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AT A SELECTED POSITION ONE RELATIVE TO THE OTHER

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ABSTRACT OF THE DISCLOSURE

An adjusting device to be used, for example, to releasably hold the backrest of an automobile seat at an adjusted angular position with respect to a lower seat portion, thereof. The device includes a pair of components one of which is movable relative to the other and is to be fixed at an adjusted position with respect to the other component. A pair of lock means coast with these components for releasably holding them in a selected position one with respect to the other. One of the lock means is movable to and from a locking position with respect to the other lock means, and a manually operable means coacts with this one lock means for displacing it between locking and unlocking positions. However, this one lock means is capable of automatically returning from its unlocking position to its locking position, independently of the manually operable means, in response to a speed of movement of one of the components relative to the other which is greater than a predetermined speed. Therefore, if, when the one lock means is in its unlocking position, one of the components should suddenly move at high speed relative to the other, the one lock means will automatically resume its locking position to prevent the high-speed movement of the one component.

BACKGROUND OF THE INVENTION

The present invention relates to adjusting devices for releasably holding one adjustable component at a selected position with respect to another component. This device of the invention is particularly suited for releasably holding a tiltable backrest of an automobile seat at a selected angular position with respect to the lower seat portion of the automobile seat. The components are held in their adjusted position by way of a pair of lock means one of which is displaceable between a locking and unlocking position with respect to the other. When this one lock means is in its unlocking position the position of the components can be adjusted one relative to the other.

With known devices of this general type where the lock structure must be displaced to an unlocking position in order to adjust the components one relative to the other, there is the disadvantage that an unexpected load suddenly encountered by one of the other of the adjustable components is undesirably displaced movement thereof, as long as the lock structure is in its release position unlocking the components for adjustable movement. For example, when such a known construction is used for releasably holding the tiltable backrest of an automobile seat at an adjusted angular position, it can happen, for example, in a sudden impact or thrust which acts on the vehicle while the device is in its unlocked position, the backrest will move suddenly to injure the person who occupies the seat because the backrest does not provide any rigid body against which the individual can hold himself for protection. There are known lock devices for tiltable backrests, for example, in the form of self-locking drives, which also operate during adjustment of the inclination of the backrest to secure the backrest against tilting movement under the action of a load which acts on the backrest. However, such known devices have the disadvantage that they permit only a relatively slow rate of adjustment to be carried out, which is of a particular disadvantage in the case where the backrest is to be tilted forwardly through a large distance so as to facilitate entry of an occupant into the rear part of the vehicle.

SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide a device of the above general type which will avoid the above drawbacks.

In particular, it is an object of the invention to provide an adjusting device which can be unlocked to provide for adjustment of one component relative to another but which at the same time will automatically assume a locked position if this one adjustable component should happen to move unexpectedly at a speed greater than a given speed.

In particular, it is an object of the invention to provide a construction which can be manually operated so as to be displaced between locked and unlocked positions but which can operate independently of the manual operation to assume its locked position if during adjustment of the components when the device is unlocked a sudden unexpected movement at a relatively high speed is imparted to one of the adjustable components.

It is also an object of the present invention to provide a construction of this type which is exceedingly simple and compact while capable of achieving the desired results.

Also, it is an object of the invention to provide a construction of this type which can be very simply manipulated and which will provide for rapid movement of an adjustable component to a selected position as long as the adjusting structure is unlocked.

Thus, it is an object of the invention to provide a construction which will automatically respond to a load greater than a given load for automatically locking the components against adjustable movements.

In accordance with the invention these objects are achieved by providing a pair of lock means which coast with a pair of adjustable components one of which is adjustable relative to the other. To bring about adjustable movement of one of these components one of the lock means is displaceable from a locking position to an unlocking position with respect to the other lock means. A manually operable means coacts with this one lock means for displacing it between its locking and unlocking positions. However, when an unexpected load acts on the one adjustable component, to move it at a speed greater than a given speed, while the one lock means is in its unlocking position, this one lock means will respond independently of the manually operable means to return to its locking position and thus retard the unexpected movement of the one adjustable component. The one lock means can respond or automatically turn to its locking position either as a result of its own inertia, this one lock means being provided with a suitable mass for this purpose, or it can be shifted back to its locking position in response to a component of force emanating from the adjustable component when the latter moves at a speed greater than a given speed. In order to release the one lock means for automatic return to its locking position only upon exceeding of a given force, a means in the form of a suitable spring, is provided on the one lock means for urging it to its unlocking position, so that this one lock means will return to its locking position only in opposition to the spring.

