ABSTRACT

A seat position adjustor comprising a selectively extendible and contractible connecting link assembly adapted operatively to interconnect a stationary horizontally disposed seat bench member and a seat back member pivotally mounted relative to said bench member and to locate the seat back in one of a plurality of positions. The assembly includes a one piece, thin-walled, tubular housing partially and slidably receiving a rod that is spring biased toward an extended position out of the housing. Within the housing and surrounding the rod are a plurality of pivotally mounted locking plates spring biased into an angular orientation relative to the rod to lock the rod against movement. Manually operable cam means act on the locking plates to change and position and allow freedom of rod movement. The link assembly is designed so the thin-walled, tubular housing may be machined and shaped from exterior of the housing prior to or during the final assembly of the parts of the device to provide stop means and fulcrum means within the housing.

7 Claims, 11 Drawing Figures
EXTENDIBLE AND CONTRACTIBLE SEAT POSITION ADJUSTER

BACKGROUND OF THE INVENTION

Position adjustors for reclining seat backs are well known and widely are utilized in vehicles such as automobiles, buses and airplanes. Historically, available position adjustors were equipped with ratchet and pawl mechanisms. Because such mechanisms are noisy in operation and allow for only a limited number of adjustment positions, a demand arose for a silent adjustor allowing for an infinite number of seat back positions. Attempts to satisfy this demand with hydraulic actuators generally proved unsatisfactory because hydraulic models proved either uneconomic or subject to hydraulic fluid leakage problems.

In recent years, however, development was accomplished of an actuator design using a previously known concept of a connecting link including extensible rod arrangement that selectively is locked or released by movement of a stack of tiltable washers functioning as lock plates. Refinement of this concept produced a design having the requisite compactness, light weight, dependability and low cost necessary for commercial acceptance. An example of such an actuator connecting link is taught by U.S. Pat. No. 2,771,071, issued Sept. 6, 1966, and owned by the assignee of this invention.

The actuator connecting link disclosed by this patent has somewhat limited usage, however, because it is spring biased towards its extended position and thus adapted for mounting within the seat back for movement therewith and for extension into a lengthened condition as the seat back is moved from an upright position toward a reclining position. In certain vehicle reclining seats, however, it is desirable for reasons of simplicity of design and packaging of component parts to mount the actuator connecting link in the horizontal seat back. In such an arrangement, a simplified actuator mechanism design is facilitated by providing that the connecting link moves from an extended to a contracted condition as the seat back swings towards a reclining position.

Additionally, it has been recognized in the motor vehicle product development and marketing studies that the extent of commercial acceptance for so-called “comfort and convenience items” such as reclining seats is related in an inverse manner to the customer cost for such items. A constant need, therefore, exists for new designs for vehicle components such as seat back actuators that retain high standards of reliability and performance but enable cost savings in manufacture. Because of the many parts in actuator connecting links, it especially is desirable for a link design to provide for ease of manufacturing and assembly of the link by workers having little in the way of special training. Such a goal can be achieved if the link design allows formation of structure located within the link housing by machining and working of the housing from exterior thereof, and if all of the internal link components easily may be slid within the housing during assembly without the need for complex special operations or tooling.

It is, therefore, an object of this invention to provide extendible and contractible connecting link assembly for a vehicle reclining seat back actuator that normally is in an extended condition. A further object of the invention is to provide a connecting link of simplified design in which various internal structural features may be formed by machining and working of the link assembly housing from exterior thereof. A still further object of the invention is to provide a connecting link design allowing assembly of many of the component parts primarily by sliding these parts in proper sequence within the link housing.

SUMMARY OF THE INVENTION

A selectively extendible and contractible reclining seat actuator connecting link assembly designed and constructed in accordance with this invention comprises a thin-walled, tubular housing having an internal chamber. First plug means close one end of the housing and second plug means having an aperture formed therethrough partially close the other end of the housing. A rod extends through this aperture and partially is slidable received in the housing. Within the chamber are first stop means formed by diametrically opposed portions of the housing wall deformed radially inwardly into said chamber. A washer is positioned against said first stop means with the rod extending through the central aperture of the washer. The rod is formed with radially extending flange means projecting therefrom inside the chamber. A main operating spring surrounds the rod and is compressed between the washer and the flange means and biases the rod out of the housing. This biasing of the rod naturally provides for a biasing of the link assembly towards an extended condition. A plurality of juxtaposed, centrally apatured lock plates are positioned within the chamber with the rod extending through the apatures therein. The lock plate apatures are larger than the rod so that the lock plates can be tilted relative to the rod. Second stop means formed by an inwardly deformed portion of the assembly housing comprises a fixed fulcrum offset from the axis of the rod and in contact with one of the lock plates to prevent movement of the lock plates away from the end of the housing from which the rod protrudes. A locking spring encircles the rod and is compressed between a fixed portion of the assembly and the side of the lock plates remote from the second stop means. This locking spring is operative to tilt the lock plates about the fulcrum and lock the rod and thus the housing against contractible movement. A cam member is rotatable supported in the housing for selective direct engagement with the lock plates on the side of the lock plates away from the fulcrum. The cam member may be rotated to move the lock plates against the force of the locking spring until the locking plates are substantially perpendicular to the axis of the rod thereby permitting free rod movement in either direction.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side elevation view of a reclining vehicle seat including the seat actuator extendible and contractible connecting link assembly of this invention;

