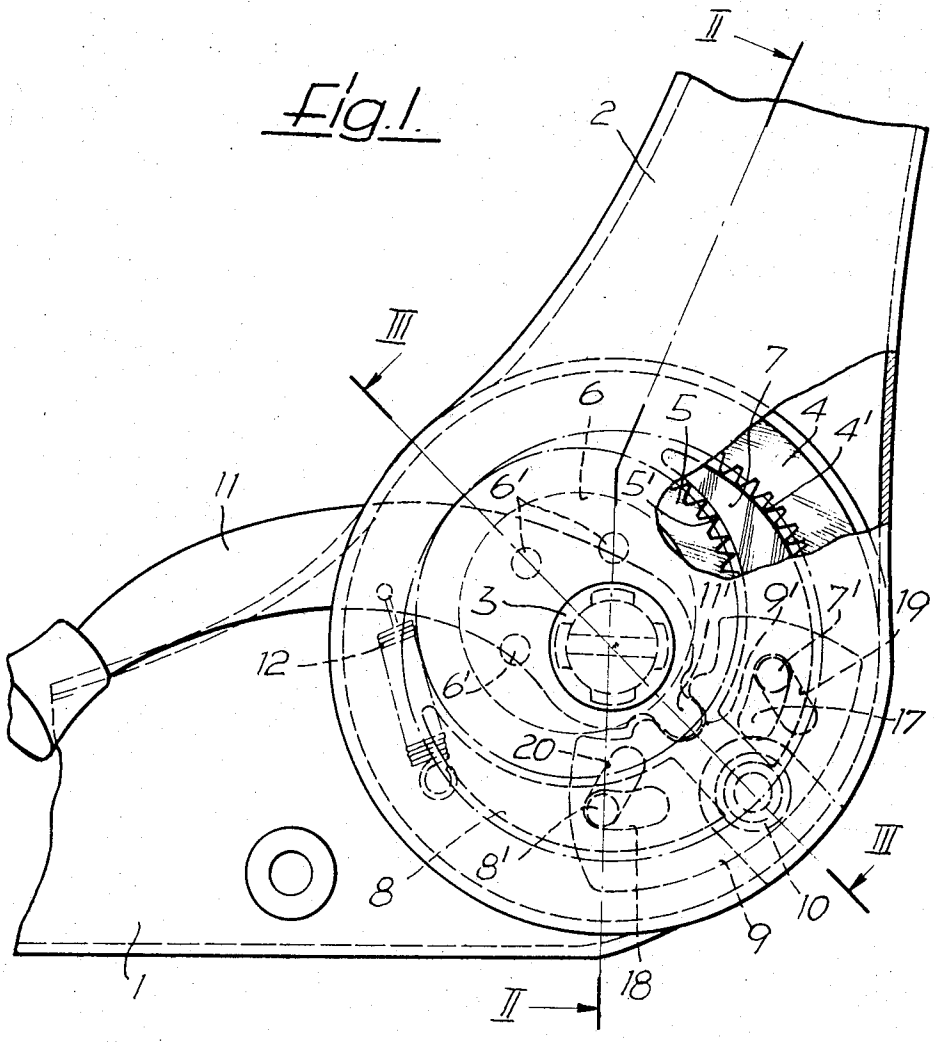
Feb. 16, 1971 N. KÖLLER 3,562,851

DEVICE FOR RELEASABLY LOCKING AT A SELECTED POSITION COMPONENTS WHICH ARE MOVABLE ONE WITH RESPECT TO THE OTHER

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Fig. 1.



Inventor:
Norbert KÖLLER
by: Arthur O. Klein
his Attorney

Feb. 16, 1971 N. KÖLLER 3,562,851

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Fig. 2.

