A ratchet device for a rocking furniture member has a plurality of structural elements. The ratchet device temporarily retains the furniture member in multiple engaged positions and includes: a pawl assembly having a pawl link rotatably connected to a first structural element; a plastic pawl lever rotatably connected to the pawl link; a first biasing element positioned between the pawl link and the pawl lever which biases the pawl lever toward a contact position with the pawl link; and a U-shaped bracket rotatably coupled to the pawl link and fixed to the first structural element. A ratchet having engagement teeth is fixed to a second structural element and located with the engagement teeth in a rotational path of the pawl lever. A second biasing element connected between the pawl link and the U-shaped bracket biases the pawl lever to engage the ratchet teeth.
FOLDABLE PAWL AND RATCHET ASSEMBLY

FIELD OF THE INVENTION

[0001] The present invention relates in general to furniture member operating mechanisms and more specifically to a device and method for operating a furniture leg rest assembly.

BACKGROUND OF THE INVENTION

[0002] Conventionally, reclining articles of furniture (i.e., chairs, sofas, loveseats, and the like) require a mechanism to bias a leg rest assembly in the extended and stowed positions. Known mechanisms commonly include a large number of moving parts that tends to increase the manufacturing time and costs associated with the furniture.

[0003] Most rocking chairs typically include an upholstered chair frame supported from a stationary base assembly in a manner permitting the chair frame to “rock” freely with respect to the base assembly. In order to provide enhanced comfort and convenience, many rocking chairs also include a “reclining” seat assembly and/or an “extendible” leg rest assembly. For example, combination platform rocking/reclining chairs, as disclosed in Applicant's U.S. Pat. Nos. 3,096,121 and 4,179,157, permit reclining movement of the seat assembly and actuation of the leg rest assembly independently of the conventional “rocking” action. The leg rest assembly is operably coupled to a drive mechanism to permit the seat occupant to selectively move the leg rest assembly between its normally retracted (i.e., “stowed”) and elevated (i.e., “extended”) positions. The drive mechanism is manually-operated and includes a handle which, when rotated by the seat occupant, causes concurrent rotation of a drive rod for extending or retracting the leg rest assembly.

[0004] As an additional comfort feature, a latching mechanism may also be provided for releasably retaining the chair frame in one or more rearwardly rocked or “tilted” positions on the base assembly following extension of the leg rest assembly towards its extended position. In this manner, normal “rocking” action of the rocking chair is inhibited until the leg rest assembly is returned to its normally “stowed” position. Applicant's above-mentioned U.S. patents each disclose the use of a “one-way” pawl and ratchet type latching mechanism having a pawl member supported for pivotal movement from the base assembly and a toothed ratchet sector fixed to the chair frame. An elongated U-shaped spring link is used to couple the pawl member to a drive link fixed to the drive rod.

[0005] Movement of the pawl member between positions of engagement and disengagement with the toothed ratchet sector is caused in response to movement of the leg rest assembly between its extended and retracted positions, respectively. More particularly, when the handle is slightly rotated for partially extending the leg rest assembly, concurrent rotation of the drive rod and the drive link causes the spring link to forcibly pivot the pawl member toward the toothed ratchet sector until the locking tip of the pawl member is positioned in locked engagement with the teeth of the ratchet sector. Thereafter, continued rotation of the drive rod and drive link for completely extending the leg rest assembly causes “elastic” flexure of the elongated spring link for applying a compressive force on the pawl member.

[0006] However, the magnitude of the compressive force exerted by flexure of the spring link can vary since the displacement between the drive rod and sequential ratchet points on the ratchet sector vary in response to rearward tilting movement of the chair frame. Therefore, the flexure of the elongated spring link must be sufficient to ensure that the compressive force exerted on the pawl member is sufficient to maintain locked engagement between the pawl member and the teeth of the ratchet sector throughout the entire range of rearward “tilting” movement of the chair frame. The common one-piece construction of the pawl arm and locking tip may not provide the optimum angle for engagement with the teeth of the ratchet sector. An improved pawl/ratchet assembly is therefore desirable to improve engagement between the pawl and ratchet assembly.

SUMMARY OF THE INVENTION

[0007] Known leg rest mechanisms also provide multiple functional positions, which can be reached using a detent mechanism, which temporarily holds the leg rest at each successive position. As the furniture member rocks backward when the leg rest is moved between the successive positions, a noticeable ratcheting or clicking noise occurs as the pawl engages successive teeth of the ratchet. This noise results at least in part because common pawl members and ratchet sectors are both created of metal material which transmit contact noise. An improved pawl/ratchet assembly is therefore desirable to reduce this operational noise.

[0008] According to one preferred embodiment for a foldable pawl and ratchet assembly of the present invention, a ratchet device for a furniture member having a plurality of structural elements is operable to temporarily retain the furniture member in each of a plurality of rotated engaged positions. The ratchet device includes a pawl assembly having a pawl link rotatably connectable to a first one of the structural elements of the furniture member; a pawl lever rotatably connectable to the pawl link; and a biasing element operable to bias the pawl lever toward a contact position with the pawl link. A ratchet assembly includes a ratchet body having a plurality of engagement teeth. The ratchet assembly is fixed to a second one of the structural elements and located to position the engagement teeth in a rotational path of the pawl lever upon rotation of the pawl link.

