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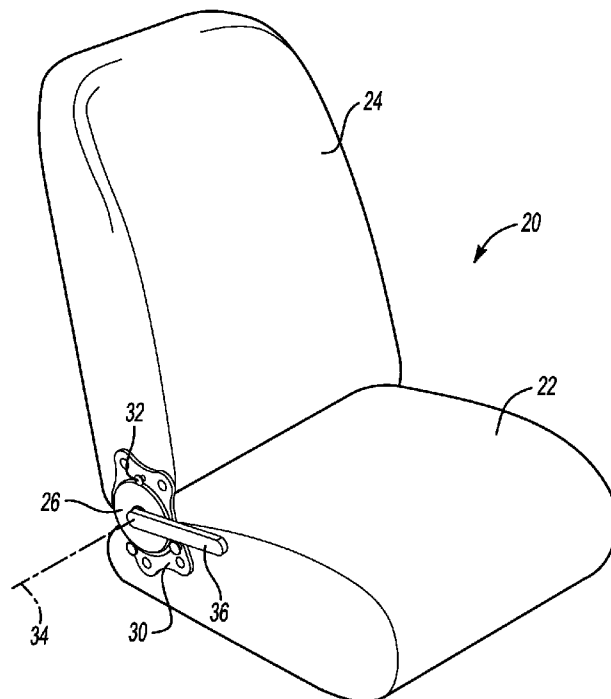
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- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *of inventorship (Rule 4.17(iv))*

[Continued on next page]

(54) **Title:** DISCONTINUOUS RECLINER



**Fig-1**

(57) **Abstract:** A vehicle seat recliner has a first plate with an axially extending cylindrical surface and a second plate assembled to the first plate that pivots about a pivot axis. A locking assembly selectively locks the first and second plates together but is released to allow the second plate to pivot relative to the first plate. A case is secured to the second plate and extends about the first plate to prevent axial displacement of the first plate relative to the second plate. The case has a circular portion that provides a bearing surface for the cylindrical surface of the first plate when the first plate and the second plate pivot relative to each other.

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## DISCONTINUOUS RECLINER

### TECHNICAL FIELD

[0001] This disclosure relates to a discontinuous recliner for a vehicle seat that has a gear plate that rides on a bearing surface of a case that is attached to a guide plate.

### BACKGROUND

[0002] Reclining mechanisms for vehicle seats permit the seat back to pivot in two directions to allow a passenger to recline or incline the seat. Discontinuous recliners generally have a guide plate and a gear plate that are selectively pivoted relative to each other when locking elements are disengaged from teeth provided on the gear plate. The close spacing between guide features on the guide plate and the teeth on the gear plate in some situations may result in unwanted noise during recliner adjustment.

[0003] This disclosure is directed to eliminating noise in discontinuous recliners and other problems as summarized below.

### SUMMARY

[0004] According to one aspect of this disclosure, a vehicle seat recliner is provided that comprises a first plate having a pivot axis with an axially extending cylindrical surface and a second plate assembled to the first plate that pivots about the pivot axis. A locking assembly is selectively actuated to lock the first and second plates together and is released to pivot the second plate relative to the first plate. A case is secured to the second plate and extends about the first plate to retain the first plate adjacent to the second plate and prevent axial displacement of the first plate away from the second plate. The case has a circular portion that provides a bearing surface for the cylindrical surface of the first plate when the first plate and the second plate pivot relative to each other.

[0005] According to other aspects of the disclosure, a plurality of radially inwardly facing teeth are disposed on the first plate that cooperate with a plurality of radially outwardly facing teeth

provided on the locking assembly. The outwardly directed teeth engage the radially inwardly directed teeth when the locking assembly is actuated. The outwardly directed teeth disengage the radially inwardly facing teeth when the locking assembly is released. At least one guide feature is disposed on the second plate that guides the locking assembly as the locking assembly is moved between the actuated and released conditions. The radial spacing between the circular portion and the cylindrical surface is less than the radial spacing between the at least one guide feature and the radially inwardly facing teeth.