Moreover, the displacement of the one lock means between its locking and unlocking positions requires move-
ment of the one lock means along only a relatively short distance, so that a very rapid return of the one lock means to its locking position can be achieved.

Moreover, the manually operable means which coacts with the one lock means is a gear 4 having camming slots which coact with cam followers for assuring displacement of the one lock means from its locking to its unlocking position, these slots having with respect to the cam follower pins a width substantially greater than the thickness of these pins when the one lock means is in its unlocking position to assure the possibility of unrestrained returned movement of the one lock means to its locking position automatically and independently of the manually operable means. With camming slots of this type it is also possible to provide the slots with a configuration which will exclude the possibility of return of the one lock means automatically to its locking position, if desired.

However, it is also possible to achieve the results of the invention by way of a construction where the one lock means which is displaced between the locking and unlocking positions takes the form of a nut surrounding and threadedly engaging a shaft such as a spindle 10 having a thread of large pitch to result in rotary movement of the nut in response to axial movement of the spindle. This spindle moves axially in response to adjusting of the one component, and when the latter is unexpectedly subjected to a load large enough to provide a speed of movement exceeding a predetermined speed of movement, the spindle will yield with a slight thrust with respect to the nut sufficiently great to shift the latter back to its locking position, even in opposition to a spring which tends to urge the nut away from its locking position.

BRIEF DESCRIPTION OF DRAWINGS

The invention is illustrated by way of exemplifying the accompanying drawings which form part of this application and in which:

FIG. 1 is a partly broken away fragmentary side elevation of one possible embodiment of a structure according to the invention;

FIG. 2 is a transverse sectional elevation of the structure of FIG. 1 taken along line II—II of FIG. 1 in the direction of the arrows;

FIG. 3 is a transverse section of the structure of FIG. 1 taken along line III—III of FIG. 1 in the direction of the arrows;

FIG. 4 is a schematic fragmentary side elevation showing a different type of cam which may be used with the embodiment of FIGS. 1-3;

FIG. 5 is a schematic side elevation showing a further embodiment of a cam structure which may be used with the assembly of FIGS. 1-3;

FIG. 6 is a schematic end elevation of an automobile seat to which the structure of FIGS. 7 and 8 is connected;

FIG. 7 is a fragmentary sectional elevation showing the structure at the lower left portion of FIG. 6, the section of FIG. 7 being taken in a plane which contains the axis of a spindle of the device; and

FIG. 8 is a fragmentary top plan view of the structure shown at the lower left portion of FIG. 6.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to FIGS. 1-3, the structure illustrated therein includes a lower stationary component 1 which is adapted to be fixed to and form part of a lower seat portion of a automobile seat, for example. This lower component 1 is pivotally connected with a swingable component 2 by way of a pivot pin 3 carried by the component 1 and forming a guide means which guides the component 2 for movement with respect to the component 1. The component 2 is connected to and forms part of the backrest of an automobile seat, in the example illustrated in this application so that this backrest can be swung with respect to the seat portion to a selected angular position.

A lock means is operatively connected with the components 1 and 2, and this lock means includes in FIGS. 1-3 a circular ring 4 having inner teeth. The gear 4 is fixed to the stationary component 1 and concentrically surrounds the pivot pin 3. The lock means further includes a gear 5 which meshes with the inner teeth of the ring 4 and which is supported for rotary movement on the circular periphery of a disc or plate 6 which eccentrically surrounds the pin 3, the plate 6 forming with the pin 3 a guide means for guiding not only the swingable component 2 but also the gear 5 of the lock means. The plate 6 is freely turnable about the pin 3 and is fixed to the component 2 for swinging movement with the latter about the pin 3, while the gear 5 can turn freely on the periphery of the eccentric plate 6. Thus, the lock means 4, 5 has the construction of a planetary drive since during swinging of the component 2 with respect to the component 1 the gear 5 will planetate along the inner teeth of the gear 4.