[0009] In another aspect of the invention, a ratchet device for a rocking furniture member has a plurality of structural elements. The ratchet device temporarily retains the furniture member in multiple engaged positions and includes: a pawl assembly having a pawl link rotatably connected to a first structural element; a plastic pawl lever rotatably connected to the pawl link; a first biasing element positioned between the pawl link and the pawl lever which biases the pawl lever toward a contact position with the pawl link; and a U-shaped bracket rotatably coupled to the pawl link and fixed to the first structural element. A ratchet having engagement teeth is fixed to a second structural element and located with the engagement teeth in a rotational path of the pawl lever. A second biasing element connected between the pawl link and the U-shaped bracket biases the pawl lever to engage the ratchet teeth.

[0010] According to another aspect of the invention, a furniture member leg rest mechanism is connectable to both a furniture member structure and a seat frame. The leg rest
mechanism includes a drive mechanism having a drive rod for rotational movement in a first and second direction, an actuator permits a seat occupant to selectively actuate the drive mechanism, a ratchet providing a plurality of ratchet teeth, and a pawl assembly having two independently rotatable members.

[0011] According to still another aspect of the invention, a method for creating a pawl and ratchet assembly operable to position a furniture member in each of a plurality of engagement positions is provided.

[0012] A foldable pawl and ratchet assembly of the present invention provides several advantages. By rotatably coupling a pawl lever to a pawl link, the pawl lever can more easily disengage from an engaged position between teeth of a ratchet, to allow continued backward rotation of a furniture member. The use of a polymeric material for the pawl lever provides a quieter operation as the pawl lever rotates past the teeth both between engaged positions and when paw lever is released. The polymeric material also reduces the sliding contact friction between the pawl lever and teeth. A biasing element continuously biases pawl lever toward a contact position with pawl link which promotes engagement of a ratchet engaging end of pawl lever with teeth to prevent forward or return motion of the furniture member until the operator manually disengages the leg rest operating mechanism and pawl assembly together.

[0013] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating some aspects of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0015] FIG. 1 is a front perspective view of a reclining chair having a foldable pawl and ratchet assembly of the present invention;

[0016] FIG. 2 is an exploded perspective view of a chair with upholstery, biasing elements and other parts removed from the pre-assembled components for illustrating the adjustable spring toggle assembly for an actuation mechanism;

[0017] FIG. 3 is a plan view of the leg rest mechanism in accordance with a preferred embodiment of the present invention;

[0018] FIG. 4 is a cross sectional side elevational view taken at section 4-4 of FIG. 3;

[0019] FIG. 5 is a front perspective exploded assembly view of the folding pawl assembly of one aspect of the present invention;

[0020] FIG. 6 is a front elevational view of the pawl lever of FIG. 5;

[0021] FIG. 7 is a cross sectional view taken at section 7-7 of FIG. 6;

[0022] FIG. 8 is a cross sectional view taken at section 8-8 of FIG. 6;

[0023] FIG. 9 is a cross sectional plan view taken at section 9-9 of FIG. 6;

[0024] FIG. 10 is a rear elevational view of the pawl link of FIG. 5;

[0025] FIG. 11 is a side elevational view of the pawl link of FIG. 10;

[0026] FIG. 12 is a top plan view of the pawl link of FIG. 10;

[0027] FIG. 13 is a cross sectional partial side elevational view similar to FIG. 4 showing the folding pawl assembly disengaged from teeth of the ratchet assembly;

[0028] FIG. 14 is a cross sectional partial side elevational view similar to FIG. 13 showing the folding pawl assembly engaged with teeth of the ratchet assembly;

[0029] FIG. 15 is an exploded elevational view of the ratchet engagement end of the pawl lever in contact with the ratchet teeth;

[0030] FIG. 16 is a cross sectional partial side elevational view similar to FIG. 14 showing partial disengagement of the pawl lever from the ratchet teeth;

[0031] FIG. 17 is a cross sectional side elevational view similar to FIG. 4, further showing the leg rest assembly in an extended position; and

[0032] FIG. 18 is a rear perspective view of a linkage assembly of one aspect of the invention operable to engage the folding pawl assembly with the ratchet.

DETAILED DESCRIPTION

[0033] The following description of some preferred aspects of the present invention is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0034] With particular reference now to the drawings, in accordance with the teachings of the present invention and referring generally to FIG. 1, a furniture member 10 such as a rocking, reclining chair includes an actuation mechanism 12 for use in single or multi-person furniture members 10. In the aspect shown, furniture member 10 is a chair, however, the invention is not limited to chairs. Furniture member 10 can be any of a plurality of furniture members, including, but not limited to chairs, sofas and/or loveseats. Furniture member 10 and actuation mechanism 12 in the Figures herein are further shown representing a rocking configuration. Actuation mechanism 12 controls the position of a leg rest 14 between a stowed position (shown in phantom) and an extended position (partially shown) by operation of a hand lever 16 in a rotation direction A. Rotation of hand lever 16 in the direction of rotation A rotates leg rest 14 in a direction B. It will be apparent that rotation of hand lever 16 in an opposite direction from direction A will return the leg rest 14 to the stowed position. Furniture member 10 can further “rock” or rotate on a rotational axis 18 about arcs of rotation C and C’.