[0006] According to other aspects of the disclosure, the locking assembly may further comprise a plurality of locking elements that include the radially outwardly facing teeth on a radially outwardly facing surface, and a cam that engages the locking elements to move the locking elements reciprocally in a radial direction. The plurality of radially inwardly facing teeth on the first plate are spaced from the guide feature by between 0.2 to 0.3 mm and the spacing between the circular portion and the cylindrical surface is between 0.05 and 0.15 mm.

[0007] The circular portion of the case may be the inner diameter of a radially inwardly extending flange. A glide ring may be attached to an axially inwardly facing surface of the radially inwardly extending flange.

[0008] According to another aspect of the disclosure, a vehicle seat recliner is disclosed that comprises a gear plate having a pivot axis, a plurality of radially inwardly facing teeth, and an axially extending cylindrical surface. A guide plate is assembled to the gear plate that pivots about the pivot axis. At least one guide feature is disposed on the guide plate. A plurality of locking members are selectively actuated to lock the gear and guide plates together. The locking members are released to pivot the guide plate relative to the gear plate. A plurality of radially outwardly facing teeth are provided on the locking members that engage the radially inwardly directed teeth of the gear plate when the locking members are actuated. The outwardly facing teeth disengage the radially inwardly facing teeth when the locking members are released. A cam is rotated to actuate the locking members. A case is secured to the guide plate that extends about the gear plate to retain the gear plate adjacent to the guide plate and prevent axial displacement of the gear plate away from the guide plate. The case has a circular portion that provides a bearing surface for the cylindrical surface of the gear plate when the gear plate and the guide plate pivot relative to each other.

[0009] The above aspects and other aspects of this disclosure will be better understood in view of the attached drawings and the following detailed description of the illustrated embodiments of the disclosed recliners.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIGURE 1 is a perspective view of a seat assembly including a discontinuous recliner;

[0011] FIGURE 2 is an exploded perspective view of the discontinuous recliner in accordance with the present invention;

[0012] FIGURE 3 is a side elevation view of a guide plate, a pair of locking elements, cam and a pair of springs of the discontinuous recliner: and

[0013] FIGURE 4 is a diagrammatic cross-sectional view of the discontinuous recliner.

#### DETAILED DESCRIPTION

[0014] The illustrated embodiments are disclosed with reference to the drawings. However, it is to be understood that the disclosed embodiments are intended to be merely examples that may be embodied in various and alternative forms. The figures are not necessarily to scale and some features may be exaggerated or minimized to show details of particular components. The specific structural and functional details disclosed are not to be interpreted as limiting, but as a representative basis for teaching one skilled in the art how to practice the disclosed concepts.

[0015] Referring now to Figure 1, a seat assembly is illustrated and referenced generally by numeral 20. The seat assembly 20 includes a generally horizontal member that is referred to as a seat base 22. The seat assembly 20 also includes an upright member that is referred to as a seat back 24. A pair of reclining mechanisms 26 connect the seat base 22 to the seat back 24 in the illustrated embodiment. The reclining mechanisms 26 are connected together by a shaft (shown in Figure 2) that links and coordinates locking and unlocking the reclining mechanisms 26 to change the angle of the seat back 24 relative to the seat base 22.

**[0016]** In one embodiment, the pair of reclining mechanisms 26 each have a guide plate 30, that connects the reclining mechanism 26 to the seat base 22. Any suitable method of connecting the guide plate 30 to the seat base 22 is contemplated within the scope of the present invention such as a mechanically fastening the guide plate 30 to the seat frame. The reclining mechanisms 26 each have a gear plate 32 that connects the reclining mechanism 26 to the seat back 24. Any suitable method of connecting the gear plate 32 to the seat back 24 is contemplated within the scope of the present invention.

**[0017]** Referring to Figures 1 and 2, the guide plate 30 is connected to the gear plate 32 to pivot about the pivotal axis 34. The pivotal axis 34 is located in the center of the guide plate 30 and the gear plate 32. A shaft 39 extends along the pivotal axis 34 and is rotated about the pivotal axis 34. Gear plate 32 rotates about the pivotal axis 34 and allows the seat back 24 to be reclined or inclined. A hand lever 36 is manually actuated to release the seat back 24 for rotation with the shaft 39 about the pivotal axis 34.