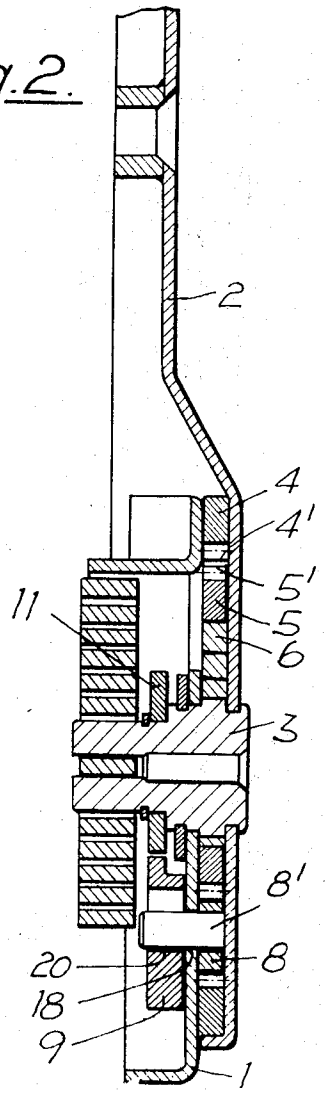
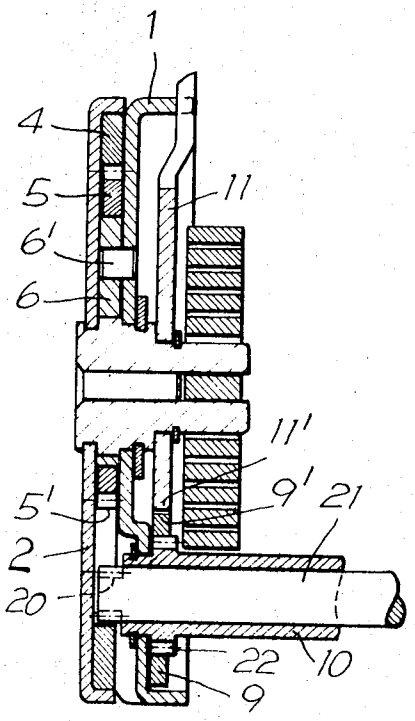


Fig. 3.



Inventor:
Norbert KÖLLER
by: Arthur O. Klein
his Attorney

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DEVICE FOR RELEASABLY LOCKING AT A SELECTED POSITION COMPONENTS WHICH ARE MOVABLE ONE WITH RESPECT TO THE OTHER
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Fig.5.

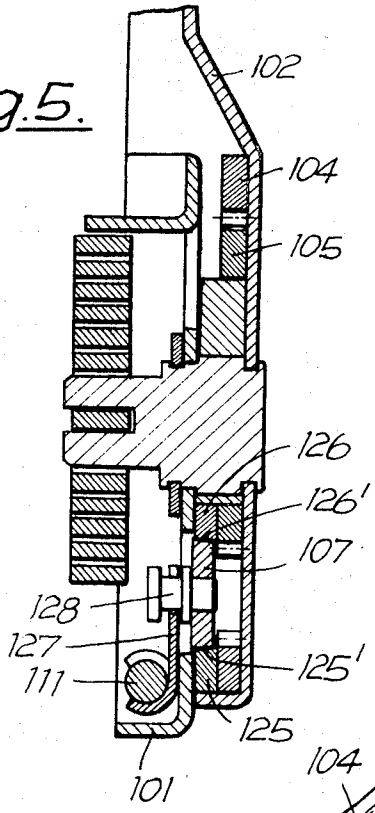


Fig.4.

Inventor:
Norbert KÖLLER
by: Arthur O. Klein
his Attorney

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Fig. 7.

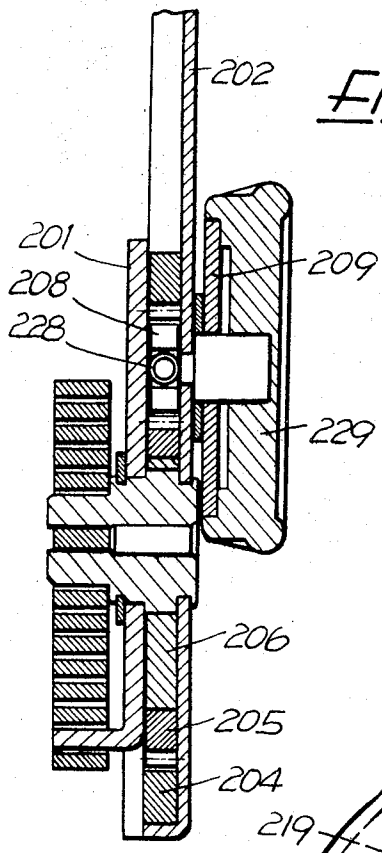


Fig. 6.

Inventor:
Norbert KÖLLER
by: Arthur O. Klein
his Attorney

Feb. 16, 1971 N. KÖLLER 3,562,851
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Fig. 9.

