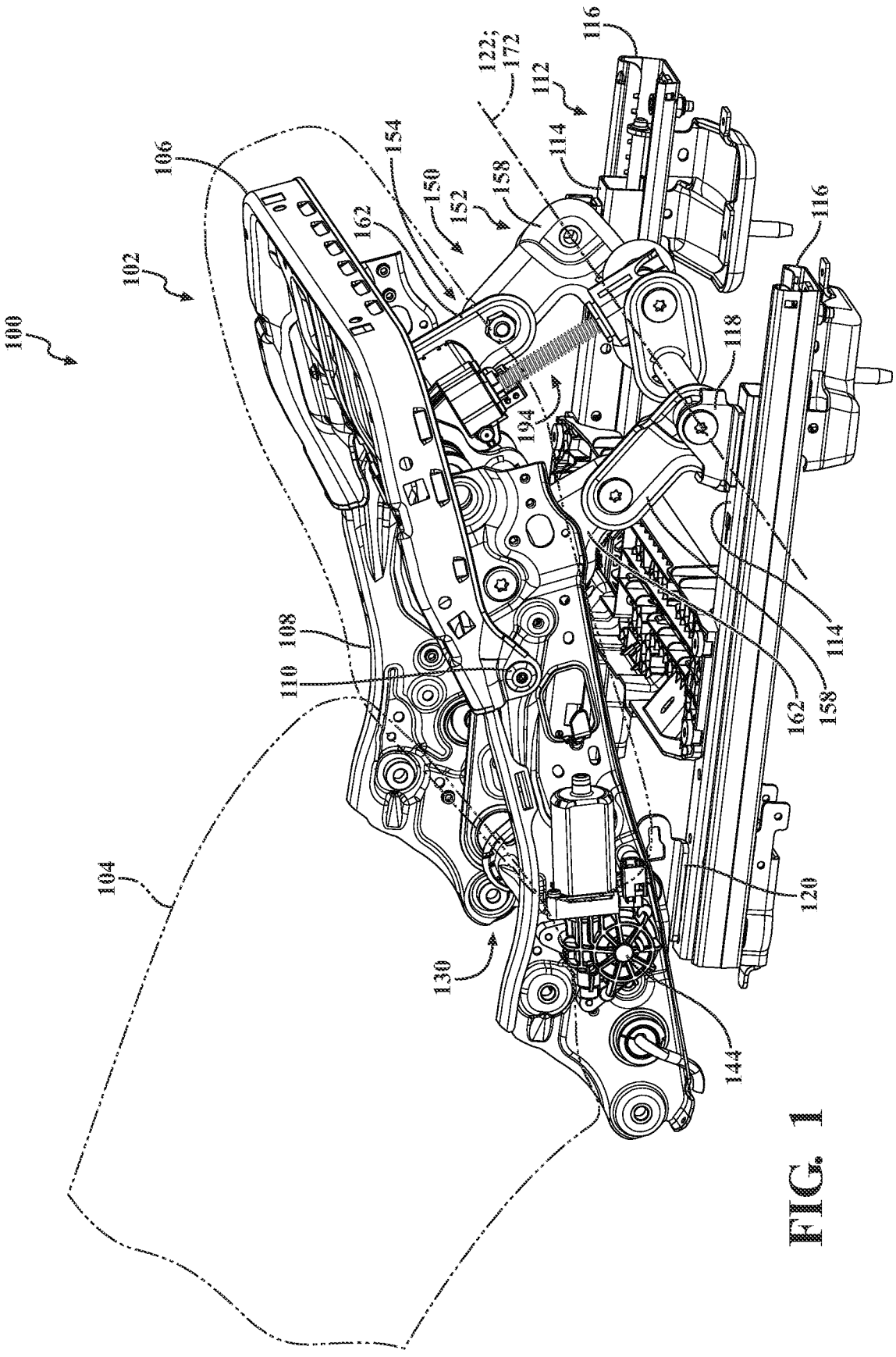
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FIG. 1

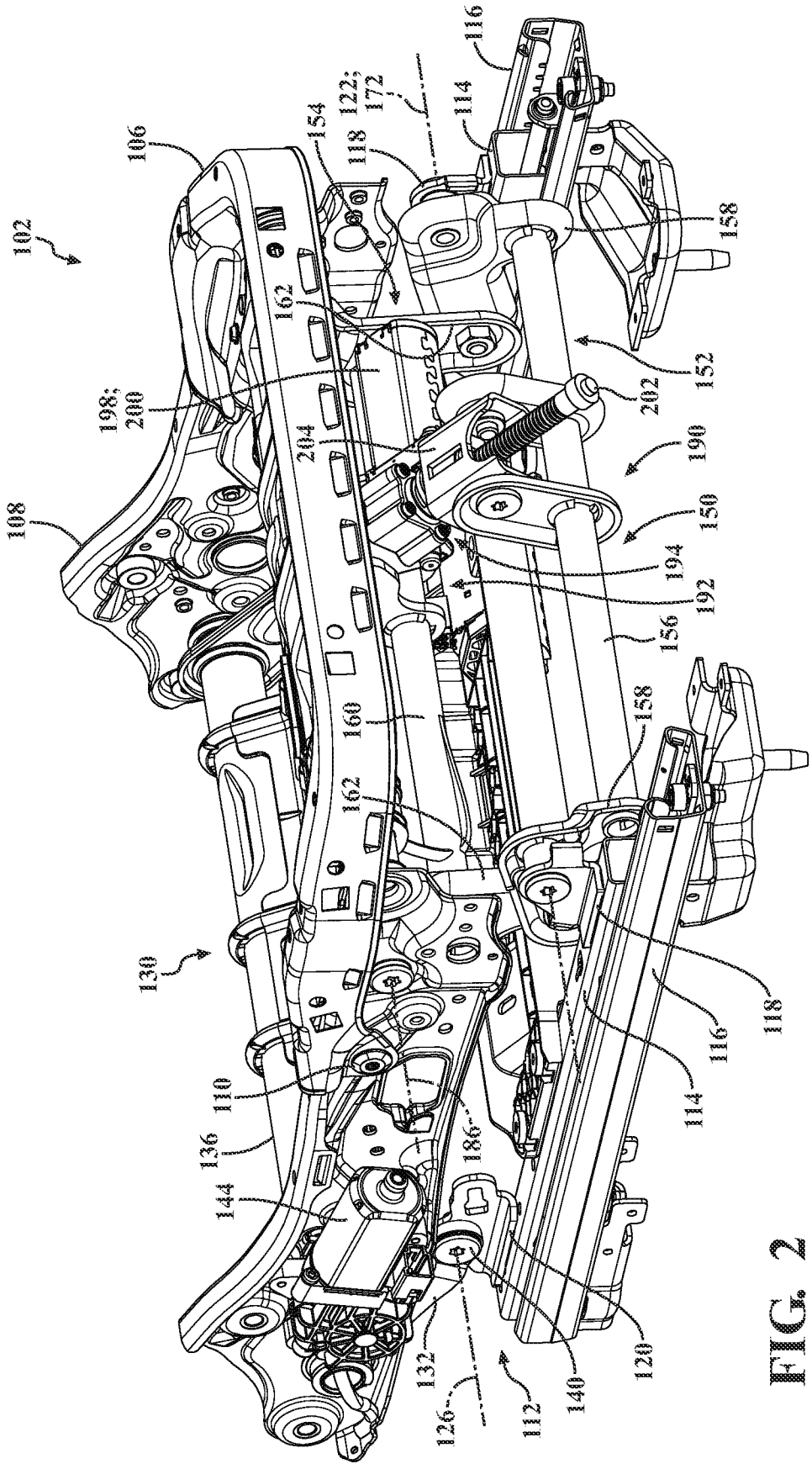
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FIG. 2