As is apparent from FIG. 1, the elements 4 and 5 of the lock means have a thread of substantially wedge-shaped configuration, and a second lock means coacts with the lock means 4, 5 for releasably holding the component 2 at a selected angular position with respect to the component 1. This second one of the pair of lock means includes a pair of lock members 7 and 8 in the form of elongated curved plates of substantially wedge-shape configuration having shapes which conform to the space between the elements 4 and 5 at the region of the ends of this space. Thus, the lock elements 7 and 8 extend from the part of the sickle-shaped space which is of maximum width to the opposed ends thereof which are of minimum width. Thus, the lock members 7 and 8 which are spaced from each other engage the tips of the teeth of the lock elements 4 and 5 for pressing against these teeth to prevent relative movement between elements 4 and 5 when the lock means 7, 8 is in its locking position. If the component 2 tends to swing in a counterclockwise direction, as viewed in FIG. 1, while the lock means 7, 8 is in its locking position, then the element 5 will press radially against the element 8 to press the latter more tightly against the teeth of the element 4, so that the element 8 becomes transversely compressed between the elements 4 and 5, and in this way the pair of lock means coact to prevent movement of the component 2 in a clockwise direction, as viewed in FIG. 1. If there is a tendency for the component 2 to turn in a clockwise direction, as viewed in FIG. 1, then it is the element 7 which is compressed between the elements 4 and 5 to increasing extent as a force acting on component 2 tends to turn the latter in a clockwise direction, and in this latter case it is the element 7 which retains the component 2 in its adjusted position.

At a location which is aligned with the space between the lock elements 7 and 8, the swingable component 2 carries a pivot pin 10 which supports a cam plate 9 for swinging movement. This cam plate 9 forms part of a cam means for controlling the positions of the elements 7 and 8, and for this purpose the cam plate 9 has camming edges 17 and 18 indicated in FIG. 1. The cam means further includes cam-follower pins 7' and 8' respectively fixed to and extending perpendicularly from the elements 7 and 8 through slots 19 and 20 formed in the component 2, so that the pin 7' and 8' have distant from the lock 4 engaged, at their side surfaces, the camming edges 17 and 18. The guide slots 19 and 20 extend along a circle which is concentric with the pin 3. Thus, when the lock elements 7 and 8 move longitudinally in the space between elements 4 and 5, the follower pins 7' and 8' move along a circular path which is concentric with the pivot axis of the component 2.
The configuration of the camming edges 17 and 18 is such that when the cam plate 9 is swung in a counterclockwise direction, as viewed in FIG. 1, the lock means 7, 8 is displaced to its locking position, so that the elements 7 and 8 are pushed apart from each other. The turning moment required to turn the cam plate 9 is derived from a manually operable cam mechanism 6 in the form of a cam lever 11 accessible to the operator and forming an integral extension of the cam plate 9. A spring 12 is operatively connected with the lever 11 to urge the latter to turn with the cam plate 9 in a counterclockwise direction, as viewed in FIG. 1, so that the spring 12 maintains the lock means 7, 8 in its locking position.

A pair of springs 27 and 28 respectively press against the cam follower pins 7' and 8' to urge them toward each other so as to tend to displace the elements 7 and 8 toward the central region of the sickle-shaped space where this space has its maximum width. In the illustrated example each of the springs 27 and 28 is the form of a substantially rigid acting on element having one end fixed to the swingable component 2. The free ends of the springs 27 and 28 press against the follower pins 7' and 8' at side surfaces thereof directed away from the camming edges 17 and 18, so that the springs 27 and 28 also function to maintain the follower pins 7' and 8' in engagement with the cam plate 9. When then the lever 11 in opposition to the force of the spring 12, the camming edges 17 and 18 release the pins 7' and 8' for movement toward each other, so that the pins 7' and 8' together with the elements 7 and 8 are displaced toward each other under the influence of the springs 27 and 28, and thus shifting of the lock means 7, 8 under these conditions from its locking to its unlocking position is assured. When the lock means 7, 8 is in its unlocking position, the swingable component 2 can be swung forwardly or rearwardly since the gear 5 will simply roll along the inner teeth of the gear 4 and the elements 7 and 8 and will remain in and move together with the sickle-shaped space the configuration of which does not change.

During turning of the component 2 with respect to the component 1, a force of inertia will act on the lock elements 7 and 8 in accordance with the mass thereof, particularly when the movement of the component 2 is accelerated. This force of inertia acts on one of the elements 7 and 8 in the same direction as that in which the component 2 is turned with this force of inertia acting in the same direction on one element as the spring which presses against the follower pin thereof and acting on the other element in opposition to the spring which presses against the follower pin thereof. Thus, irrespective of the direction in which the component 2 is turned, one of the springs 27 and 28 will urge one of the components 7 and 8 in a direction opposite to the force of inertia acting thereon. Thus, when the component 2 is swung in a clockwise direction, as viewed in FIG. 1, the spring 28 will urge the lock means 7, 8 and tend to move the latter also in a clockwise direction, while when the component 2 is turned in a counterclockwise direction, as viewed in FIG. 1, the spring 27 will oppose the tendency of the element 7 to move under a force of inertia also in this counterclockwise direction.