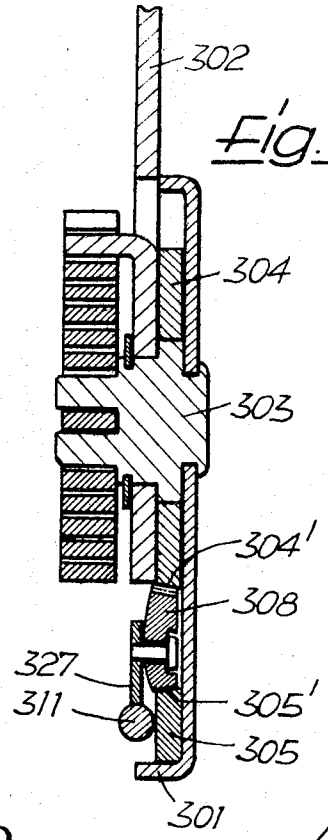


Fig. 8.

Inventor:
Norbert KÖLLER
by: Arthur O. Klein
his Attorney

United States Patent Office 3,562,851 Patented Feb. 16, 1971

3,562,851

DEVICE FOR RELEASABLY LOCKING AT A SELECTED POSITION COMPONENTS WHICH ARE MOVABLE ONE WITH RESPECT TO THE OTHER

Norbert Köller, Oschelbronn, Germany, assignor to Recaro AG, Glarus, Switzerland, a firm

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Claims priority, application Germany, Sept. 16, 1967, P 16 80 261.2
Int. Cl. E05d 11/08
U.S. Cl. 16—140 18 Claims

ABSTRACT OF THE DISCLOSURE

A device for releasably fixing, at a selected position relative to each other, a pair of components which are movable one with respect to the other, such as the back rest of an automobile seat with respect to the seat portion thereof. A pair of outer lock means are respectively connected with the components so that one of the outer lock means is movable relative to the others, and this pair of outer lock means respectively has a pair of lock surfaces directed toward each other. A guide means coacts with the pair of lock means to guide the one lock means for movement relative to the other along a path which does not change the configuration of a space which is defined between the lock surfaces. An intermediate lock means has a locking position located in this space and has a pair of outer lock surfaces directed away from each other and engaging the lock surfaces of the pair of outer lock means with at least an interlocking type of engagement when the intermediate lock means is in its locking position. A manually operable means coacts with the intermediate lock means for moving it between its locking position situated in the space and an unlocking position where the lock surfaces of the intermediate lock means are respectively spaced from the lock surfaces of the pair of outer lock means.

BACKGROUND OF THE INVENTION

The invention relates to a device for fixing, at a selected position one with respect to the other, a pair of components which are movable with respect to each other. The device of the invention is particularly suitable for releasably fixing a swingable backrest of an automobile seat with respect to the seat portion thereof, so that the backrest can have a selected inclination. The invention relates particularly to that type of device where lock elements coact with each other for releasably locking the components at a selected position with one respect to the other.

With known structures of this general type the lock components take the form, for example, of elements having the structure of gears, these elements meshing with each other when in their locking position. The disadvantage of a locking device of this type resides above all in the fact that the adjustment of the components relative to each other can take place only in predetermined steps with no possibility of selecting adjustments between given positions of the components one with respect to the other corresponding to the intermeshing of the gears with respect to each other. There are, however, known devices which provide a stepless type of adjustment permitting an infinite selection within a given range, but with an adjustment of this type the lock elements, instead of having an interlocking relationship, as is the case with meshing gears, have only a pressure relationship so that in order to achieve a reliable locking action such lock elements must have a very high force of friction between themselves. This latter requirement of course has the disadvantage that relatively large forces are required in order to release the locking action so that the components can be adjusted.

SUMMARY OF THE INVENTION

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

In particular, it is an object of the present invention to provide a device enabling an infinite selection of adjusted positions to be provided in a stepless manner without, however, requiring large friction forces and releasing forces as is required by conventional devices which provide this possibility.

Thus, it is an object of the invention to provide a construction according to which the lock elements will have with respect to each other, at least in part, an interlocking action similar to that of intermeshing gear teeth while at the same time permitting an infinite selection of adjusted positions to be made in a stepless manner within a given range.

A further object of the present invention is to provide a construction of this type which can be manually operated to release the lock structure whenever desired in an exceedingly simple manner.

It is also an object of the present invention to provide a construction of the above type which automatically assumes a locking position when released by the operator.