**[0018]** With specific reference to Figure 2, the reclining mechanism 26 is shown in an exploded view. The reclining mechanism 26 includes the guide plate 30 and the gear plate 32. A hub 38 may be inserted into the guide plate 30 to pivot about the pivotal axis 34. The hub 38 receives the shaft 39, and is secured to the gear plate 32 by the clip 40.

**[0019]** The cam 42 defines a central bore 43 that receives the hub 38. The hub 38 has a splined connection to the cam 42. The cam 42 pivots about the pivotal axis 34 with the hub 38. Cam 42 drives the two lock elements 44 in opposite directions relative to the pivotal axis 34. The guide plate 30 guides the lock elements 44 as they radially reciprocate. The gear plate 32 is unable to rotate about the pivotal axis 34 when an outer end 45 of one of the lock elements engages the gear plate 32. The gear plate 32 may pivot about the pivotal axis 34 when the outer ends 45 of the lock elements 44 are not in contact with the gear plate 32. The outer ends 45 have a gear segment 47 that selectively engages a set of gear teeth 49 formed on the gear plate 32.

**[0020]** In one embodiment, the cam 42 has a cam pawl 46 and the lock elements 44 each have an associated lock pawl 48. The cam pawl 46 drives the lock element 44 outward so that the outer end 45 contacts the gear plate 32 when the cam pawl 46 is disengaged from the lock pawl 48.

The cam pawl 46 hooks the lock pawl 48 to pull the lock element 44 toward the pivotal axis 34. When the lock elements 44 are pulled toward the pivotal axis 34, the outer ends 45 of the lock elements 44 are no longer in contact with the gear plate 32 allowing the gear plate 32 and the associated seat back 24 to rotate about the pivotal axis 34.

**[0021]** In the illustrated embodiment, a pair of torsion springs 50 are operatively connected to the guide plate 30 and the cam 42. The torsion springs 50 bias the cam 42 to urge the lock elements 44 outwardly and into engagement with the gear plate 32.

**[0022]** A case 52 is secured to the guide plate 30 and encloses the gear plate 32, cam 42 and lock elements 44. The case 52 has a radially inwardly extending flange 54 that terminates at a circular edge 56 that functions as a bearing surface as will be described more fully below. A glide ring 58 is provided to separate the gear plate 32 from the flange 54. The glide ring 58 has a plurality of axially extending tabs 60 that are received in a corresponding plurality of arcuate slots, or cut-outs, 62 defined in the circular edge 56 of the case 52. The gear plate 32 is secured to a plate 64, or other structure that is secured to or associated with the seat back 24 (shown in Figure 1). The gear plate 32 has protrusions 66 that are assembled into holes 68 defined in the plate 64 in the illustrated embodiment. It should be understood that many different assembly methods and fastening mechanisms may be used to secure the recliner 26 to the seat 20.

**[0023]** Referring to Figure 3, the recliner 26 is partially illustrated to show the interaction of the hub 38 with the cam 42 and the locking elements 44. The springs 50 and locking elements 44 are located on the guide plate 30 by four guide blocks 70. The guide blocks 70 have a radially outwardly facing surface 72 that is spaced radially inward from the internal teeth 49 formed on the gear plate 32. When the cam 42 pulls the locking elements inwardly to disengage the internal teeth 49 of the gear plate 32, the teeth 45 on the outer ends of the locking elements 44 are pulled radially inwardly until they are radially inboard of the outwardly facing surface 72 of the guide blocks 70.

**[0024]** Figure 4 is a cross-sectional view of half of a recliner 26 that shows the guide plate 30 secured to the hub 38 by the clip 40. The guide plate 30 supports the cam 42 and is formed to include the guide blocks 70. The outer surface 72 of the guide blocks 70 is spaced apart from the internal teeth 49 by about 0.2 to 0.3mm. A cylindrical wall 76 is provided on an outer surface of the

gear plate 32. The circular edge 56 of the case 52 and the cylindrical wall 76 of the gear plate 32 are secured together with a tight fit of between 0.05 and 0.15 mm. The tight fit between the case 52 and the cylindrical wall 76 establish a bearing surface between the case 52 and the wall 76.