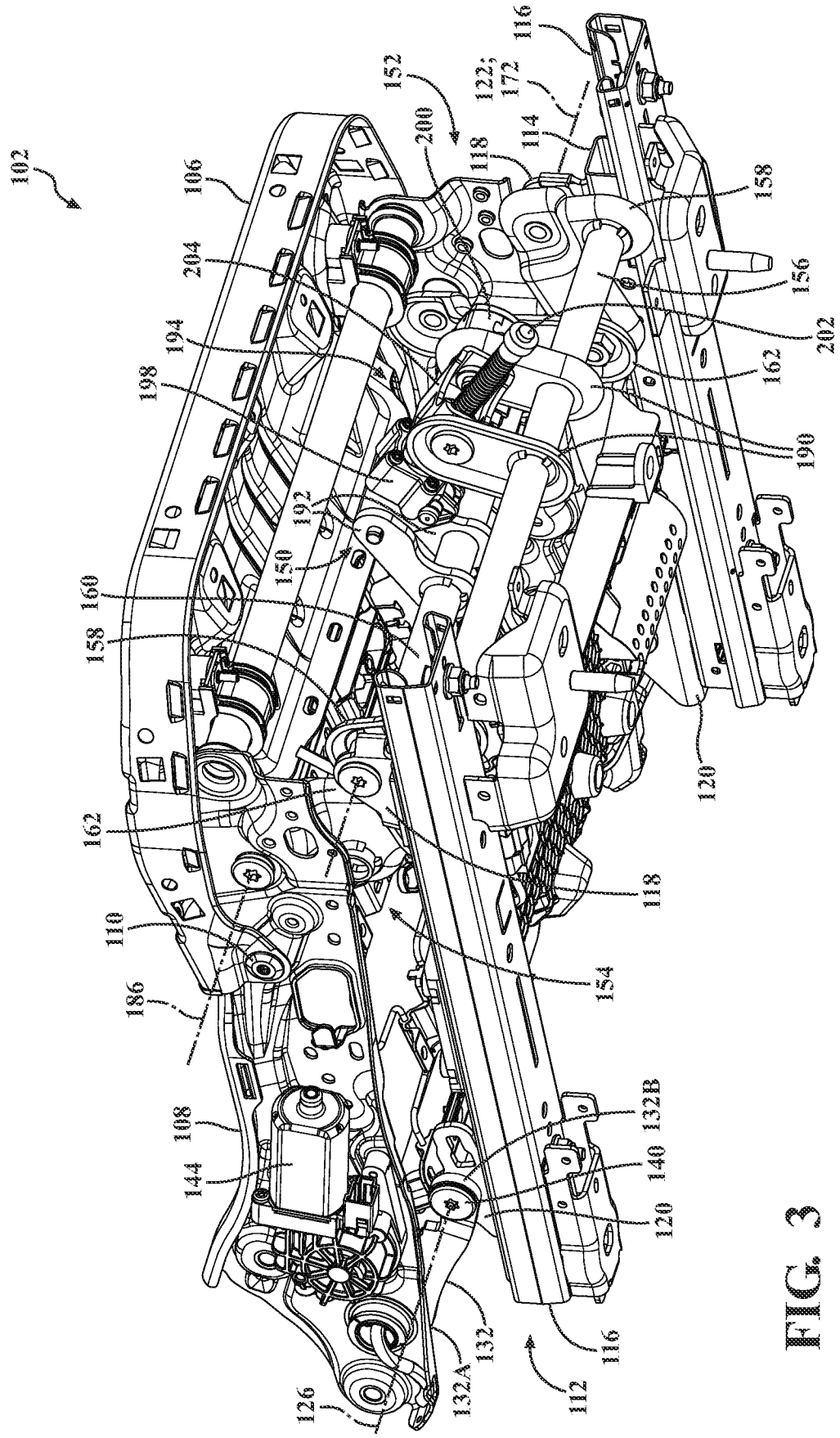
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FIG. 3