FIG. 2 is a top view of a connecting link assembly included in the seat of FIG. 1;

FIG. 3 is a side view of the assembly of FIG. 2;

FIG. 4 is an end view of the assembly of FIGS. 2 and 3 taken along the line of sight denoted by the arrow 4 of FIG. 3;

FIG. 5 is a section view taken along the line 5—5 of FIG. 3;

FIG. 6 is a section view taken along the line 6—6 of FIG. 3;
FIG. 7 is a side section view of the assembly of FIGS. 2 and 3 showing the assembly in an extended condition; FIG. 8 is a view similar to FIG. 7, but showing the assembly in a contracted position; FIG. 9 is a bottom view of a portion of the assembly of this invention; and FIG. 10 is a bottom view of a portion of the assembly of this invention; and FIG. 11 is an exploded view of the parts of the manually operable actuating mechanism of the connecting link assembly of this invention.

DESCRIPTION OF THE DRAWINGS

Referring now in detail to the drawings and in particular to FIGS. 1-4 thereof, the numeral 12 denotes generally a vehicle seat assembly of the reclining type. This seat includes a horizontal, relatively stationary seat bench portion 14 and a substantially upright seat back portion 16. Both the seat bench and back may be provided with suitable upholstery padding. Seat back 16 is pivotedly secured to the seat bench 14 at pivot point 18 for swinging movement into an infinite number of reclining positions. The seat back actuator mechanism includes an extendible and contractible connecting link assembly 20 adapted to interconnect the seat back and seat back and regulate relative movement therebetween. Furthermore, as this assembly 20 is connected to seat back 14 at point 22 and at point 24 is connected to a sector portion 26 of the seat back 16.

The assembly 20 comprises a main housing 28 closed at one end by a plug 30. Integrally formed with the plug 30 is a projecting clevis portion 32 apertured at 34 to facilitate the interconnection of assembly 20 with seat back 14 at point 22. The end of housing 28 remote from plug 30 is partially closed by plug 36 having a central aperture 38 (FIGS. 7 and 8) extending therethrough. An elongate rod 40 extends through aperture 38 and is partially slidably received in the housing 28. The free end of rod 40 has a threaded portion 40a of reduced diameter upon which is threadedly received a clevis 42 suitably apertured at 44. Since clevis 42 is threadedly received on rod portion 40a and may be adjustably positioned therealong, the effective length of rod 40 may be varied to accommodate variances in tolerances of the parts of said seat assembly 12. A lock nut 46 also is received on rod portion 40a and secures clevis 42 in the position desired.

Projecting laterally from housing 28 is a camshaft 48 having a splined end 50. The free end of camshaft 48 is splined in order to facilitate the mounting thereon of an operating handle (shown only in FIG. 11 of the drawings), the purpose of which will be disclosed in detail below.

The details of the construction and component parts of assembly 20 may be seen with particular reference to FIGS. 5-9 of the drawings. There it may be seen that housing 28 is a thin-walled, integral tube having a central passageway 29 extending therealong. The plug 30 has a main body 52 that extends into the tubular housing 28 and has a circumferential groove 54 formed in the outer periphery thereof. The extent to which body 52 may extend into housing 28 is limited by the integrally formed plug flange 56 that bears against the longitudinal extremity of the housing 28. Plug 30 is held in place by the radially inward deformation of the wall of housing 28 at 58 into the plug groove 54. This deformation may be accomplished by staking or other suitable means.

Plug 36, that partially closes the end of housing 28 remote from plug 30, has a main body 60 with a circumferential groove 62 formed about the outer periphery thereof. The plug body 60 extends into housing 28 an amount limited by an integrally formed plug flange 64 that contacts the end extremity of the housing 28. Plug 36 is locked into the position shown by the radially inward deformation of the wall of housing 28 at 66 into the groove 62. This deformation may be accomplished by staking or other suitable means.