**[0025]** Gear plate 32 pivots within and contacts the circular edge 56 of the flange 54. Grease may be applied in the area of the bearing surface between the case 52 and the cylindrical wall 76 to assure smooth contact. The gap between the cylindrical wall 76 and the circular edge 56 of the case 52 is less than the gap between the outwardly facing surface 58 of the gear plate and the internal teeth 49. The additional spacing between the outer surface 72 of the guide blocks 70 and the internal teeth 49 of the gear plate 32 prevents the guide blocks 70 from touching the teeth 49 of the gear plate 32.

**[0026]** Referring again to Figure 2, tabs 60 are received in the arcuate slots 62 in the circular edge 56 and fill the slots 62 with a soft plastic material to provide a smooth circular surface. The cylindrical wall 76 bears upon the circular edge 56 of the case 52 and avoids undesirable noise during recliner adjustment.

**[0027]** While exemplary embodiments are described above, it is not intended that these embodiments describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention. Additionally, the features of various implementing embodiments may be combined to form further embodiments of the invention.



## WHAT IS CLAIMED IS:

1. A vehicle seat recliner comprising:
  - a first plate having a pivot axis and an axially extending cylindrical surface;
  - a second plate assembled to the first plate that pivots about the pivot axis;
  - a locking assembly that is selectively actuated to lock the first and second plates together and that is released to pivot the second plate relative to the first plate; and
  - a case secured to the second plate that extends about the first plate to retain the first plate adjacent to the second plate and prevent axial displacement of the first plate away from the second plate, wherein the case has a circular portion that provides a bearing surface for the cylindrical surface of the first plate when the first plate pivots relative to the second plate.
  
2. The recliner of claim 1 further comprising:
  - a plurality of radially inwardly facing teeth disposed on the first plate;
  - a plurality of radially outwardly facing teeth provided on the locking assembly that engage the radially inwardly facing teeth when the locking assembly is actuated and that disengage the radially inwardly facing teeth when the locking assembly is released;
  - at least one guide feature disposed on the second plate that guides the locking assembly as the locking assembly is moved between the actuated and released conditions; and
  - wherein the radial spacing between the circular portion and the cylindrical surface is less than the radial spacing between the at least one guide feature and the radially inwardly facing teeth.
  
3. The recliner of claim 2 wherein the locking assembly further comprises:
  - a plurality of locking elements that include the radially outwardly facing teeth on a radially outwardly facing surface;
  - a cam that engages the locking elements to move the locking elements reciprocally in a radial direction; and
  - wherein the plurality of radially inwardly facing teeth on the first plate are spaced from the guide feature by between 0.2 to 0.3 mm and the spacing between the circular portion and the cylindrical surface is between 0.05 and 0.15 mm.

4. The recliner of claim 1 wherein the circular portion of the case is an inner diameter of a radially inwardly extending flange.

5. The recliner of claim 4 wherein a glide ring is attached to an axially inwardly facing surface of the radially inwardly extending flange.

6. A vehicle seat recliner comprising:  
a gear plate having a pivot axis, a plurality of radially inwardly facing teeth, and an axially extending cylindrical surface;  
a guide plate assembled to the gear plate that pivots about the pivot axis, at least one guide feature disposed on the guide plate;  
a plurality of locking members that are selectively actuated to lock the gear and guide plates together and that is released to pivot the guide plate relative to the gear plate, a plurality of radially outwardly facing teeth provided on the locking members that engage the radially inwardly facing teeth when the locking members are actuated and that disengage the radially inwardly facing teeth when the locking members are released;  
a cam that is rotated to actuate the locking members; and  
a case secured to the guide plate that extends about the gear plate to retain the gear plate adjacent to the guide plate and prevent axial displacement of the gear plate away from the guide plate, wherein the case has a circular portion that provides a bearing surface for the cylindrical surface of the gear plate when the gear plate pivots relative to the guide plate.