[0035] Referring generally now to FIG. 2, the functional and structural aspects of actuation mechanism 12, shown operably suspended from the various pre-upholstered box-like frame components of furniture member 10 (partially...
shown), will now be described. Actuation mechanism 12 includes a spring biased toggle assembly 20 to bias a leg rest assembly 22 in either of the stowed (shown) or extended positions. Moreover, single biasing element toggle assembly 20 simplifies the assembly process and improves the reliability of the actuation mechanism 12. In the disclosed embodiments, furniture member 10 includes pre-assembled actuation mechanism 12 and various upholstered frame components (not shown). Moreover, since the actuation mechanism 12 of the present invention is relatively compact in size, the use of loose upholstered cushions, which is an important feature in marketing various styles of chair, sofa or loveseat furniture, is also possible.

[0036] For purposes of clarity, FIG. 2 shows the various pre-assembled frame components with their upholstery, padding, springs, etc. removed to better illustrate the interdependency of the frame components' construction which can be rapidly and rigidly assembled in a relatively easy and efficient manner. Therefore, all of the frame components can be individually fabricated or sub-assembled to include the requisite brackets, springs, padding and upholstery on an “off-line” batch-type basis. Thereafter, the various pre-assembled and upholstered frame components are assembled for totally integrating actuation mechanism 12 therein.

[0037] As best seen in reference to FIGS. 2 through 4, actuation mechanism 12 of furniture member 10 is integrated into and operably suspended from left and right side (in reference to a seated user of furniture member 10) frame assemblies 24, 25. In addition to side frame assemblies 24, furniture member 10 also includes front and rear rail assemblies 26, 28, respectively, which when interconnected define a rigid “box-like” chair frame 29. A seat assembly 30 of a substantially rectangular shaped wooden frame is supported within the side frame assemblies 24. As will be described in greater detail hereinafter, actuation mechanism 12 includes a drive rod 32 and front support shaft 34, both of which are spatially oriented to be “suspended” from left and right side frame assemblies 24, 25.

[0038] Actuation mechanism 12 supports leg rest assembly 22 thereon. More specifically, leg rest assembly 22 includes left and right pantograph linkages 36, 37 and toggle assembly 20 which is operably associated with drive rod 32 and front support shaft 34 to selectively actuate leg rest assembly 22. A rigid cross-brace 38 is secured between drive rod 32 and front support shaft 34 for providing structural rigidity within actuation mechanism 12. One end of cross-brace 38 is journal supported on drive rod 32 while the opposite end thereof is configured as a bracket 40 which is fixedly secured (such as by suitable threaded fasteners) to an inner surface 42 of front rail assembly 26. Furthermore, front support shaft 34 is fixed to an intermediate portion of cross-brace 38 to inhibit rotation of front support shaft 34 upon rotation of drive rod 32. In one preferred construction, drive rod 32 is an elongated rectangular shaped shaft having hand lever 16 (shown in FIG. 1) provided adjacent an upholstered exterior portion of one of left or right side frame assemblies 24, 25 that can be easily reached by a person seated in furniture member 10 for convenient actuation thereof.

[0039] As best seen in FIG. 2, most of the structural frame components such as left and right side frame assemblies 24, 25, front rail assembly 26, rear rail assembly 28, seat assembly 30, and a leg rest frame board 44 are each constructed in a manner which enables them to support connecting elements, padding, upholstery, etc. in order to complete a decorative and stylish furniture member 10. Preferably, each of these frame components is fabricated from one or more wood panels and/or rails that are fixedly secured together by suitable fasteners, such as dowels, staples, nails and screws, and which may be reinforced at critical joints by metal reinforcement plates or brackets and/or wood corner blocks in a known manner. As previously noted, each frame component is individually pre-assembled for subsequent assembly into the furniture member 10. However, it is to be understood that the specific construction shown for each frame component is merely exemplary in nature.

[0040] Frame board 44 has an outer surface 45 that is padded and upholstered. Frame board 44 is supported and moved by identical left and right hand pantograph linkages 36, 37 through apertures 46 of front rail assembly 26. Pantograph linkages 36, 37 may be similar in function and structure to that shown in FIG. 3 of U.S. Pat. No. 3,096,121, assigned to the common Assignee of the present invention, with the exception that pantograph linkages 36, 37 are operably suspended about the second set of “fixed” suspension points defined by front support shaft 34.

[0041] Referring now more specifically to FIGS. 3 and 4, a ratchet 48 is fastenably mounted to inner surface 42 of front rail assembly 26. A folding pawl assembly 50 is moved from a non-engaged position shown to an engaged position with a plurality of teeth 52 of ratchet 48 by a drive link 54 of a linkage assembly 56 which responds to rotation of drive rod 32 using hand lever 16 to position a rotatable pawl lever 58 into operable contact with teeth 52 of ratchet 48. Pawl lever 58 is pinned for rotation about an arc of rotation “D” to a pawl link 60 by a first pin 62. Pawl link 60 is itself rotatably pinned to a substantially U-shaped bracket 64 by a second pin 66 for rotation about an arc of rotation “E”. A biasing element 68 such as a torsion spring of sprang metal normally biases pawl link 60 toward ratchet 48. U-shaped bracket 64 is mounted such as by fasteners 70 to a cross frame member 72 of chair frame 29.