As best may be seen in FIGS. 2, 3, 9 and 10, a pair of spaced apart slots 68 and 68a are formed through the wall of housing 28. Diametrically opposed from the position of slots 68 and 68a, a pair of corresponding spaced apart slots 70 and 70a also are formed along the housing wall. The housing wall portion between slots 68 and 68a comprises the web 72 while the web 74 is located between slots 70 and 70a. Both webs 70 and 72, as best may be seen from FIGS. 6 and 9, are deformed radially inwardly to form stop means located within the passageway 29 that extends the length of housing 28. A washer 76 having an outside diameter less than the inside diameter of housing 28 and a central aperture 76 is positioned against the left side of webs 72 and 74 as viewed in the drawings. Rod 40 extends through the washer hole 76 that is sufficiently larger than the diameter of the rod to permit free and easy movement of the rod through this aperture.

The portion of rod 40 within passageway 29 carries a snap ring 80 that is received in a peripheral groove 82 formed in rod 40. A washer 84 surrounds rod 40 and bears on right side of snap ring 80. The purpose of snap ring 80 and washer 84 is to form a radially extending flange means that projects from the rod 40. Accordingly, it should be understood that such flange means could be formed by simply increasing the outside diameter of the snap ring 80 or by welding a washer to the rod 40, expedients that would be the full equivalent of the snap ring and washer arrangement illustrated.

Partially compressed between the washers 76 and 84 is an operating coil spring 86. It readily may be understood that the force exerted by spring 86 biases the rod 40 towards the left as viewed in the drawings into an extended condition relative to the housing 28. Movement of rod 40 to the left due to the force of spring 86 is limited by contact between the snap ring 80 and the inner surface of body 60 of plug 36. Such contact occurs when assembly 20 is in the fully extended condition as occurs when seat back 16 is in the upright position illustrated in FIG. 1.

A laterally extending slot 88 is formed through the wall of housing 28 and is located between web 72 and plug 30. A portion 90 of the wall of housing 28 adjacent slot 88 on the side of this slot proximate plug 30 is deformed radially inwardly and projects into passageway 29. This inwardly deformed wall portion 90 functions as a fulcrum for the assembly locking means. These locking means comprise a stack of juxtaposed lock plates or washers 92 (six shown) having central apertures formed therethrough having a diameter only slightly larger than the diameter of the rod 40. Rod 40 extends through the lock plates 92 in a sliding fit. One of the stack of lock plates 92 bears against fulcrum 90 and thus is prevented from movement towards the right as viewed in the drawings. A locking coil spring 94 is
partially compressed between lock plates 92 and a washer 96 through which rod 40 extends. The washer 96 bears on the sides of webs 72 and 74 remote from washer 76. The central aperture of washer 96 is sufficiently large to permit free movement of the rod there-through.

Referring now to FIGS. 5, 9, 10 and 11, it may be seen that a large transversely extending slot 98 is formed through the wall of housing 28. A cam release mechanism, denoted generally by the reference numeral 100, partially is received in slot 98 as will be described in detail below.

Mechanism 100 includes the camshaft 48 having a portion of reduced diameter 102. Extending from camshaft portion 102 is a cam lobe 104. Camshaft portion 102 is received in slot 98 so cam lobe 104 is located within passageway 29.

A pair of pins 106 and 108 extend through diametric bores formed through camshaft portion 102 and project from these bores. It is to be understood, however, that projections integrally formed with camshaft portion 102 would be the full equivalent of pins 106 and 108.

A U-shaped bracket 110 serves to hold the camshaft 48 so that camshaft portion 102 is rotatably positioned within the slot 98. Bracket 110 has a generally flat main body 112 that is in contact with the outer surface of the bottom of housing 28. This position of bracket 110 may be maintained solely by the fastener means described below or by a combination of fastener means and adhesive bonding between body 112 and the outer surface of assembly housing. Upwardly projecting legs 114 and 116 extend from main body 112 and have formed therein downwardly extending slots 118 and 120 respectively. Slots 118 and 120 are suitably dimensioned to receive the extremities of camshaft portion 102 that project from slot 98. The inner surface of legs 114 and 116 are in intimate contact with the arcuate wall of housing 28.

Main body 112 has formed therethrough a pair of slots 122 and 124 that receive pins 108 and 106 respectively. This interrelationship between slots 122 and 124 and pins 108 and 106 serves to limit the magnitude of angular rotation of camshaft 48 as best may be seen in FIG. 9. An aperture 126 also extends through bracket main body 112 and is aligned with a similar aperture 127 (FIG. 9) formed through housing 28.