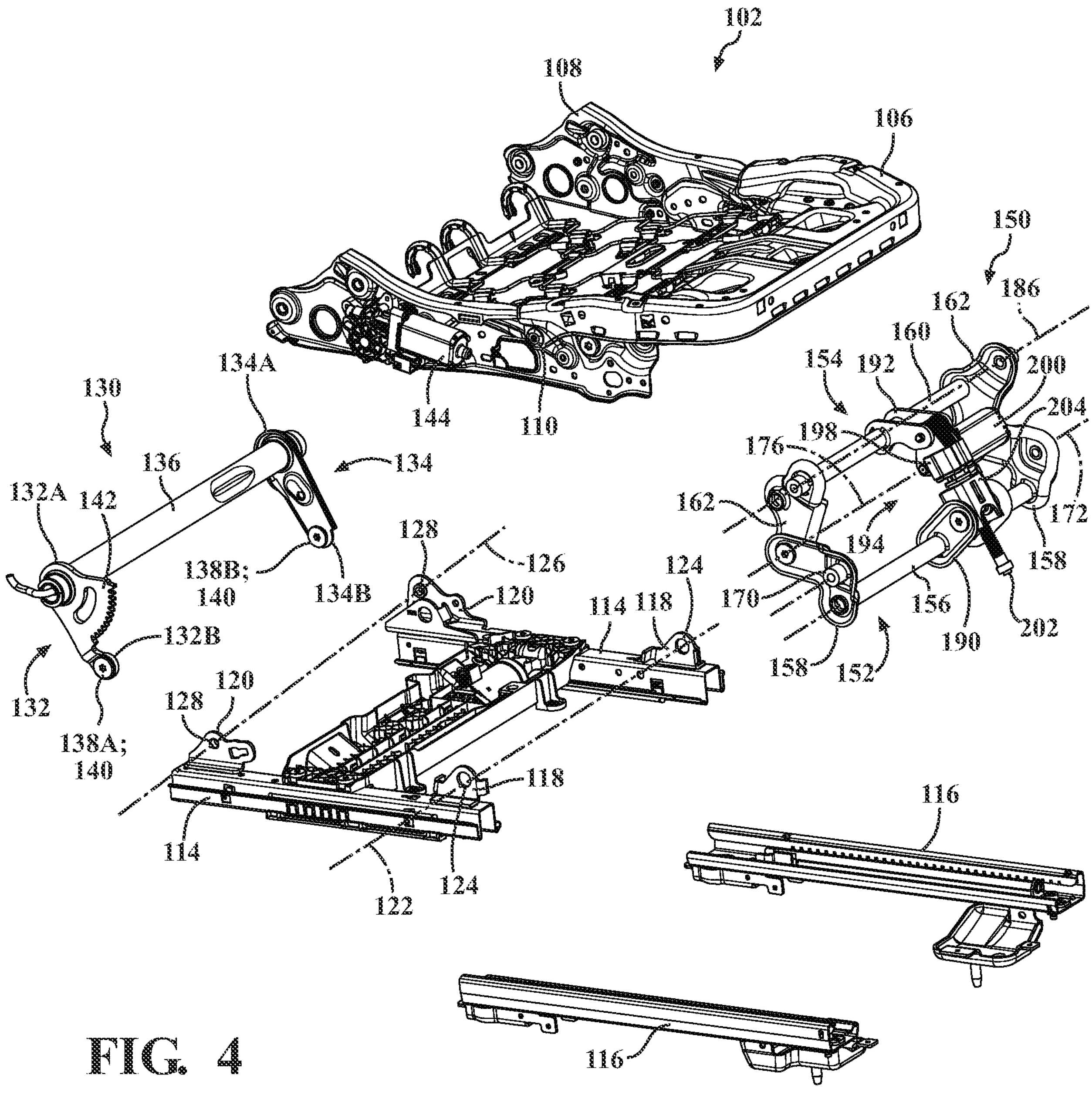
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FIG. 4

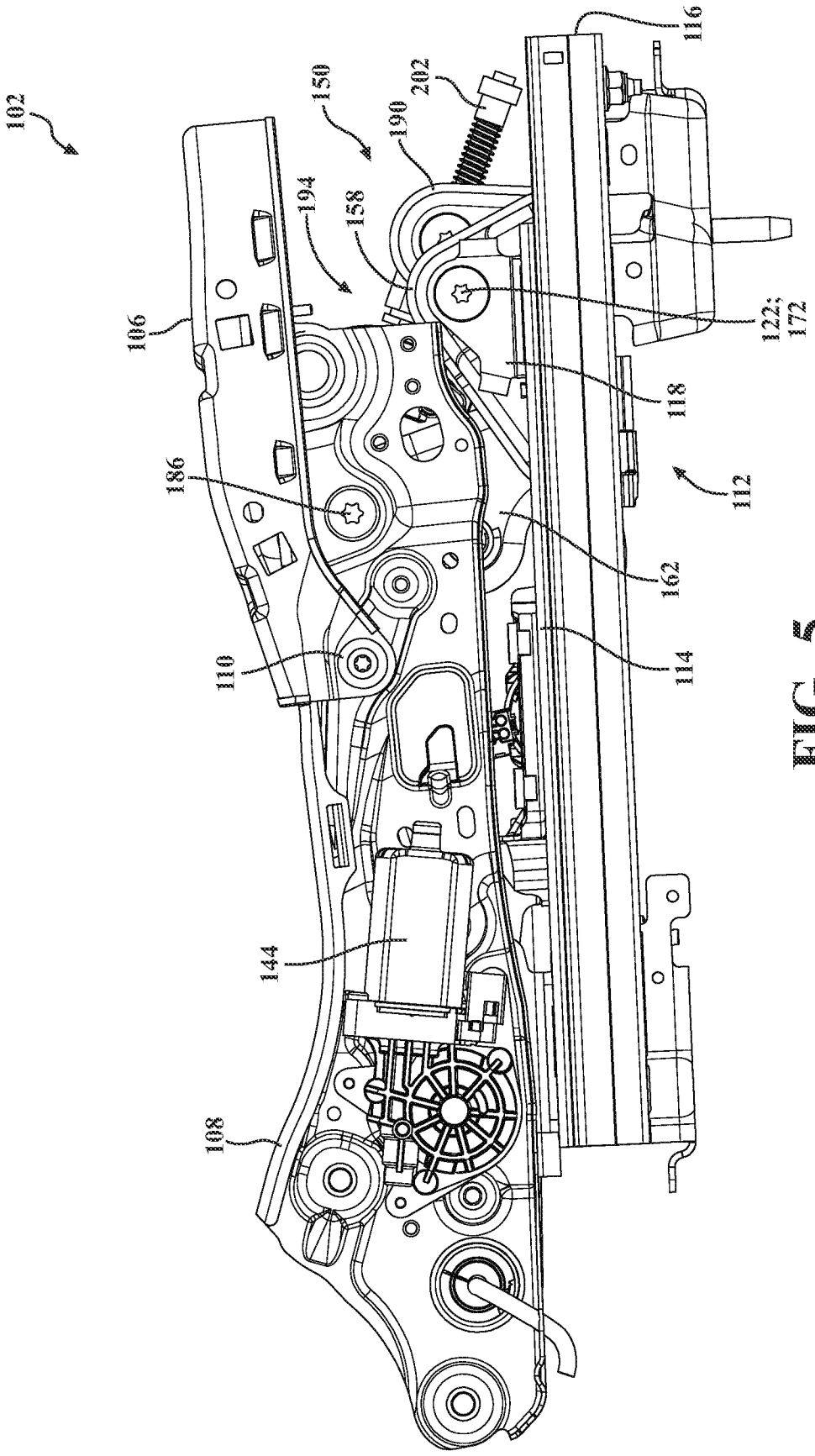
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FIG. 5