[0042] Referring now generally to FIGS. 5-12, pawl lever 58 in one aspect is a polymeric material such as nylon, and is formed for example by injection molding and includes a main body portion 74 with opposed integral walls 76, 78 extending substantially perpendicular to main body portion 74. Each of a co-axially aligned pair of clearance apertures 80, 82 are created through one of opposed walls 76, 78. A ratchet engaging end 84 substantially defining an apex is created at an opposite end of main body portion 74 from the location of clearance apertures 80, 82. Pawl lever 58 can also be created from a composite material or a polymeric material other than nylon having hardness and wear resistance properties similar to nylon.

[0043] Referring more specifically to FIGS. 5 and 10-12, pawl link 60 is substantially U-shaped and includes integral opposed first and second link walls 86, 88 extending substantially perpendicular to a main wall 90. Pawl link 60 further includes at a link first end 92 a co-axially aligned pair of first and second through apertures 94, 96 which are both co-axially alignable with clearance apertures 80, 82 of pawl
lever 58. First and second through apertures 94, 96 are individually created through one of opposed first and second link walls 86, 88. A hook 98 is positioned proximate to link first end 92 and is created such as by a punching or stamping operation in main wall 90. At a link second end 100 of pawl link 60, a co-axially aligned pair of third and fourth through apertures 102, 104 are individually created through one of first and second link walls 86, 88. In one aspect of the invention, pawl link 60 is a metal material such as steel or aluminum which is stamped or similarly formed to provide apertures 94, 96, 102, and 104, and hook 98, and then bent to create the opposed first and second link walls 86, 88. In other aspects, pawl link 60 can be of a formed polymeric material or a composite material.

Referring specifically to FIG. 5, U-shaped bracket 64 includes a bracket common wall 106 and integral opposed first and second legs 108, 110 which extend substantially perpendicular to common wall 106. Each of opposed first and second legs 108, 110 include a first and second aperture 112, 114 respectively, which are co-axially aligned with each other and are co-axially alignable with third and fourth through apertures 102, 104 of pawl link 60. At least one fastener receiving aperture 116 is provided in common wall 106 to receive one of fastener(s) 70 used to mount U-shaped bracket 64 to cross frame member 72. A raised element 118 can also be provided, for example by partially stamping a portion of bracket common wall 106. Raised element 118 provides a stop location to limit the rearward travel of pawl link 60 to prevent overstressing biasing element 68.

Folding pawl assembly 50 is assembled as follows. To rotatably couple pawl lever 58 to pawl link 60, first pin 62 is inserted through clearance aperture 82 of pawl lever 58, through second through aperture 96 of pawl link 60, and a first looped portion 120 of a biasing element 122 such as a torsion spring. First pin 62 is then further inserted through a second looped portion 124 of biasing element 122, through first through aperture 94 of pawl link 60 and out through clearance aperture 80 of pawl lever 58. A pin distal end 126 of first pin 62 receives a retention fastener 128 to rotatably retain first pin 62. In other aspects, first pin 62 is assembled in a reverse order to that described above.

Pawl link 60 is rotatably joined to U-shaped bracket 64 as follows. Second pin 66 is first inserted through second aperture 114 of U-shaped bracket 64, then inserted through a first looped section 130 of biasing element 68, and into fourth through aperture 104 of pawl link 60. Second pin 66 is then inserted in third through aperture 102 of pawl link 60, through a second looped section 132 of biasing element 68, and out through first aperture 112 of U-shaped bracket 64. A pin distal end 134 of second pin 66 receives a retention fastener 136, similar to retention fastener 128, to rotatably retain second pin 66. In other aspects, second pin 66 is assembled in a reverse order to that described above.

As best seen in FIG. 5, when folding pawl assembly 50 is assembled, a contact end 138 of biasing element 122 contacts main body portion 74 of pawl lever 58 and a pair of first and second free ends 140, 141 (only first free end 140 is visible in FIG. 5) contact main wall 90 of pawl link 60. Also partially visible is a perimeter-shape-matching end 142 of biasing element 68 which is contoured to closely follow an outer perimeter 144 of pawl link 60. First and second free portions 146, 148 of biasing element 68 engage bracket common wall 106 of U-shaped bracket 64.

Referring more specifically to FIGS. 6-9, pawl lever 58 further includes: a total width “W”; a distance “G” between a centerline of clearance apertures 80, 82 to ratchet engaging end 84; a thickness “H” of ratchet engaging end 84; and a distance “J” between inner facing surfaces of walls 76, 78. In one aspect, total width “W” is approximately 3.72 cm, distance “G” is approximately 5.08 cm, thickness “H” is approximately 0.46 cm, and distance “J” is approximately 2.96 cm. In one aspect, ratchet engaging end 84 defines an angle α of approximately 70 degrees with an inner face 85.