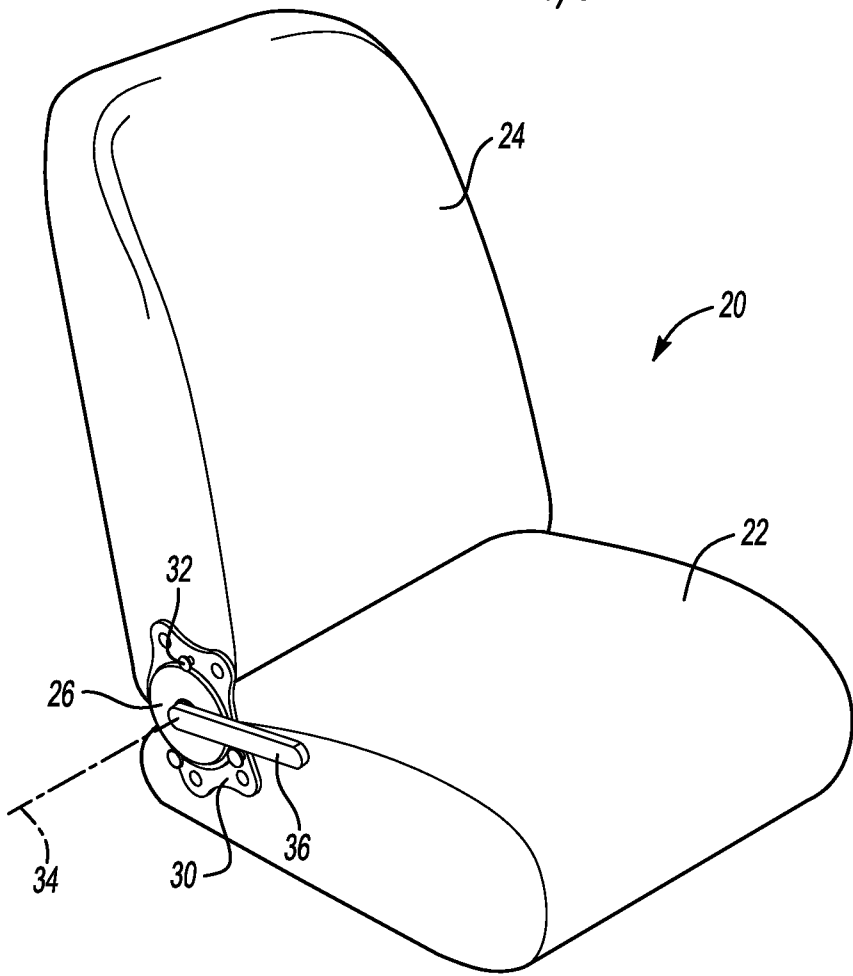
7. The recliner of claim 6 further comprising at least one guide feature disposed on the guide plate that guides the locking members as the locking members are moved between the actuated and released conditions.

8. The recliner of claim 7 wherein the radial spacing between the circular portion and the cylindrical surface is less than the radial spacing between the at least one guide feature and the radially inwardly facing teeth.