Furthermore, it is an object of the invention to provide a construction which will operate reliably to prevent movement of a movable component, with respect to a stationary component, in both of a pair of opposed directions.

In addition, it is an object of the invention to provide a construction which when it is unlocked enables a free unrestrained movement of a movable component to be achieved.

Also, it is an object of the invention to provide a construction of the above general type which is composed of a small number of simple rugged elements which operate reliably to achieve, at relatively low cost, the results set forth above.

In accordance with the invention the components which are movable one with respect to the other respectively have a pair of outer lock means fixed thereto. The pair of lock means respectively have directed toward each other lock surfaces which define between themselves a space of a given configuration. A guide means coacts with the pair of outer lock means, to guide them for movement one relative to the other without changing the configuration of the space defined between their lock surfaces. An intermediate lock means has a pair of outer lock surfaces directed away from each other and pressing against the lock surfaces of the pair of outer lock means when the intermediate lock means is in a locking position, with the intermediate lock means having with respect to the pair of outer lock means, at least in part, an interlocking coaction. A manually operable means coacts with the intermediate lock means for moving it between its locking position and an unlocking position where the lock surfaces of the intermediate lock means are spaced from the lock surfaces of the pair of outer lock means.

BRIEF DESCRIPTION OF DRAWINGS

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

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

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

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

FIG. 4 is a fragmentary side elevation of another embodiment of a device according to the invention;

FIG. 5 is a transverse sectional elevation taken along line V—V of FIG. 4 in the direction of the arrows;

FIG. 6 is a partly broken away side elevation of a further embodiment of a device according to the invention;

FIG. 7 is a transverse sectional elevation of the structure of FIG. 6 taken along line VII—VII of FIG. 6 in the direction of the arrows;

FIG. 8 is a fragmentary side elevation of yet another embodiment of a device according to the invention; and

FIG. 9 is a transverse sectional elevation taken along line IX—IX of FIG. 8 in the direction of the arrows.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings and to FIGS. 1–3 in particular, it will be seen that the structure illustrated therein includes a stationary component **1** forming a support means for the entire structure and forming part of the lower seat portion of the seat of an automobile in the illustrated example. The structure includes a second component **2** which is movable with respect to the component **1** and which is to be releasably fixed at a selected position with respect to the component **1**. This component **2** is connected with and forms part of a structure such as the swingable backrest of an automobile seat which is to be displaced to a desired angular position with respect to the seat portion. For this purpose a guide means is provided to guide the movable component **2** for movement with respect to the stationary component **1**, and this guide means includes the pivot pin **3** which is carried by the stationary component **1** and which supports the swingable component **2** for movement about a horizontal axis determined by the axis of the pivot pin **3**.

A pair of outer lock means are respectively carried by the components **1** and **2**. One of these outer lock means is fixedly connected with the movable component **2** for turning movement therewith about the axis of the pin **3**. This latter outer lock means takes the form of a ring **4** fixed to the component **2** and concentrically surrounding the pin **3**, this outer lock means **4** having inner teeth **4'** so that it forms an inner ring gear. The teeth of the ring **4** need only be located within the range of adjustment of the component **2**.

The other outer lock means is carried by the stationary component **1** and in the illustrated example takes the form of an inner gear **5** whose teeth mesh with the teeth of the ring gear **4**. The guide means includes, in addition to the pin **3** which guides the component **2** and the outer lock means **4** for turning movement about the axis of the pin **3**, a circular plate **6** which is fixedly carried by the pin **3** and which is fixed to the component **1** so as to be stationary. The circular plate **6** has its center displaced from the axis of the pin **3**, so that the plate **6** is eccentrically positioned with respect to the common axis of the ring **4** and the component **2**. In order to fix the plate **6** against rotation, pins **6'** interconnect the plate **6** with the stationary component **1**, as indicated in FIG. 3. It will be noted that the pair of outer lock means **4** and **5** and the plate **6** are all situated in a common plane.