Referring more specifically to FIGS. 10-12, pawl link 60 further includes: a total length “K”; a total width “L”; a distance “M” from the co-axial aligned centerlines of third and fourth through apertures 102, 104 to a centerline of hook 98; a first and second aperture 152, 154 in main wall 90 acting for example as pilot holes to help align a corresponding stamping die for pawl link 60; a height “N” from the co-axial aligned centerlines of third and fourth through apertures 102, 104 to the co-axial aligned centerlines of first and second through apertures 94, 96; and a height “P” measured from an end of pawl link 60 proximate to third and fourth through apertures 102, 104 to the co-axial aligned centerlines of third and fourth through apertures 102, 104. In one aspect, total length “K” is approximately 11.43 cm, total width “L” is approximately 2.86 cm, distance “M” is approximately 8.25 cm, height “N” is approximately 10.16 cm, and height “P” is approximately 0.63 cm. Each of first and second link walls 86, 88 define an angle θ from main wall 90 of approximately 90 degrees.

As best seen in reference to FIG. 13, a disengaged position of folding pawl assembly 50 is shown. In the disengaged position, pawl lever 58 is biased into contact with pawl link 60 by the biasing force provided by biasing member 122 (shown in FIG. 5) wherein an inner surface 150 (shown in FIG. 8) of pawl lever 58 contacts pawl link 60. In the pawl lever/pawl link contact position, an “over-center” position of pawl lever 58 with respect to pawl link 60 is defined as a perpendicular measurement defining a distance U measurable from a centerline or axis of rotation T of first pin 62 to an axis V. Axis V is defined as an imaginary line drawn from ratchet engaging end 84 through an axis of rotation W of second pin 66. In one preferred embodiment, distance U is approximately 0.15 cm. Inner surface 150 therefore controls distance U. The over-center position ensures that pawl lever 58 remains in contact with pawl link 60 when ratchet engaging end 84 engages teeth 52. This contact allows the direct transfer of the weight of leg rest assembly 22 (through teeth 52) from pawl lever 58 through pawl link 60, without relying on the biasing force of biasing element 122. Also in the “over-center” contact position, further rotation of pawl lever 58 in a direction opposite to arc of rotation D with respect to pawl link 60 is prevented.

Referring to FIGS. 1, 5, and 13, the disengaged position of folding pawl assembly 50 is maintained by the connection of drive link 54 to drive rod 32. An apertured distal end of drive link 54 releasably engages hook 98 of pawl link 60. In the stowed position of leg rest assembly 22, linkage assembly 56 is oriented as shown having drive link 54 retaining pawl lever 58 out of contact with teeth 52 of ratchet 48. Drive link 54 therefore provides sufficient force
to overcome the normal biasing force of biasing element 68. In the disengaged position, furniture member 10 is free to rotate or rock about rotational axis 18. From the disengaged position, pawl link 60 can be rotated about arc of rotation E until ratchet engaging end 84 contacts teeth 52 of ratchet 48.

[0052] Referring generally to FIGS. 1, 14 and 15, when hand lever 16 is rotated in arc of rotation A (counterclockwise as viewed in FIG. 1), drive rod 32 rotates linkage assembly 56 which directs drive link 54 to rotate pawl link 60 about arc of rotation E (clockwise as viewed in FIG. 15) in a first direction toward ratchet 48. Pawl lever 58 is thereby rotated with pawl link 60 about second pin 66 until ratchet engaging end 84 of pawl lever 58 engages between adjacent pair of teeth 52 of ratchet 48. If the occupant of furniture member 10 thereafter rocks further “backward” in the direction of arc of rotation C, the apex shape of ratchet engaging end 84 and the “over-center” design of folding pawl assembly 50 maintain ratchet engaging end 84 in contact with further adjacent pairs of teeth 52. This provides multiple releasable “locked” positions of furniture member 10 wherein furniture member 10 is prevented from rocking forward in the direction of arc of rotation C.

[0053] As best seen in reference to FIG. 15, ratchet engaging end 84 includes a rounded surface leading to a point substantially defining an apex. The apex includes an angle α, which is less than an included angle μ defined by teeth 52, allowing the point of the apex (ratchet engaging end 84) to contact a bottom of any one of teeth 52. The difference between angle α and angle μ therefore defines a clearance angle φ between an edge of the apex and a face of one of teeth 52. The clearance angle φ reduces the surface areas in contact between ratchet engaging end 84 and teeth 52, which allows easier release of ratchet engaging end 84.

[0054] As best seen in reference to FIGS. 1 and 16, to disengage ratchet engaging end 84 of pawl assembly 50 from teeth 52 of ratchet 48, the occupant of furniture member 10 rotates hand lever 16 clockwise (as viewed in FIG. 1) in the direction of arc of rotation A’. As hand lever 16 is rotated, drive rod 32 is also rotated in arc of rotation A’, which directs drive link 54 to return pawl link 60 about arc of rotation E’ in a second direction away from ratchet 48. Leg rest 14 returns to the stowed position and furniture member 10 can then freely rotate or “rock” about rotational axis 18. As pawl link 60 begins to rotate away from ratchet 48, the downward force exerted by the weight of extended leg rest 14 and leg rest assembly 22 causes front rail assembly 26 and attached ratchet 48 to move downward (as viewed in FIG. 16). This downward travel of front rail assembly 26 causes pawl lever 58 to rotate about arc of rotation D against the biasing force of biasing element 122. Pawl lever 58 rotates through arc of rotation D about axis of rotation X of first pin 62 until pawl lever 58 releases from contact with teeth 52.