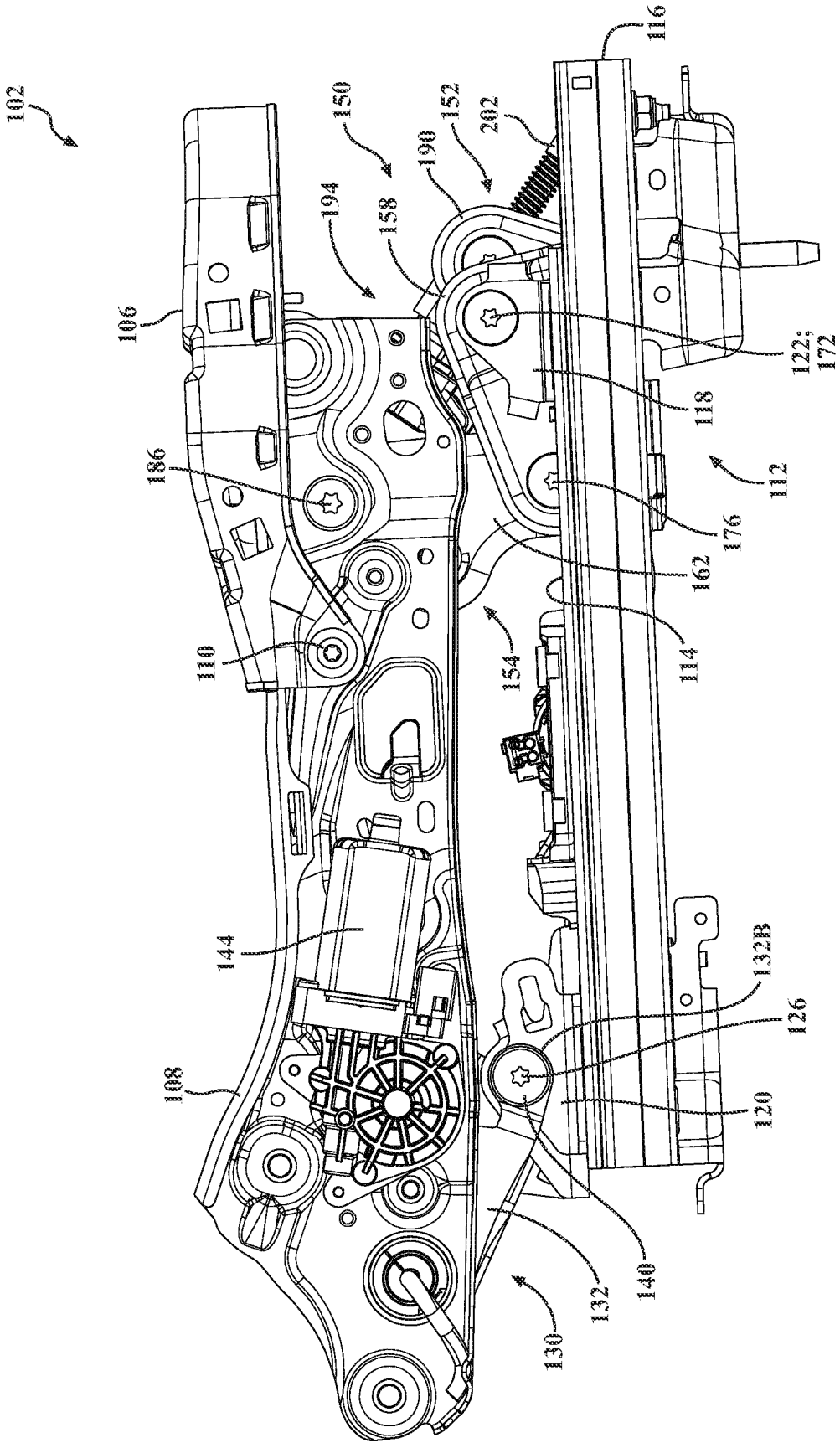
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FIG. 6

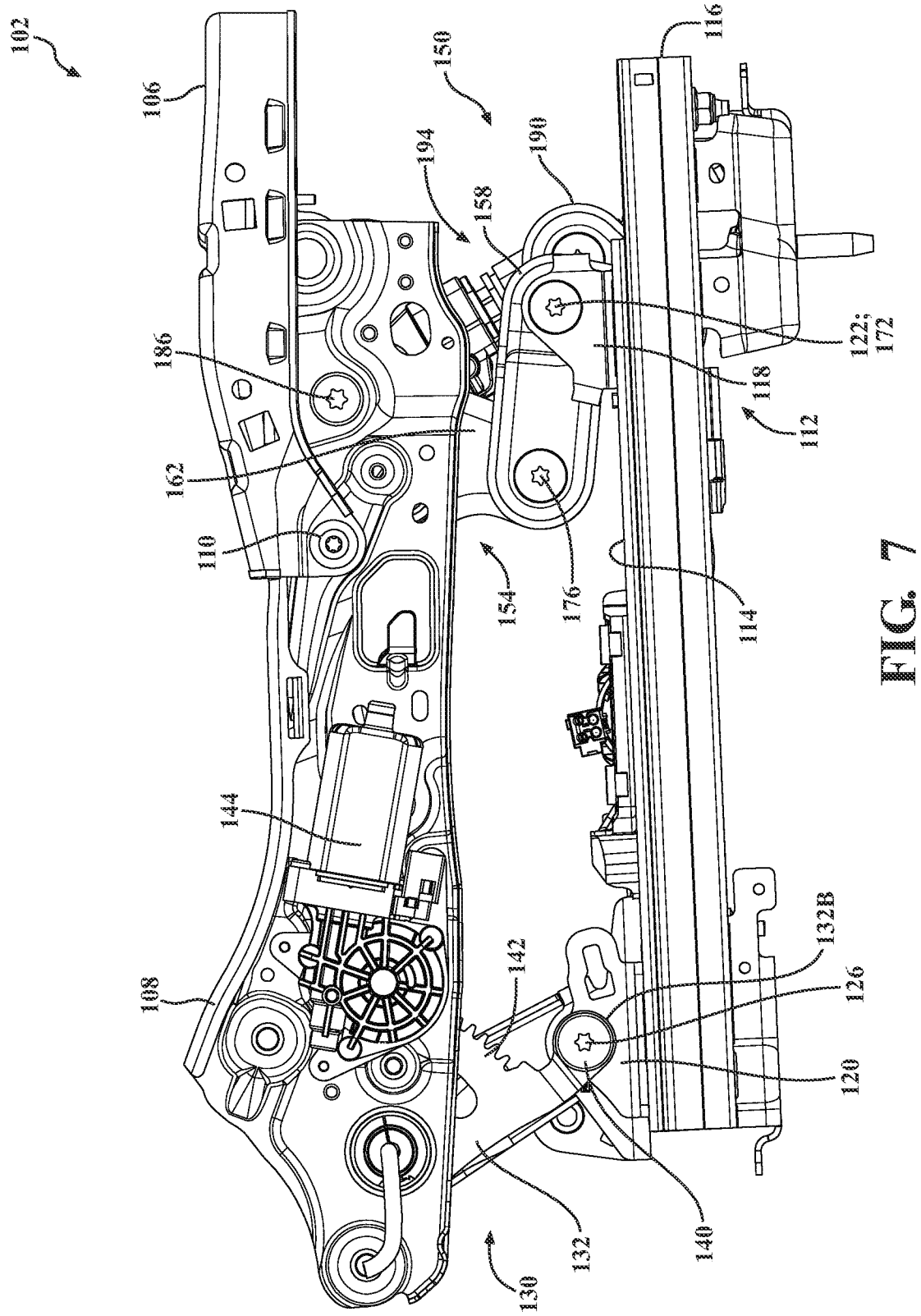
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FIG. 7