It will be noted that with this construction the pair of outer lock means **4** and **5** define between themselves an elongated curved space which tapers toward its opposite ends and which is of a generally sickle-shaped configuration. The guide means formed by the pin **3** and the plate **6** guide the pair of lock means for movement in such a way that the sickle-shaped configuration of the space does not change, and during turning of the component **2** with respect to the component **1** the gear **5** rotates, since its teeth **5'** mesh with the teeth **4'**, in the manner of a planetary gear which rotates in response to rotary movement

of a sun gear with which the outer lock means **4** is analogous. The tips of the teeth **4'** and **5'** form at the sickle-shaped space lock surfaces which are directed toward each other, and the region of its ends the sickle-shaped space has a pair of oppositely tapered gaps which gradually taper so as to be of a curved wedge-shaped configuration. These opposed gaps each have a pair of lock surface portions of the outer lock means **4** and **5** formed by the tips of the teeth **4'** and **5'** thereof.

Within this sickle-shaped space is situated an intermediate lock means which has opposed outer lock surfaces pressing against the lock surfaces formed by the tips of the teeth **4'** and **5'** when the intermediate lock means is in the sickle-shaped space in a locking position. This intermediate lock means includes a pair of curved substantially wedge-shaped lock members **7** and **8** the configuration of which conform respectively to the configuration of the elongated opposed end gaps of the sickle-shaped space, these latter portions being situated beyond a central portion of the sickle-shaped space where its width is a maximum. In the embodiment of FIGS. 1–3, the pair of wedge-shaped lock members **7** and **8** which form the intermediate lock means are longitudinally movable toward and away from each other in the sickle-shaped space. The opposed outer edge surfaces of the intermediate lock members **7** and **8** form the pair of outer lock surfaces of the intermediate lock means which press against the tips of the teeth **4'** and **5'** when the intermediate lock means **7**, **8** is in its locking position.

A cam means is provided for displacing the pair of intermediate lock members **7** and **8** toward each other away from their locking positions, and this cam means includes a pair of cam pins **7'** and **8'** respectively fixed to the lock members **7** and **8** at the region of their wider ends and respectively extending parallel to each other and the pin **3**. These cam pins **7'**, **8'**, which form cam followers, respectively extend through guide slots **17** and **18** which are formed in the stationary component **1** and which extend along a circle whose center is in the axis of the pin **3**. Thus, the cam follower pins **7'** and **8'** are guided by the slots **17** and **18** for movement along a curved path which is concentric with the pin **3**. The cam means further includes a swingable cam plate **9** formed with camming slots **19** and **20** through which the pins **7'** and **8'** respectively extend. The cam plate **9** is carried by a rotary tube **10** which is itself supported for turning movement about its axis by the stationary component **1** which forms part of the support means. The axis of the tube **10** extends parallel to the axis of the pin **3**. The configuration and situation of the camming slots **19** and **20** is such that upon turning of the cam **9** the follower pins **7'** and **8'**, and thus the intermediate lock members **7** and **8**, are displaced to the same extent but in opposed directions.

A manually operable means is provided for swinging the cam **9** together with the tube **10** about the axis of the latter, and this manually operable means includes a manually engageable lever **11** freely accessible to the operator and having a projection **11'** received in a notch **9'** of the swingable cam plate **9**. Thus, in response to swinging of the lever **11** the cam plate **9** will also be turned. A spring **12** is connected at one end to the stationary component **1** and at its opposite end to the lever **11** to urge the latter to turn in a counterclockwise direction, as viewed in FIG. 1, about the axis of the pin **3**. FIGS. 2 and 3 in particular illustrate how the manually operable means **11** is turnably carried by the pin **3**. This turning of the lever **11** by the spring **12** will result in turning of the cam plate **9** in a clockwise direction, as viewed in FIG. 1. This direction of turning of the cam **9** results in displacement of the follower pins **7'** and **8'** away from each other so that the spring **12** forms a means urging the pair of intermediate lock members **7** and **8**, which form the intermediate lock means, into their locking positions. Thus, the spring **12** acts through the lever **11** and cam **9**

on the pins 7' and 8' to displace the intermediate lock members 7 and 8 toward the narrow ends of the sickle-shaped space defined between the pair of outer lock means 4 and 5. The pressing of the intermediate lock means 7, 8 against the pair of outer lock means 4 and 5 provides between the intermediate lock means 7, 8 and the pair of outer lock means an interlocked type of coaction, as distinguished from a friction-type of pressure coaction. Thus, the spring 12 holds the intermediate lock means in its locking position. Upon displacement of the lever 11 by the operator in opposition to the spring 12 the intermediate lock members 7 and 8 are displaced toward the central widest part of the space between the pair of outer lock means so as to assume an unlocked position permitting free rotary movement of the lock means 5 during turning of the lock means 4 together with the component 2. Thus, in the unlocked position the component 2 can be moved quickly and freely with respect to the component 1 to a selected position.