[0055] By allowing rotation of pawl lever 58 about arc of rotation D in a folding motion relative to pawl link 60, an engagement pressure between pawl lever 58 and teeth 52 is reduced for further backward or counterclockwise rotation of pawl assembly 50 in the direction of arc of rotation E’. Surface contact between ratchet engaging end 84 and teeth 52 is reduced by the rounded surface of ratchet engaging end 84 and clearance angle φ, which further reduces the ratchet release noise common to known operating mechanisms during drop of the leg rest assembly. By combining the features of a polymeric material for pawl lever 58 and rotation of pawl lever 58 about arc of rotation D, the sound generated by pawl lever 58 in contact with teeth 52 is reduced. This reduces the overall operational sound level of furniture member 10 during use of leg rest 14. The effort to release pawl lever 58 from ratchet 48 is also substantially eliminated because of the present invention’s use of a rotational connection between pawl lever 58 and pawl link 60. By allowing pawl lever 58 to rotate or fold away from the engaged position with teeth 52 of ratchet 48, ratchet engaging end 84 rotates away from teeth 52 which is advantageous over prior designs where disconnection from teeth 52 required a sliding motion with inherent friction over the length of teeth 52 until complete disengagement from teeth 52 was achieved.

[0056] Referring now generally to FIG. 17, leg rest 14 is shown in an extended position. Further, rearward or counterclockwise rotation of furniture member 10 about arc of rotation C and leg rest 14 in an arc of rotation R causes pawl lever 58 to engage subsequent teeth 52 of ratchet 48 in further engaged positions. In the engaged positions, furniture member 10 is prevented from rocking forward or backward as viewed in FIG. 17. In some aspects of the invention, a ratchet-type detent mechanism 150 similar to a detent mechanism 40 disclosed in U.S. Pat. No. 6,655,732 to LaPointe, co-owned by the assignee of the present invention and incorporated herein by reference, engages leg rest assembly 22 in multiple functional stepping positions, each temporarily fixing leg rest assembly 22 in one of the stepped positions and preventing leg rest assembly 22 from dropping down due to the leg weight of an occupant. Ratchet 48 and folding pawl assembly 50 therefore prevent rocking motion of furniture member 10 while detent mechanism 150 retains leg rest assembly 22 at a desired position. Multiple forces unique to each different furniture member are balanced to prevent leg rest downward drop or backward drift, such as a frame and a leg rest assembly weight, tension provided by the material covering of seat assembly 30, tension from straps used to mount pads or material to seat assembly 30, and the tension provided by a biasing element 153 provided with toggle assembly 20.

[0057] Referring now to FIG. 18, linkage assembly 56 is shown in greater detail. An adapter 154 is slidably received along drive rod 32. A swivel link 156 is coupled to adapter 154. Adapter 154 is fastenably connected to drive rod 32 using one or more fasteners 158. A pin 160 is received in an aperture 162 of swivel link 156 and an aperture (not shown) of drive link 54. A fastener 164 retains pin 160. A distal end of drive link 54 includes an aperture 166 which receives hook 98 of pawl link 60. In addition, ratchet 48 includes raised embossments 168, 170 which receive fasteners used to mount ratchet 48 to front rail assembly 26.

[0058] A functional correlation exists between the width F of pawl lever 58 and a width Y of teeth 52 of ratchet 48 and the load characteristics of actuation mechanism 12. By increasing a bearing surface or contact area between pawl lever 58 and teeth 52, for example by increasing both width F and width Y, a load capacity of actuation mechanism 12 can be increased. This is beneficial to accommodate heavier occupants of furniture member 10. A functional correlation also exists between width F of pawl lever 58 and width Y of
teeth 52 and the acoustic characteristics of actuation mechanism 12. For example, by increasing both width F and width Y noise generated during use of furniture member 10 decreases for heavier occupants.

[0059] A foldable pawl and ratchet assembly of the present invention provides several advantages. By rotatably coupling a pawl lever 58 to a pawl link 60, the pawl lever 58 can more easily disengage from teeth 52 of a ratchet 48, which reduces a ratcheting sound. The use of a polymeric material for pawl lever 58 provides a quieter operation as pawl lever 58 ratchets over teeth 52 between different engaged positions. The polymeric material also reduces the sliding contact friction between the pawl lever 58 and teeth 52. A biasing element 122 continuously biases pawl lever 58 toward an over-center contact position with pawl link 60 which allows pawl link 60 and pawl lever 58 to transfer the weight load of the leg rest assembly. A biasing element 68 promotes engagement of a ratchet engaging end 84 of pawl lever 58 with teeth 52 to prevent forward or return motion of the furniture member until the operator manually disengages the leg rest operating mechanism and pawl assembly together. A clearance angle of the ratchet engaging end 84 of pawl lever 58 reduces contact with teeth 52 which further assists in releasing pawl lever 58.