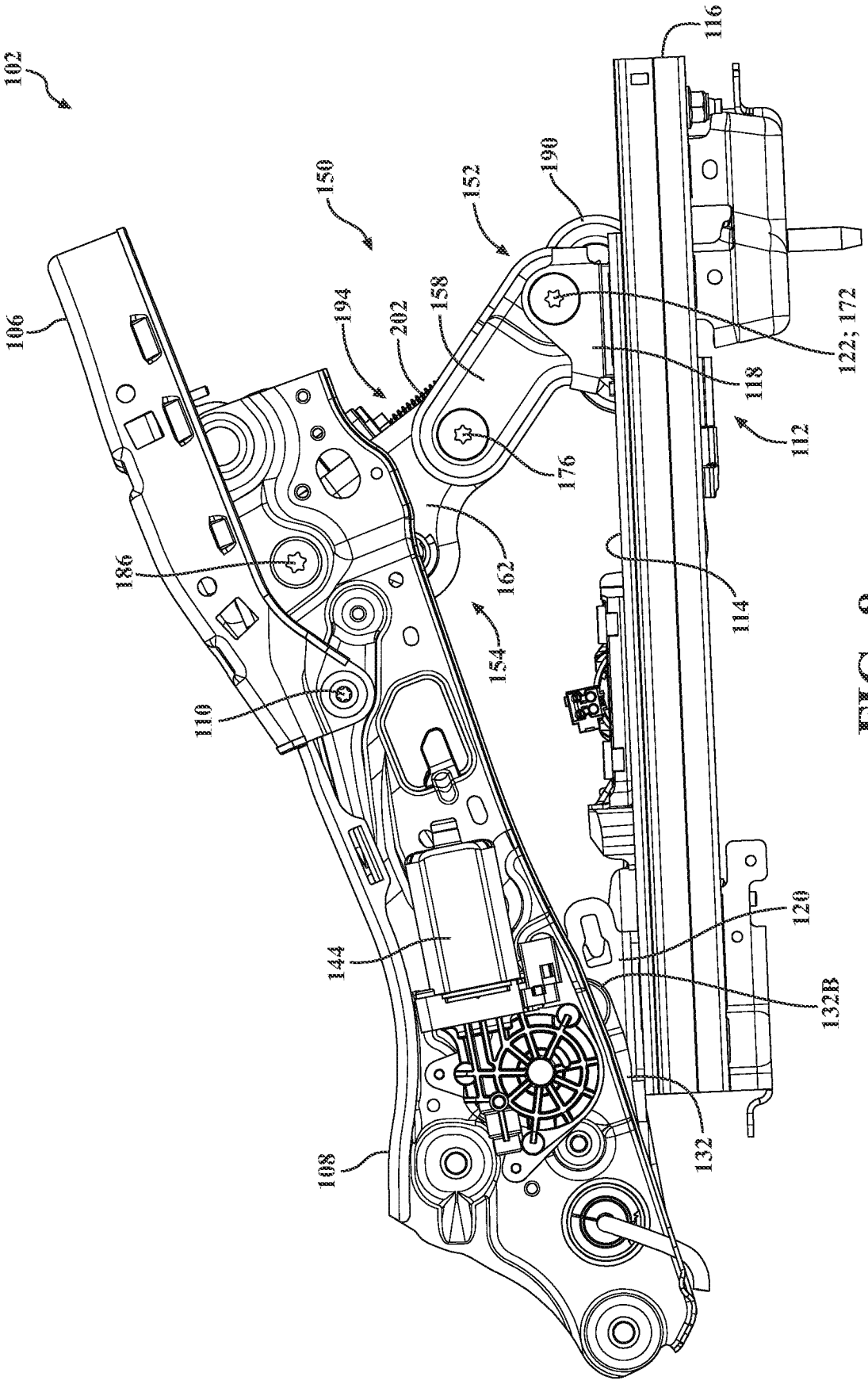
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FIG. 8