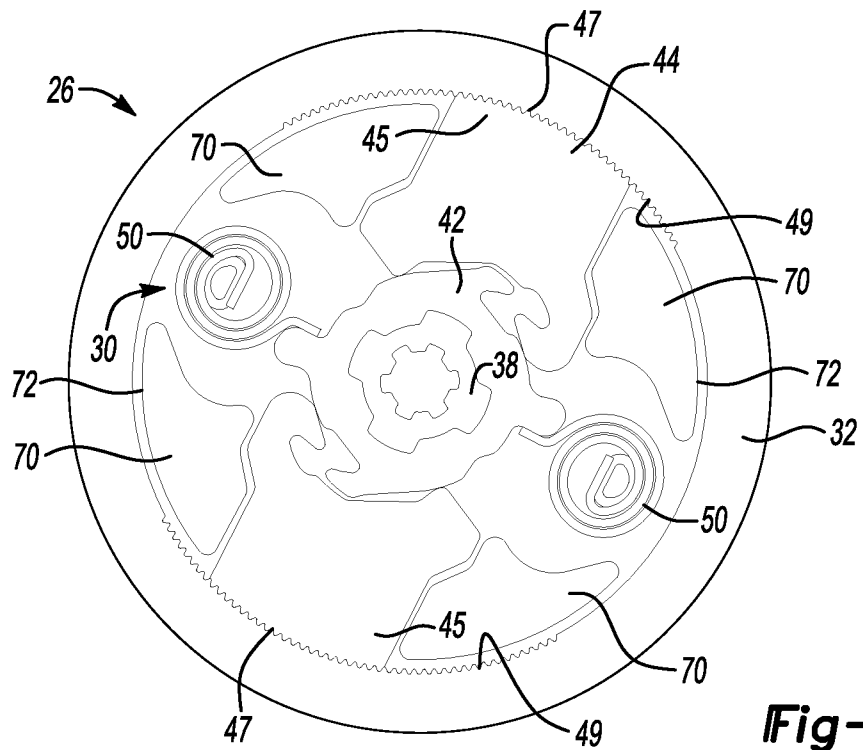
9. The recliner of claim 7 wherein the plurality of radially inwardly facing teeth on the gear plate are spaced from the guide feature by between 0.2 to 0.3 mm and the spacing between the circular portion and the cylindrical surface is between 0.05 and 0.15 mm.

10. The recliner of claim 6 wherein the cam engages the locking members to move the locking members reciprocally in a radial direction.

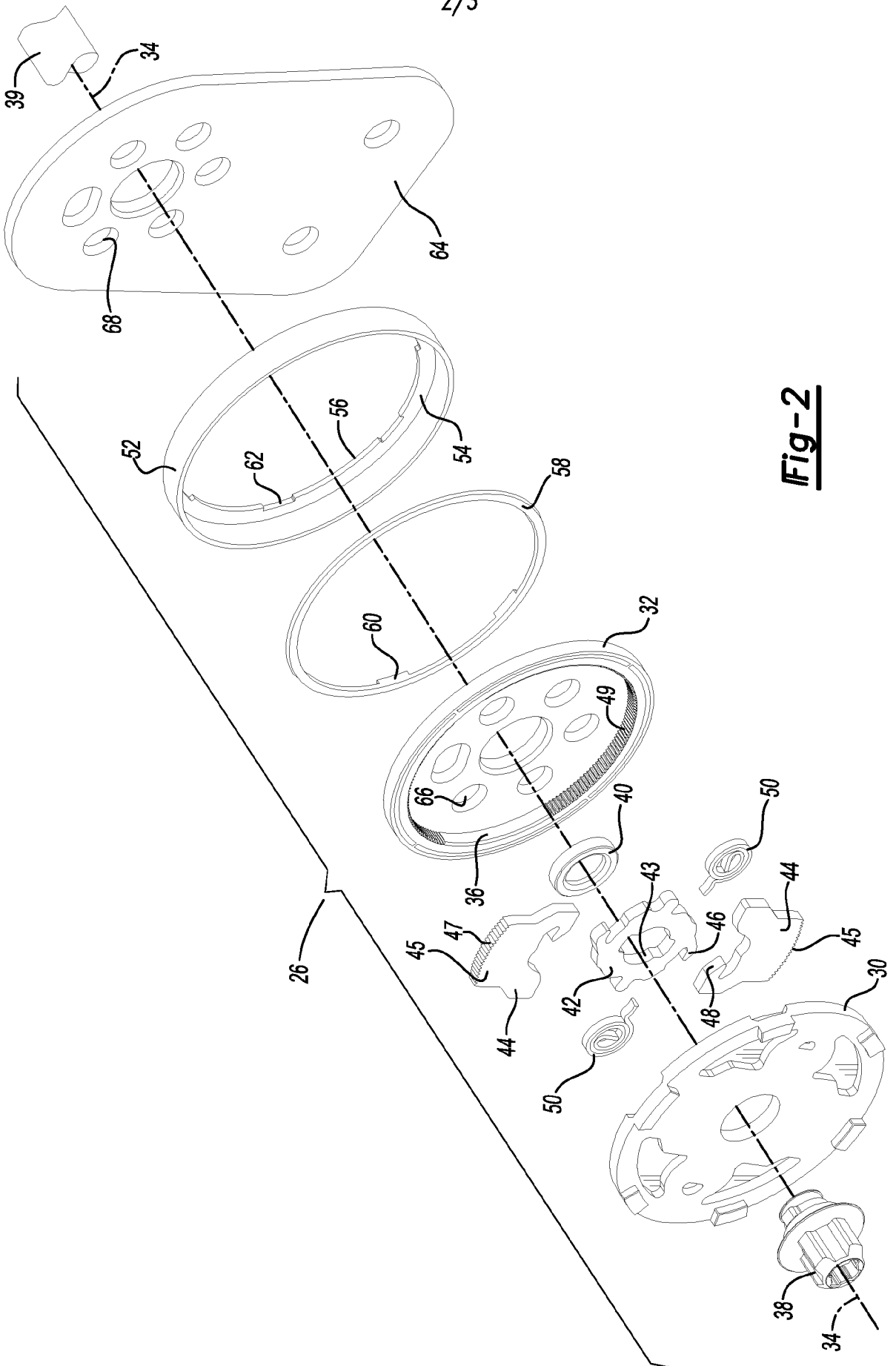
11. The recliner of claim 6 wherein a glide ring is attached to an axially inwardly facing surface of the radially inwardly extending flange.