Thus, depending upon the direction of turning of component 2, there will be a force of inertia urging one of the elements 7 and 8 toward its locking position, and when this force of inertia is sufficiently great to overcome the force of the spring 27 or 28, then the lock element will be displaced automatically by the force of inertia to its locking position pressing against the lock means 4, 5 to retard the movement of the cam component 1, and thus prevent further movement of the component 2 under these conditions. When the excessively high acceleration terminates, the spring 27 or 28 will return the element 7 or 8 which has automatically assumed its locking position back to its unlocking position, and the component 2 can again be turned by the operator. Thus, the lock means 7 and 8 is capable of responding automatically to a speed of movement of the component 2 which is above a given speed for automatically assuming its locking position to prevent movement of the component 2 at a speed which is above a given speed.

It is apparent that it is the force of the springs 27 and 28 which determines the maximum possible acceleration and speed of movement of the movable component 2. And, by selecting springs 27 and 28 of a given magnitude or force, the permissible acceleration and speed of movement of the component 2 can be automatically regulated. Such a construction is of particular advantage, for example, in the case of an automobile seat. In this latter application of the structure of the invention it is also of advantage, as is the case in the illustrated example, to situate at least one lock element 8 at such a location that its path of movement when the backrest is in the region of its normal position extends substantially in the longitudinal direction of the seat.

Thus, under these conditions the element 8 will automatically assume its locking position if the lock means 7, 8 happens to be unlocked and there is a sudden rearward thrust on the component 2 tending to swing the latter unexpectedly in a clockwise direction, as viewed in FIG. 1. Such a sudden unexpected acceleration of the component 2 in a clockwise direction, as viewed in FIG. 1, will very effectively thrust the element 8 by inertia back to its locking position with the locking force increasing as the force tending to swing the component 2 in a clockwise direction increases, so that the greater the latter force the greater the force of inertia which presses the component 8 to its locking position to increase the locking action.

Inasmuch as it is customary with seats of the above type to have a pair of the mechanisms described above respectively situated at the ends of the seats, while both of these mechanisms are manually controlled from a single manually operable means such as the lever 11, the cam plate 9 in the illustrated example is provided with an axially extending portion 9' (FIG. 3), and this extension 9' is fixed with a motion-transmitting tube 29 connected to a corresponding extension of a cam plate of the other mechanism at the other end of the seat, so that both of these mechanisms will be simultaneously actuated.

In the event that the springs 27 and 28, because of the selection of a relatively small force of inertia to overcome the force of these springs, do not act with a force sufficient to reliably displace the pins 7 and 8 from their locking to their unlocking positions when the manually operable means 11 is actuated to turn the cam plate 9 so as to release the lock, the cam plate 9 can be replaced by a cam of a different construction and capable of positively displacing the elements 7 and 8 away from their locking positions. Such a construction is illustrated in FIG. 4. In this case the cam 9 is replaced by a swingable plate 30 which also swings about the pivot 10 but which is formed with a pair of slots 31 and 32 respectively receiving the follower pins. As is shown in FIG. 4, the width of the slots 31 and 32 is not uniform over their entire length. The slot width only corresponds to the diameter of the follower pin at those ends of the slots 31 and 32 which respectively receive the follower pins when the lock means 7, 8 is in its locking position. In the example illustrated in FIG. 4 it is the lower end of the slot 31 which receives the pin 8' and has a width corresponding to the diameter of the pin 8' when the lock means 7, 8 is in its locking position while the upper end of the slot 32 has a width corresponding to the diameter of the pin 7' and receives the pin 7' when the element 7 is in its locking position. Those regions of the slots 31 and 32 which receive the follower pins when the lock means 7, 8 is in its unlocked position, have a width substantially greater than the diameters of the pins, so that at this time the lock elements 7 and 8 are free to return under the force of inertia to their locking positions, in the manner described above. Thus,
the configurations of the camming slots 31 and 32 are such that they will initially compel the lock means 7, 8 to move from its locking to its unlocking position, but when the elements 7 and 8 are in their unlocked positions, they are free to return under the force of inertia to their locking position. At the very least, the follower pins are free to move by inertia with the lock elements when the cam 30 and lever 11 have been displaced to a position corresponding to the unlocked position of the lock means 7, 8.