Against the outside (bottom) surface of bracket main body 112 is positioned a leaf spring 128 having an aperture 130 formed therethrough. Leaf spring 128 and bracket 110 are held in position by a machine screw 132 that extends through apertures 130, 126 and 127, thereby fastening the leaf spring and bracket to the housing. Leaf spring 128 overlies the slots 122 and 124 and thus bears against the portions of pins 108 and 106 that extend through these slots. The purpose of spring 132 will be explained in detail below.

The manual operating handle 134, having a splined bore 136 is received on the splined end 50 of camshaft 48 for unitary rotation therewith.

In operation, the assembly 20 serves to regulate pivotal reclining movement of the seat back 16 relative to the seat bench 14. With the seat back 16 in the upright position illustrated in FIG. 1, the assembly 20 is in the fully extended condition illustrated in FIG. 7 of the drawings. Downward pivotal movement of said back 16 in a counterclockwise direction is prevented since the force of locking spring 94 acts upon lock plates 92 and tilts these plates about fulcrum 90 causing the sharp edges of the lock plate central apertures to engage the rod 40. If the vehicle seat occupant desires to adjust the seat back 16 in a reclining position, the operator grasps handle 134 and rotates this handle causing counterclockwise rotation of the camshaft as viewed in FIGS. 7, 8 and 9. The cam lobe 104 contacts the lock plate proximate to the camshaft and forces the stack of lock plates 92 into a position substantially perpendicular to the axis of rod 40. With the lock plates so positioned, rod 40 may move unimpeded to the right as viewed in the drawings and seat back 16 may be pivoted counterclockwise against the force of operating spring 86.

When the desired seat back position of adjustment is achieved, the seat occupant releases handle 134. The force of locking spring 94, together with the force of leaf spring 132 acting on pins 106 and 108, will cause the camshaft to return to the position shown in FIG. 7 and allow tilting of the lock plates about fulcrum 90, thereby preventing further reclining movement of the seat back. When it is desired to return the seat back to the upright position, the seat back need only be grasped manually and moved to this upright position since the frictional force between the lock plates 92 and rod 40 tending to prevent movement of the rod 40 to the left as viewed in the drawings is not great and may be overcome manually.

It should be noted that leaf spring 128 also serves to prevent movement of the camshaft when the camshaft is not operating to position the plates 92. With the camshaft thus inoperative, it is in an unstrained condition and free to move within slot 98. Such movement would cause an undesirable rattling absent the force exerted by spring 128.

The design of the assembly 20 disclosed herein is particularly advantageous in that it allows for the efficient assembly of the many parts of this device by a relatively untrained workman utilizing only simple tools. Prior to assembly, the tubular housing 28 has formed therein slots 68, 68a, 72, 72a, 88 and 98. These slots simply may be formed by well known machining techniques such as sawing or milling. Also prior to assembly, the housing wall portion 90 is deformed radially inwardly to form the required fulcrum. The first assembly operation comprises the assembly of the actuating mechanism 100, the parts of which are shown in FIG. 11. This is accomplished simply by proper positioning of the parts and the insertion of the machine screw 132. If, as noted above, it is desired to position the bracket on the housing 28 by the use of an adhesive, this operation can be added.

The assembly of the parts located in the passageway 29 greatly is facilitated due to the fact that all of these parts have outside diameters less than the inside diameter of the tubular housing 28. Thus assembly of these parts may commence by a workman simply dropping the stack of lock plates 92 into the passageway 29. These plates, due to the force of gravity, will come to rest in the desired juxtaposed stack against the fulcrum 90 and camshaft portion 102. The locking spring 94 and washer 96 then are placed in passageway 29. Such force is applied to washer 96 to partially compress the spring 94 and with the spring held in this partially compressed condition the webs 72 and 74 are deformed radially inwardly to lock washer 96, partially compressed spring 94 and locking plate stack 92 into position.
Washer 76 and operating spring 86 then are placed in passageway 29. Rod 40, with washer 84 and lock washer 80 previously positioned thereon, then is inserted through operating spring 86, washers 72 and 96, spring 94 and locking plates 92. Rod 40 is inserted a sufficient distance within the housing to partially compress the spring 86. While the rod is held in this position, the plug 36 is positioned and secured at the end of the housing by the deformation inwardly of the housing at 66. Plug 30 then may be positioned in the opposite end of housing 28 and locked in place by the inward deformation of the housing at 58. Lock washer 46 and clevis 42 then are added to complete the assembly 20.