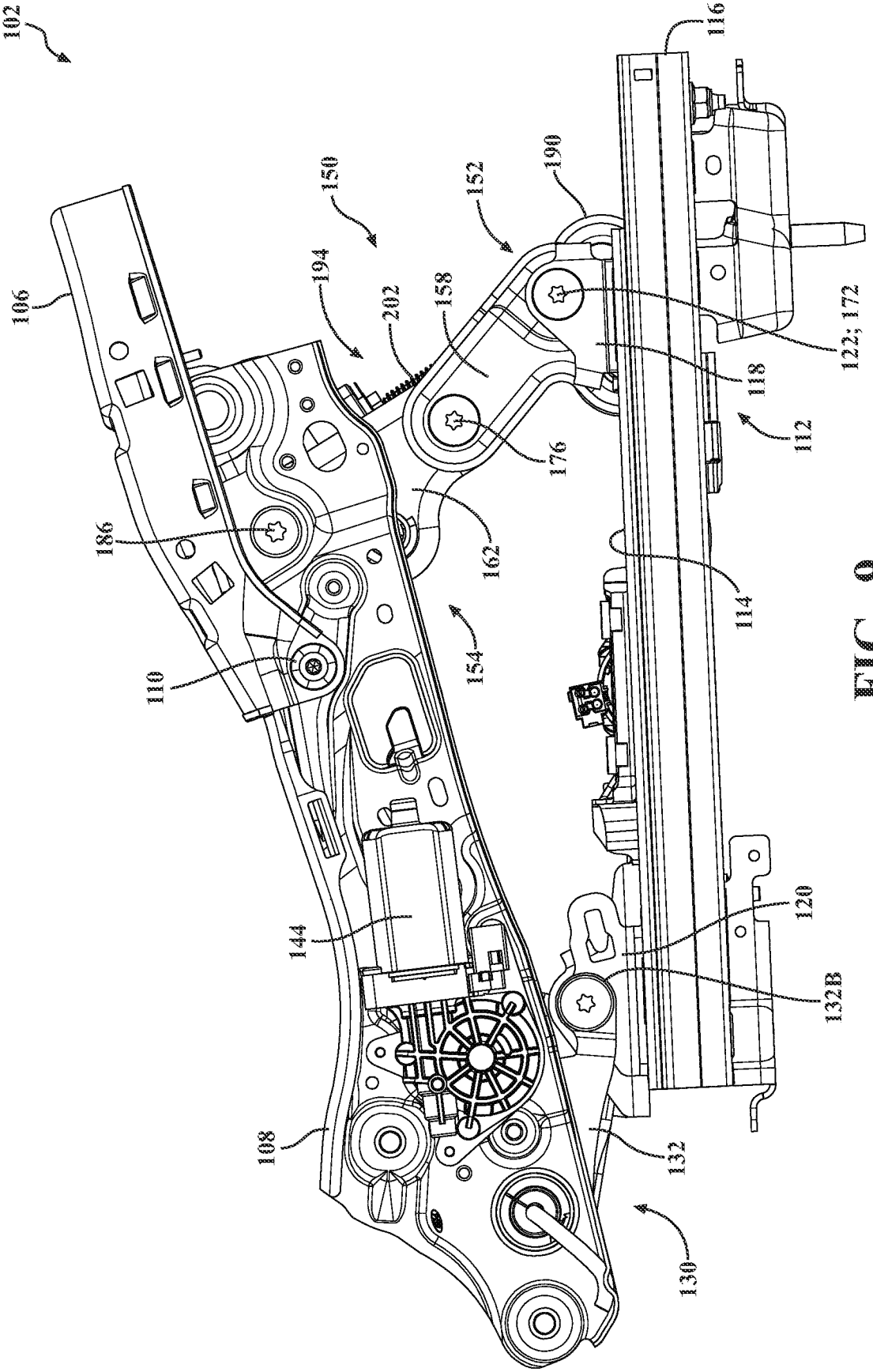
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FIG. 9

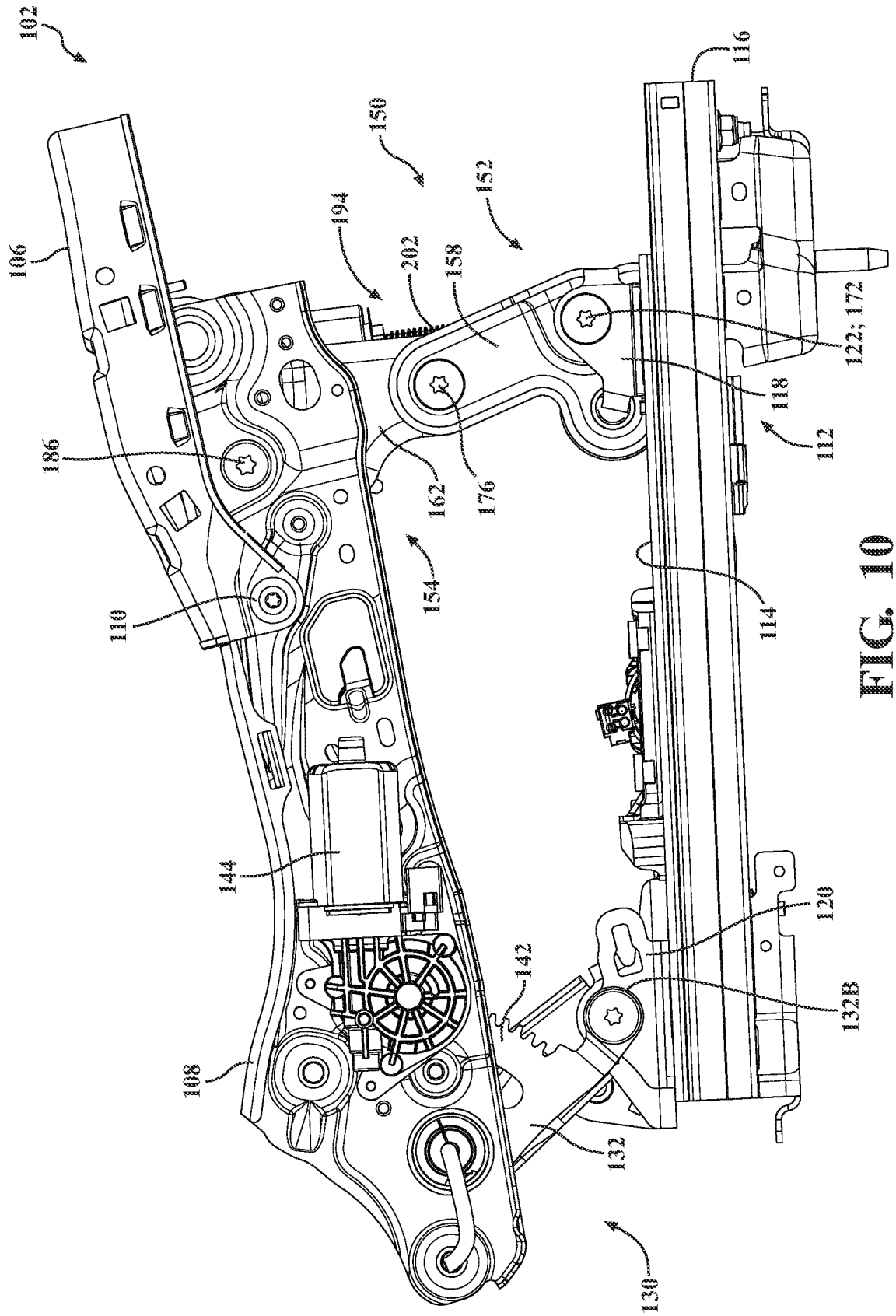
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FIG. 10