[0060] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

What is claimed is:

1. A ratchet device for a furniture member having a plurality of structural elements, the ratchet device operable to temporarily retain the furniture member in each of a plurality of rotated engaged positions, the ratchet device comprising:
   a pawl assembly including:
   a pawl link rotatably connectable to a first one of the structural elements of the furniture member;
   a pawl lever rotatably connectable to the pawl link and biased toward an over-center contact position with the pawl link; and
   a ratchet assembly including a ratchet body having a plurality of engagement teeth, the ratchet assembly fixedly connectable to a second one of the structural elements and located to position the engagement teeth in a rotational path of the pawl lever upon rotation of the pawl link.

2. The ratchet device of claim 1, further comprising a plurality of engaged positions each having the pawl lever engaged between proximate ones of the plurality of teeth, the pawl lever and the pawl link being positioned in the contact position in each of the engaged positions.

3. The ratchet device of claim 2, further comprising:
   a stowed position of the pawl assembly having the pawl lever disengaged from any of the teeth;
   wherein the pawl link is rotatable about an arc of rotation defining a first direction toward the ratchet assembly from the stowed position to any of the plurality of engaged positions, and a second direction away from the ratchet assembly.

4. The ratchet device of claim 3,
   wherein the pawl lever is rotatable in the second direction to operably return the pawl lever and the pawl link from any of the plurality of engaged positions to the stowed position; and
   wherein the pawl lever is rotatable about a second arc of rotation substantially toward the second direction with respect to the pawl link during disengagement of the pawl lever from the ratchet assembly.

5. The ratchet device of claim 1, further comprising:
   a bracket fastenably connectable to the first one of the structural elements of the furniture member and adapted to rotatably receive the pawl link; and
   a pin operable to rotatably connect the pawl link to the bracket.

6. The ratchet device of claim 5, further comprising a biasing element positioned in contact with both the pawl link and the bracket, the second biasing element operable to bias the pawl link toward the ratchet assembly.

7. The ratchet device of claim 1, wherein the pawl lever further comprises:
   a main body portion;
   first and second walls positioned in opposition to each other about the main body portion, the walls each integrally connected to the main body portion and extending substantially perpendicular to the main body portion; and
   a biasing element having a first portion positioned between the first and second walls and in contact with the main body portion.

8. The ratchet device of claim 7, wherein the pawl link further comprises:
   a main wall; and
   first and second link walls positioned in opposition to each other about the main wall, the link walls each integrally connected to the main wall and extending substantially perpendicular to the main wall;
   wherein a second portion of the biasing element is positioned between the first and second link walls and in contact with the main wall.

9. The ratchet device of claim 1, wherein the pawl lever comprises a polymeric material.

10. The ratchet device of claim 9, wherein the polymeric material further comprises a nylon material.

11. The ratchet device of claim 9, wherein the pawl link comprises one of a metal and a polymeric material.

12. The ratchet device of claim 9, wherein the ratchet comprises one of a metal and a polymeric material.

13. The ratchet device of claim 1, further comprising a pin operable to rotatably connect the pawl lever to the pawl link.

14. The ratchet device of claim 1, wherein the pawl lever further comprises a ratchet engaging end defining an apex, the apex further defining a clearance angle with a face of any of the engagement teeth, the clearance angle operable to limit contact between the ratchet engaging end and any of the engagement teeth.
15. The ratchet device of claim 1, further comprising a biasing element in contact with both the pawl lever and the pawl link operable to bias the pawl lever toward the over-center contact position.

16. The ratchet device of claim 1, wherein the over-center contact position defines a distance between:

a line extending from a center of rotation of the pawl link to a distal engagement end of the pawl lever; and

a center of rotation of the pawl link about the pawl lever.

17. A ratchet device for a rocking furniture member having a plurality of structural elements, the ratchet device operable to temporarily retain the furniture member in each of a plurality of engaged positions, the ratchet device comprising:

a pawl assembly including:

a pawl link rotably connectable to a first one of the structural elements of the furniture member;

a polymeric pawl lever rotatably connectable to the pawl link;

a first biasing element disposed between the pawl link and the pawl lever operable to bias the pawl lever toward a contact position with the pawl link; and

a substantially U-shaped bracket rotatably coupled to the pawl link and fixedly connected to one of the structural elements;

a ratchet assembly having a plurality of engagement teeth, the ratchet assembly fixedly connectable to a second one of the structural elements and located to position the engagement teeth in a rotational path of the pawl lever upon rotation of the pawl link; and

a second biasing element connected between the pawl link and the U-shaped bracket operable to bias the pawl lever toward the ratchet assembly.

18. The ratchet device of claim 17, further comprising a first pin rotatably coupling the pawl lever to the pawl link.

19. The ratchet device of claim 18, wherein the pawl lever further comprises a main body portion having integral opposing walls extending substantially perpendicular to the main body portion, each of the opposing walls having an aperture adapted to receive the first pin.