It thus may be seen that this invention provides an extendible and contractible connecting link assembly for a vehicle reclining seat back actuator that normally is spring biased towards its extended position, thus allowing this mechanism to be positioned in the seat back bench as illustrated in FIG. 1 of the drawings. The device herein disclosed is of simplified design in which various internal structural features, such as webs 72 and 74 providing stop shoulder means and the fulcrum 90, may be formed by deformation of the housing from exterior thereof. Also, the design of this invention allows a simple assembly of the plurality of component parts primarily by sliding these parts in proper sequence within the assembly housing.

I claim:

1. A selectively extendible and contractible connecting link assembly for a reclining seat actuator comprising a thin-walled, tubular housing defining a chamber retaining first plug means for sealing one end of said housing, and retaining second plug means having an aperture therethrough in the other end of said housing, a rod extending through said aperture and partially slidably received in said housing, said housing also having first stop means formed on diametrically opposed portions by spaced slotting and inwardly deforming portions of said housing, first aperture barrier means positioned against said first stop means, said rod extending through said barrier means, radially extending flange means secured to said rod within said chamber, a main operating coil spring surrounding said rod within said chamber, one end of said spring bearing on said first barrier means and the other end of said spring bearing on said flange means thereby biasing said rod out of said housing and said assembly towards its extended condition by a plurality of junxtaposed centrally apertured lock plates within said chamber, said rod extending through the apertures therein, said lock plate apertures being larger than said rod whereby said lock plates can be tilted relative to said rod, second stop means formed by inwardly deforming a portion of said housing and comprising a fixed fulcrum offset from the axis of said rod, in contact with one of said lock plates and preventing movement of said lock plates away from the end of said housing from which said rod protrudes, a locking spring encircling said rod and compressed between a second apertured barrier means positioned against said first stop means opposite from said first apertured barrier means and the side of lock plates remote from said second stop means, said spring being operative to tilt said lock plates around said fulcrum and lock said rod and said housing against contractible movement, said lock plates being effective to brake but not lock said rod against movement in an extensible direction, a cam member rotatably supported in said housing for selective direct engagement with said lock plates on the side of said lock opposite said fulcrum, and actuating means for rotating said cam to move said lock plates against the force of said locking spring until said locking plates are substantially normal to the axis of said rod whereby said rod may be freely moved in either direction.

2. The assembly of claim 1, wherein said actuating means comprises a manually actutable handle secured to said cam member.

3. The assembly of claim 1, wherein each of said apertured barriers comprises a washer having an outside diameter slightly smaller than the inside diameter of said tubular housing.

4. The assembly of claim 1, wherein said inwardly deformed portion of second stop means is adjacent a transversely extending slot formed through the wall of said housing.

5. A selectively extendible and contractible connecting link assembly adapted to operatively interconnect a relatively stationary horizontally disposed seat bench member and a seat back member pivotally connected to the seat bench member and to locate said back in one of a plurality of positions, said assembly comprising a one piece thin-walled, tubular housing defining an elongated chamber, first plug means sealing one end of said housing and adapted to be operatively secured to one of said seat members, second plug means having an aperture formed therethrough in the other end of said housing, a rod extending through said aperture and partially slidably received in said housing, the end of said rod projecting from said housing adapted to be secured to the other of said seat members, barrier means extending transversely across said chamber at a point spaced from both ends of said housing, barrier means having a central aperture extending therethrough and which said rod extends, said barrier means including a pair of diametrically oppositely located housing portions, each of said portions being bounded by a pair of transversely extending slots formed through the wall of said housing and being deformed inwardly into said chamber, a radially extending flange carried by said rod for unitary movement therewith and located between said barrier and said second plug means, a main operating spring surrounding said rod and partially compressed between said flange and said barrier means, said spring exerting a force biasing said rod out of said housing and said assembly into an extended condition, a fixed fulcrum rigid with said housing and located between said barrier means and said first plug means and offset from the axis of said rod, rockable locking means surrounding said rod between said barrier means and said fulcrum, bearing against fulcrum and rockable about said fulcrum from a first position in which said locking means engage said rod to lock said rod and said housing against contractible movement and a second position allowing freedom of axial movement of said rod, a locking spring encircling said rod and partially compressed between said barrier and said locking means, said locking spring exerting a force urging said locking means toward said first position, a cam member rotatably supported in said housing for selective direct engagement with said locking means on the side of said rod opposite said fulcrum, and actuating means for rotating said cam to move said locking means against the force of said lock-
6. The link assembly of claim 5, wherein said barrier means further includes a pair of washers, each of said washers being positioned in said chamber on opposite sides of and bearing against said housing portions.

7. The link assembly of claim 5, wherein said housing has a transversely extending slot formed therethrough, said fulcrum comprising a portion of said housing immediately adjacent said slot deformed radially inwardly into said chamber.* * * *