In the form of cam shown in FIG. 5, where there is also a cam 33 of the cam plate 9, the camming slots 34 and 35 of this cam 33 have a configuration which will prevent automatic return of the lock means 7, 8 under the force of inertia to its locking position when the component 2 moves unexpectedly at an undesirably high speed or acceleration. Thus, with this construction it is possible, if desired, to cut out the automatic action so as to prevent the latter from taking place.

For this purpose the slots 34 and 35 are respectively provided with extensions enabling the cam plate 33 to be swung beyond the position it normally assumes when the lock means 7, 8 is in its unlocking position. The normal unlocking position of the cam is easily be noted, felt by the individual operating the lever 11 since the structure is designed to provide a substantially greater force resisting turning of the cam beyond its normal position when the lock means 7, 8 is unlocked. This results is achieved by way of a leaf spring 36 the force of which must be overcome when the lever 11 and cam 33 are displaced beyond the position they normally assume when the lock means is unlocked. The slots 34 and 35 have at the regions thereof which receive the pins 7' and 8', when the lock means 7, 8 is in its normal unlocked position, a width sufficiently great so that the elements 7 and 8 can automatically return under inertia to their locking positions, if subjected to conditions described above. At the regions of the end extensions of the slots 34 and 35, however, which receive the follower pins when the cam 33 and lever 11 are turned beyond the normal unlocking position, the slots 34 and 35 have a width corresponding to the diameters of the follower pins so that when these narrower end extensions of the slots 34 and 35 receive the follower pins the elements 7 and 8 cannot return back to their locking positions.

As may be seen from FIG. 5, during swinging of the lever 11 and cam 33 from the solid to the dotted line position the leaf spring 36 remains substantially undeflected, while turning of the manually operable means 11 and cam 33 beyond the dotted line position in a closed direction, as viewed in FIG. 5, will result in positive deflection of the spring 36 while the narrower end extensions of the slots receive the follower pins, and thus the operator will be forced to oppose the lever 11 the greater force required to oppose the spring 36, and thus the operator will be forced to rotate the lock means 7, 8 to its locking position in an automatic manner.

The embodiment of the invention which is illustrated in FIGS. 6–8 also serves to releasably hold a tiltable backrest of an automobile seat at a selected angular position. Thus, FIG. 6 illustrates the backrest 101 of such a seat, and there is also schematically indicated in FIG. 6 the structure of the invention at one end of the seat for retaining the backrest 101 at a selected angular position. This structure includes the frame 102 of the backrest, this frame 102 thus forming one of the adjustable parts and being swingable relative to the stationary component 103 which forms part of the lower seat portion. This stationary portion 103 carries the shaft 104 which extends through an opening of the frame 102 so as to form a pivot axis for the backrest 101. In this case the pivot 104 is situated above the lower end of the component 102. This lower end of the component 102 is in the illustrated example pivotally connected with a free end of an elongated thread spindle 105 which extends in a generally horizontal direction. As is shown most clearly in FIG. 7, the forward elongated free end portion of the threaded spindle 105 passes through a nut 109 which is held between locking and unlocking positions. The stationary component 103 pivotally supports a holder 106 in which the nut 109 is accommodated. This holder 106 has a left end wall, as viewed in FIG. 7, through which the spindle 105 freely extends for free axial movement, and the holder has an elongated cylindrical sidewall 106' in which the lock means 109 is accommodate for free rotary movement and for free axial movement to a given extent. Spindle 105 has a steep spiral thread of a pitch long enough to rotate nut 109 during axial movement of the spindle.

Thus, the holder 106 has the configuration of a cylindrical housing which has an open end directed toward that end of the spindle 105 which is pivotally connected with the lower end of the component 102. The opposed end wall 107 of the holder 106 is formed with the axial bore 108 passing therethrough and through which the spindle 105 freely extends. The inner surface of the cylindrical wall 106' forms a slide bearing for the rotary lock member 109. Thus, the exterior surface of the nut 109 can slide freely along the interior surface of the cylinder 106'.