20. The ratchet device of claim 19, further comprising a second pin rotatably coupling the pawl link to the bracket.

21. The ratchet device of claim 17, wherein the pawl link further comprises a main wall having integral opposing link walls extending substantially perpendicular to the main wall, each of the opposing link walls having a through aperture adapted to receive the second pin.

22. The ratchet device of claim 21, wherein the pawl link further comprises a hook positioned in the main wall, the hook adapted to receive a drive link operable to rotate the pawl link about the second pin both toward and away from the ratchet assembly.

23. The ratchet device of claim 17, wherein the polymeric pawl lever further comprises a nylon material.

24. The ratchet device of claim 17, wherein the U-shaped bracket further comprises a raised element operable as a rotational stop for the pawl link.

25. A furniture member leg rest mechanism connectable to both a furniture member structure and a seat frame, the leg rest mechanism comprising:

a drive mechanism including a drive rod for rotational movement in a first and second direction;

an actuator for permitting a seat occupant to selectively actuate the drive mechanism;

a ratchet having a plurality of ratchet teeth formed thereon;

a pawl assembly, including:

a pawl link having a first end pivotally connectable to the frame for rotational movement of the pawl link between a first position and a second position, and a second end;

a pawl lever pivotally coupled to the second end of the pawl link, the pawl lever lockingly engaging the ratchet teeth in the first position wherein the frame is releasably locked in a rearwardly tilted position, and a second position released from the ratchet teeth for permitting unrestricted rocking movement of the seat frame.

26. The leg rest mechanism of claim 25, further comprising:

a release assembly including a swivel link supported on the drive rod for free rotation thereof; and

a rigid drive link having a first end coupled to the pawl link and a second end pivotally connected to the swivel link;

wherein the pawl link further comprises a hook formed thereon for engaging the release link to couple said release assembly to said pawl link.

27. The leg rest mechanism of claim 26, wherein the pawl lever is substantially U-shaped in cross section having a main body portion and a pair of laterally extending walls, the main body portion having a ratchet engaging end defining an axis for engaging the ratchet, and each of the walls having an aperture therethrough for pivotally coupling the pawl lever to the pawl link.

28. The leg rest mechanism of claim 25, further comprising a substantially U-shaped bracket having a first portion secured to the structure and a pair of laterally spaced legs for receiving the pawl link therebetween, each of the legs having an aperture therethrough for receiving a pin to pivotally couple the pawl link to the bracket.

29. The leg rest mechanism of claim 25, further comprising a biasing element for normally biasing the pawl link toward the first position, the biasing element adapted to exert an engagement force on the pawl link for maintaining locked engagement of the pawl lever with the ratchet teeth when the pawl link is in the first position.

30. A ratchet device for a furniture member, the furniture member including a plurality of structural elements, the ratchet device comprising:

a pawl assembly including:

a pawl link rotatably connectable to a first one of the structural elements of the furniture member;

a pawl lever rotatably connectable to the pawl link, the pawl lever including an engagement end having a substantially rounded surface; and
a biasing element operable to bias the pawl lever toward an over-center contact position with the pawl link; and

a ratchet assembly including a ratchet body having a plurality of engagement teeth, the ratchet assembly fixedly connectable to a second one of the structural elements and located to position the engagement teeth in a rotational path of the pawl lever upon rotation of the pawl link;

a plurality of engaged positions between the engagement end of the pawl lever and adjacent pairs of the engagement teeth, the ratchet device operable to temporarily retain the furniture member in each of a plurality of rotated engaged positions having the pawl lever in the over-center contact position; and

a release path defined when the pawl link is rotated about the rotational path away from ratchet assembly, the pawl lever being rotatably released from the over-center contact position and the substantially rounded surface operable to release the pawl lever in a folding motion from the engagement teeth.

31. The ratchet device of claim 30, wherein the pawl lever comprises a polymeric material.

32. The ratchet device of claim 30, further comprising a pin operable to rotatably connect the pawl lever to the pawl link.

33. The ratchet device of claim 30, further comprising a second biasing element operable to bias the pawl link toward the ratchet assembly.

34. The ratchet device of claim 30, further comprising a drive link connectable to the pawl link and operable to translate the pawl link about the release path.

35. A method for creating a pawl and ratchet assembly operable to position a furniture member in each of a plurality of engagement positions, the pawl and ratchet assembly having a pawl lever, a pawl link, and a ratchet having a plurality of engagement teeth, the furniture member having a plurality of structural elements, the method comprising:

rotatably connecting the pawl link to one of the structural elements of the furniture member;

rotatably coupling the pawl lever to the pawl link;

engaging a biasing element with both the pawl lever and the pawl link operable to bias the pawl lever toward a contact position with the pawl link; and

fixedly connecting the ratchet assembly to a second one of the structural elements having the engagement teeth in alignment with in a rotational path of the pawl lever to operably permit the pawl lever to engage the engagement teeth.

36. The method of claim 35, further comprising creating the pawl lever from a polymeric material.

37. The method of claim 35, further comprising increasing a width of both the pawl lever and the engagement teeth to accommodate an occupant weight.

38. The method of claim 35, further comprising increasing a width of both the pawl lever and the engagement teeth to decrease a ratcheting sound level of the pawl and ratchet assembly.

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