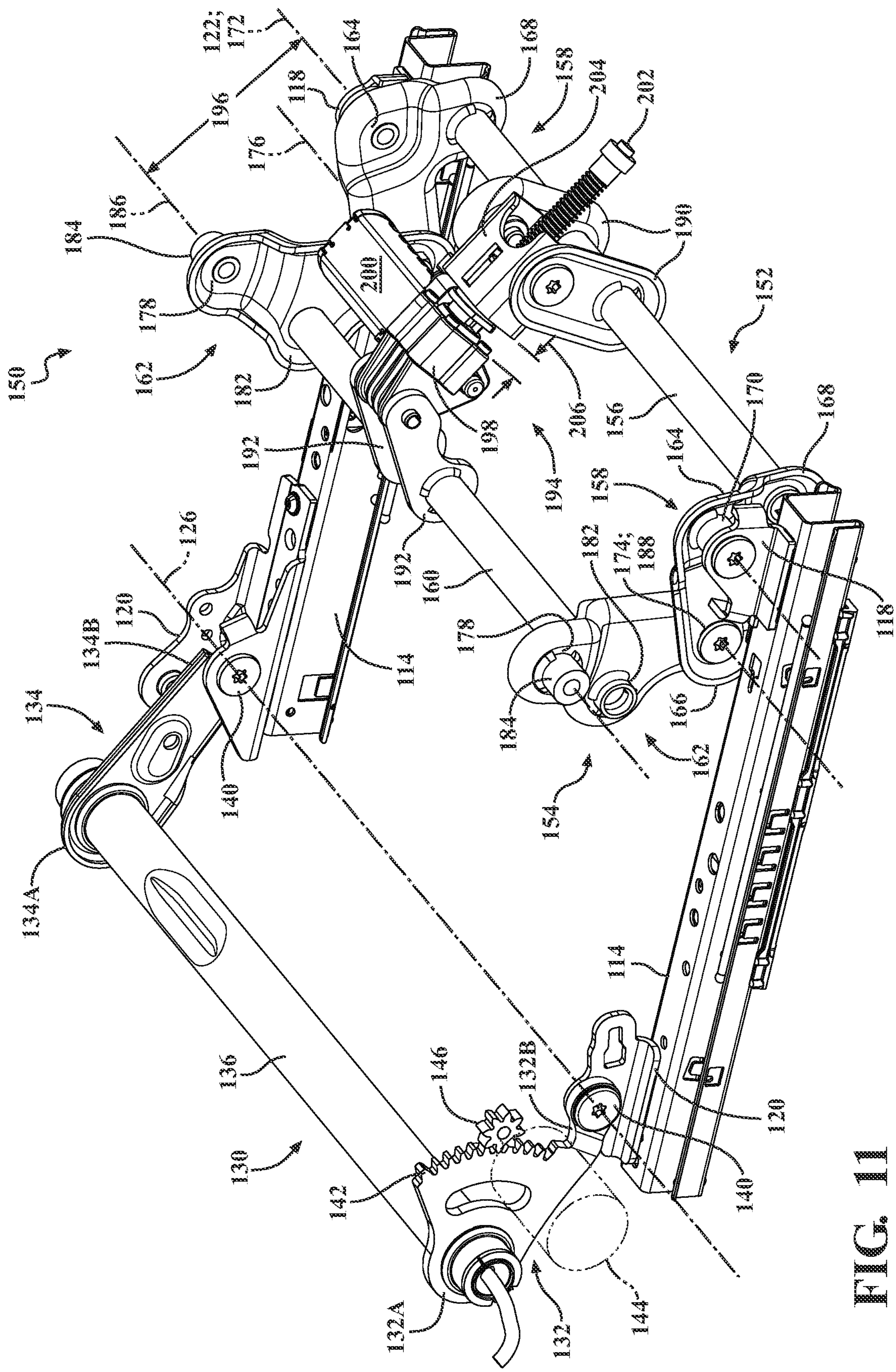
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FIG. 11

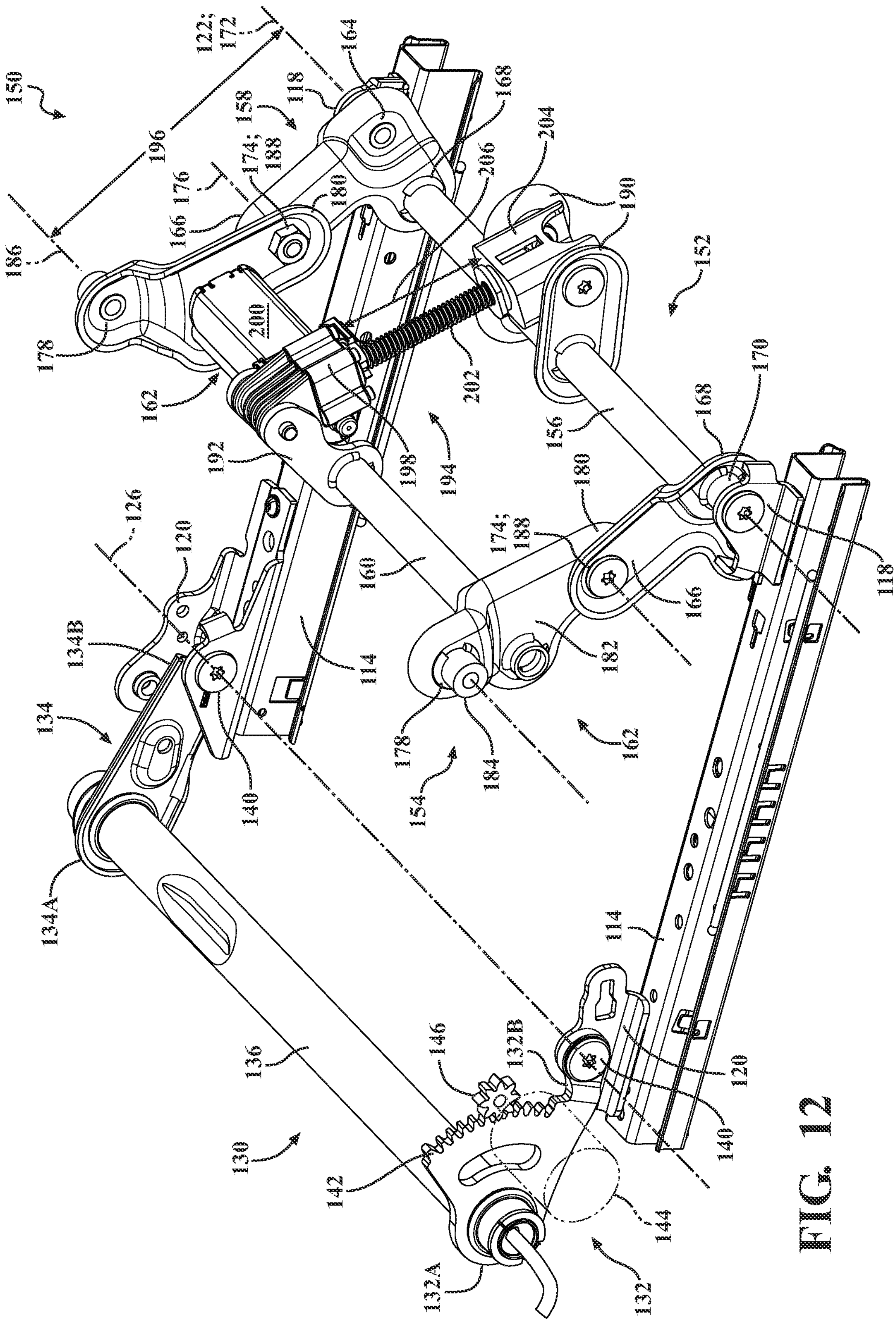
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FIG. 12