That end of the lock means 109 which is directed toward the end wall 107 is provided with axially extending teeth 110 so that it has a structure similar to that of a gear. The end wall 107 forms another lock means and for this purpose has at its end face directed toward the lock means 9 the projections 111 forming teeth which are adapted to mesh with the teeth 110. This end wall 107 thus forms a lock means which is stationary with respect to the spindle 105 since there is no relative angular movement between the axis of the spindle 105 and the lock means 107. Thus, rotary movement of the nut 109 is not possible when the lock teeth 110 and 111 mesh, so that at this time the lock means 109 is in its locking position. The distribution of the teeth 110 and 111 is selected in such a way that an angular turning of the nut 109 through an angular distance corresponding to the dimensions of a tooth is so small that the resulting axial shifting of the spindle 105 provides a hardly noticeable swinging of the backrest 101.

Beyond their end teeth 110 and 111, the pair of lock means 109 and 107 are provided with exterior cylindrical surfaces spaced inwardly from the cylindrical wall 106' to accommodate a coil spring 122 which concentrically surrounds the spindle 105 and which is compressed between shoulders of the lock means 109 and 107 which are directed toward each other. While the spring 122 directly engages the lock means 107, a washer 123 is interposed between the spring 122 and the shoulder of the lock means 109, and this washer has a peripheral projection extending into a short axial slot of the cylindrical wall 106'. In this way the washer 123 is prevented from turning. On the other hand the lock means 109 is free to turn with respect to the washer at that face thereof which is directed away from the spring 122.

Thus, the spring 122 forms a means urging the lock means 109 to its unlocking position where the teeth 110 are spaced from and out of mesh with the teeth 111. This spring 122 presses the nut 109 against the stationary end 124 engaging that end of the nut 109 which is directed away from the teeth 110. The spindle 105 also extends freely through the axial bore of the cam sleeve 124. In order to prevent tilting of the cam sleeve with respect to the axis of the spindle, the cam sleeve 124 is formed with a cylindrical extension 124' which extends within a cylindrical extension 109' of the lock means 109. In addition a pin 125 is fixed to and extends radially from the cam sleeve 124 through an axial slot of the cylindrical wall 106', so that the cam sleeve 124 is pre-
vented from turning about the axis of the spindle 105. At its end face which is directed away from the nut 109, the cam sleeve 124 is provided with a pair of diametrically opposed, convexly curved camming faces 120 urging the spring 122 against a pair of coaxial spaced pins 119. These pins 119 are fixedly carried by a pair of parallel walls between which the cylindrical holder 106 is situated. These parallel walls from part of a manually turnable lever 117 which forms the manually operable means of this embodiment. A pin 126 serves to swingably connect the holder 106 to the stationary component 103, and this pin 126 also serves to pivotally support the lever 107. The holder 106 carries a leaf spring 121 which acts on a transverse member extending between the side walls of the lever 117 to urge the latter to turn to a position where the pins 119 act on the cam 124 to locate the lock means 109 in its locking position where the teeth 110 mesh with the teeth 111. Thus, the spring 121 acts to automatically hold the lock means 109 in its locking position, and the operator will turn the lever 117 to a clockwise direction, as viewed in FIG. 7, in opposition to the spring 121 into the position illustrated in FIG. 7 in order to release the structure so that the lock means 109 will assume, under the action of the spring 122, the unlocked position shown in FIG. 7.

These faces 120 have a self-locking action. When the lever 117 is turned by the spring 121 in a counterclockwise direction, as viewed in FIG. 7, to its end position placing the teeth 110 in mesh with the teeth 111 a force acting from the rear on the backrest 101 cannot displace the spindle 105 and the nut 109 to the right, as viewed in FIG. 7, so that the lock means 109 cannot be displaced to its unlocking position under these conditions. At this time the cam sleeve 124 is restrained by the pins 119 against axial movement. A force acting from the front toward the rear on the backrest will also fail to displace the lock means 109 to its unlocking position, since such a force acts to increase the force urging the teeth 110 in mesh with the teeth 111.