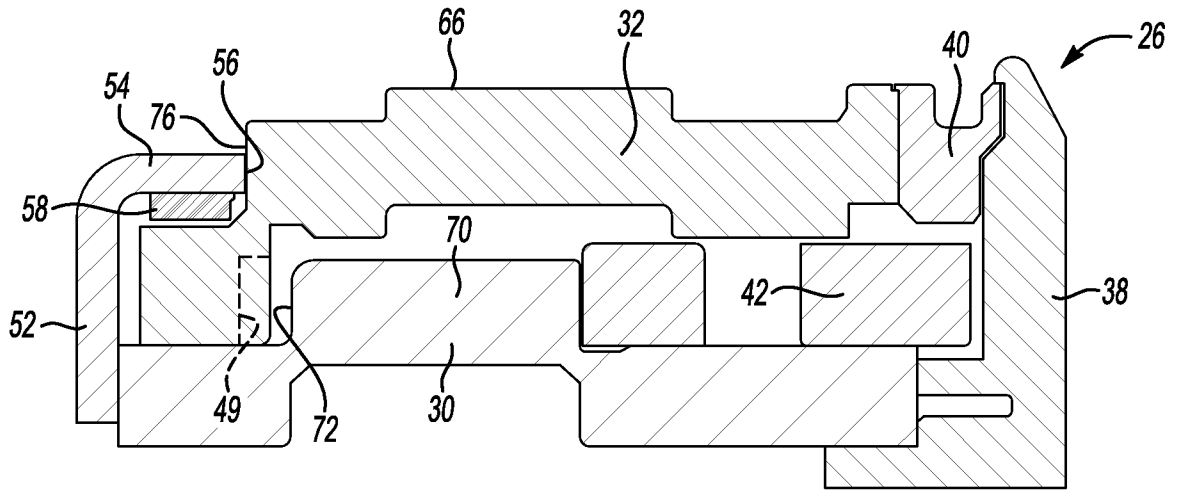
**Fig-1**



**Fig-3**



**Fig-2**



**Fig-4**

**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/US2012/037521

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(8) - B60N 2/20 (2012.01) USPC - 297/369 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC(8) - B60N 2/20, 2/235 (2012.01) USPC - 297/366, 367R, 369 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) PatBase, Google Patents		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y  X ----- Y  A	US 2009/0140565 A1 (WAHLS et al) 04 June 2009 (04.06.2009) entire document  US 2011/0304189 A1 (WAHLS) 15 December 2011 (15.12.2011) entire document  US 2001/0001220 A1 (ROHEE et al) 17 May 2001 (17.05.2001) entire document	1-5 ----- 8  6-7, 9-11 ----- 8  1-11
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Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Blaine R. Copenheaver  PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774