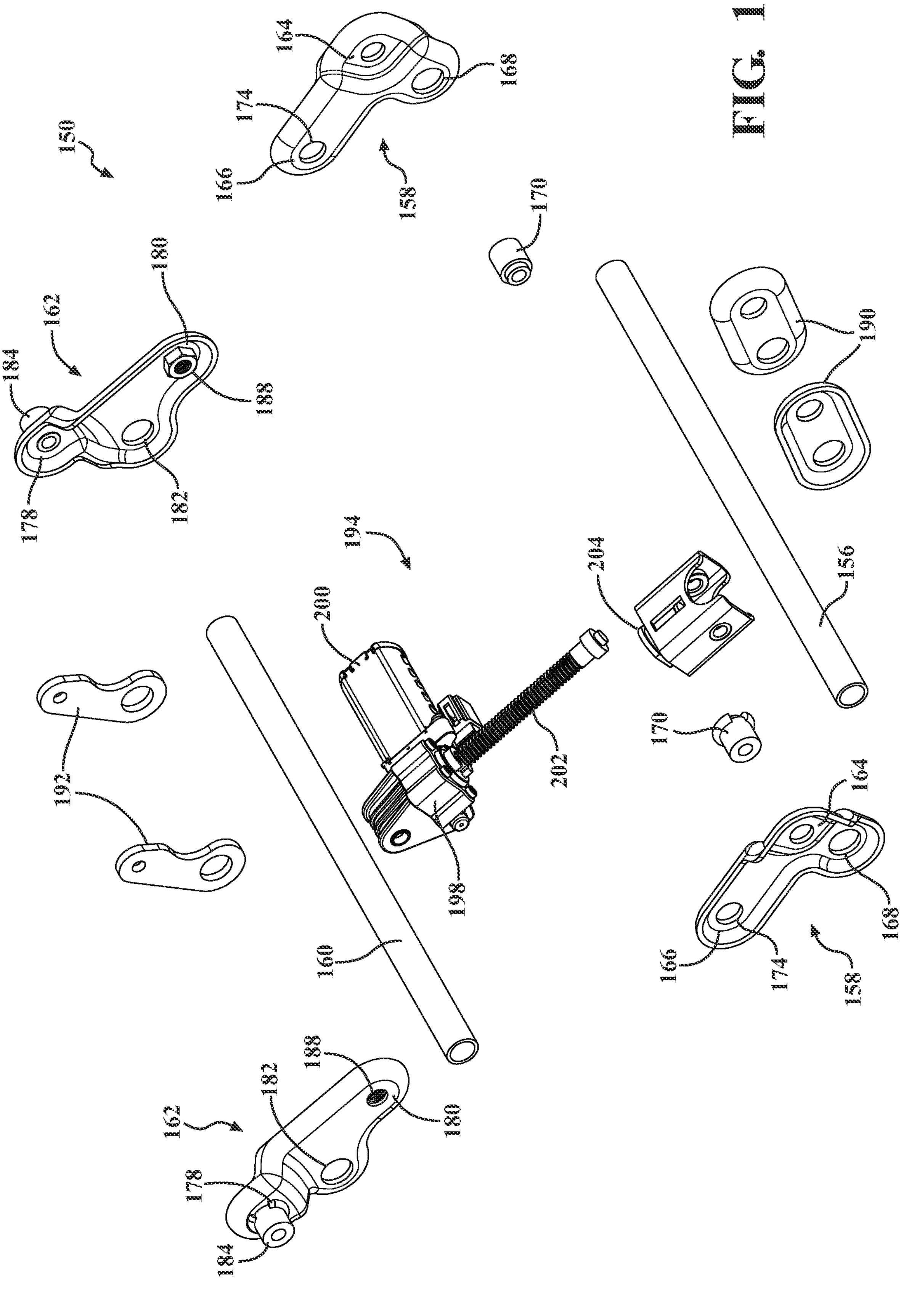
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FIG. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2024/033271

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60N2/16 B60N2/18
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60N

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	CN 201 856 665 U (FAURECIA SHANGHAI MAN CO LTD) 8 June 2011 (2011-06-08) figures 1-4	1-10 11-21
Y	CN 113 968 176 A (MAGNA HONGLI AUTOMOTIVE SYSTEM GROUP CO LTD) 25 January 2022 (2022-01-25) figures 1-8	11-21
Y	DE 10 2016 015170 A1 (GM GLOBAL TECH OPERATIONS LLC [US]) 21 June 2018 (2018-06-21) paragraphs [0051] - [0066]; figure 1	11-21
A	WO 2014/009270 A1 (HAMMERSTEIN GMBH C ROB [DE]) 16 January 2014 (2014-01-16) page 9, line 21 - page 12, line 23; figures 1-4	11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
3 September 2024	09/10/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Lotz, Klaus-Dieter

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2024/033271

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 201856665 U	08-06-2011	NONE	
CN 113968176 A	25-01-2022	NONE	
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