However, when the handle 117 is turned clockwise in opposition to the spring 121 by the operator, the spring 122 will displace the teeth 110 away from the teeth 111, as long as the backrest is not loaded with a force acting from the front toward the rear. In this latter case the turning of the lever 117 in a clockwise direction to release the lock device will not compel an axial shifting of the nut 109 to its unlocking position to take place. Unlocking will only take place when the axial force transmitted to the nut 109 from the spindle 105 is smaller than the force of the spring 122. Therefore, in order to adjust the backrest, it is necessary to move the lever 117 to the release position where the backrest is not subjected to any load, so that the operator cannot rest with his back against the backrest when the means is released. The backrest cannot be turned forwardly until the lock means 109 is displaced through the short distance required to assume its unlocked position by the spring 122, in which position the means 109 and 109 remains in its unlocking position the spindle 105 will be axially displaced forwardly or rearwardly to turn the nut 109 freely within the cylindrical housing 106, since the pitch of the threads of the spindle 105 are sufficiently great so that the nut 109 will turn in response to axial movement of the spindle 105 with respect thereto.

In the event that during such an adjustment of the backrest there is a sudden load thrusting the backrest toward the rear, because, for example, the vehicle suddenly accelerates, then the spring 122 is compressed and the teeth 110 engage the teeth 111 to prevent further axial displacement of the spindle 105 so as to prevent continued turning of the nut 109. Only when the thrust transmitted axially to the nut 109 from the spindle is again of a lesser force than that of the spring 122 will the lock means 109 again assume its unlocked position. The maximum value of the speed of adjustment depends upon the selection of the spring constant for the coil spring 122. This selection can be made in such a way that in spite of the possibility of a rapid adjustment of the backrest, nevertheless a sudden thrust or impact will reliably prevent an uncontrolled swinging of the backrest.

Although the invention is illustrated and described with reference to a plurality of preferred embodiments thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a plurality of preferred embodiments, but is capable of numerous modifications within the scope of the appended claims.
locking elements having a configuration conforming at least in part to the space defined between the teeth of said gears and situated in said space engaging the tips of said teeth at regions of said space spaced from a central region thereof, and said elements of said one lock means being longitudinally movable along said space between the locking and unlocking positions.

6. The combination of claim 5 and wherein said one lock means has a pair of movable lock elements longitudinally displaceable in said space and respectively situated in portions of said space which are spaced from each other.

7. The combination of claim 5 and wherein a cam means cooperates with said elements of said one lock means for displacing said elements.

8. The combination of claim 7 and wherein said elements of said one lock means respectively carry cam follower pins extending through slots formed in one of said components and extending longitudinally of the space between said members of said other lock means, said cam follower pin cooperating with a turnable cam plate forming part of said manually operable means.

9. The combination of claim 8 and wherein a pair of springs respectively press against said cam follower pins for urging said elements of said one lock means to the unlocking positions while urging said cam follower pins against camming edges of said cam plate, said camming edges having a configuration which displaces said lock elements of said one lock means to their locking positions in response to turning of said cam plate in a given direction.

10. The combination of claim 9 and wherein said cam plate is formed with camming slots which respectively receive said cam follower pins, and said slots having portions corresponding to the diameters of said pins for compelling the latter to move when in said portions of said slots while other portions of said slots have a width sufficiently greater than the thickness of said pins to provide for free movement of the latter together with said elements of said one lock means independently of said manually operable means.

11. The combination of claim 1 and wherein said one lock means automatically returns to its locking position independently of said manually operable means in response to shifting movement of said one lock means to its locking position resulting from a component of force acting on said one lock means from movement of said one component at said speed greater than said given speed.

12. The combination of claim 11 and wherein said one lock means is formed with a threaded bore coating with a threaded spindle of pitch large enough to provide for rotary movement of said one lock means about said spindle without displacement of said one lock means along the axis of said spindle to its locking position except when said one component moves at a speed greater than said given speed, said spindle extending along the path of movement of said one lock means to its locking position.

13. The combination of claim 12 and wherein said other lock means includes a lock member coaxially surrounding said spindle and prevented from turning movement with respect thereto, said pair of lock means respectively having end faces directed toward each other, and a spring situated between and engaging said end faces for urging said one lock means away from said other lock means to an unlocking position.

14. The combination of claim 12 and wherein a support means supports said one lock means for limited axial movement along said spindle and said support means being connected with said other lock means, the latter lock means coaxially surrounding said spindle and being prevented from rotary and axial movement with respect thereto.

References Cited

UNITED STATES PATENTS
2,311,105 2/1943 Will ______________ 297—367
3,008,765 11/1961 Tischler et al. __________ 297—367

FOREIGN PATENTS
1,091,994 11/1967 Great Britain __________ 297—373
1,347,823 11/1963 France _______________ 297—373

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