In accordance with the particular portions of the sickle-shaped space to which the configurations of the lock members 7 and 8 conform, the force which is transmitted to the lock members 7 and 8 from the gears 4 and 5 longitudinally of the space between the gears 4 and 5 is zero either in a direction toward the narrow ends of the sickle-shaped space or in an opposite direction toward the central region of the space which is of maximum width. Inasmuch as the intermediate lock members 7 and 8 have a frictional engagement with the tips of the teeth of the gears 4 and 5, it is possible through this frictional engagement to achieve an automatic increase in the locking action as well as to facilitate movement of the lock members 7 and 8 toward each other out of their locking position. It is also of advantage that the movement of the lock members 7 and 8 toward their unlocking position takes place with only a small extent of movement of the members 7 and 8 so that it is not possible for the tips of the teeth to break as is the case with known toothed lock mechanisms where during locking or unlocking movement at slow speed under load it is indeed possible for the teeth of the locking components to break.

It is to be noted that when the component 2 tends to turn in a clockwise direction, as viewed in FIG. 1, the lock member 8 becomes compressed in a substantially radial direction transversely of the sickle-shaped space between the teeth of the gears 4 and 5 so as to provide the interlocking type of coaction, while when the component 2 tends to swing forwardly in a counterclockwise direction, as viewed in FIG. 1, it is the intermediate lock member 7 which is compressed transversely in a substantially radial direction between the gears 4 and 5 to provide the automatically increasing interlocking type of coaction. As distinguished from a friction-type of pressure lock, as in the case of a slip clutch, for example, the interlocking type of action achieved with the structure of the invention will require permanent deformation or breaking of the lock members 7 and 8 before the lock will fail.

In the illustrated example the swinging movement of the cam 9 is transmitted to a mechanism identical with that of FIGS. 1–3 but situated at the other end of the seat so that the locking and unlocking action takes place automatically at the opposite ends of the seat in response to the action of the lever 11.

For this purpose the cam 9 is fixed to the tube 10 by way of intermeshing teeth 22 so that the tube 10 transmits the turning movement of the cam plate 9 shown in the drawings to the other cam plate which is at the other end of the seat. Of course, this transmission of the swinging movement between the cam plates 9 can take place by way of an elongated rod interconnecting the plates 9 and having its axis parallel to but spaced from the common turning axis of the plates 9.

In order to assure the same rotary directions of the devices at the opposed ends of the seat, the opposed ends of a bar 21 which extends through the tube 10 are respectively formed with pinions 20 which mesh with the inner teeth of the gears 4 of both of the mechanisms respectively situated at the ends of the seat.

According to the embodiment of the invention which is illustrated in FIGS. 4 and 5, there is also an inner ring gear 104 forming an outer lock means which is fixed to the swingable component 102 for turning movement therewith about the axis of the stationary pivot pin. The inner teeth of the outer lock means 104 mesh with the outer teeth of the other outer lock means formed by the gear 105 which turns about its axis in response to turning of the component 102, as a result of the drive between these gears, and which is also eccentrically positioned, as is apparent from FIG. 4. However, in this embodiment, as is most clearly shown in FIG. 5, the pair of outer lock means respectively include ring segments 125 and 126 which are coaxially fixed to the rings 104 and 105. The surfaces of the segments 125 and 126 which are directed toward each other define a pair of lock surfaces for the pair of outer lock means and define between themselves a space identical in configuration with that which is defined between the elements 104 and 105, so that in this case also a sickle-shaped space is defined between the pair of outer lock means. Of course, instead of segments of rings it is possible for the lock elements 125 and 126 to form complete rings. It is sufficient, however, if, as shown in the illustrated example, the segments are provided with a length adapted to the desired range of adjustment.

The surfaces 125' and 126' which form the lock surfaces of the pair of outer lock means and which are directed toward each other are opposite beveled, as is particularly apparent from FIG. 5, so that the space defined between the segments 125 and 126 is tapered transversely with respect to this space.

The intermediate lock means of this embodiment is formed by a curved member 107 situated in the sickle-shaped space between segments 125 and 126 when the intermediate lock means 107 is in its locking position. This intermediate lock means 107 in this embodiment extends from the central region of the sickle-shaped space where it has its greatest width toward the opposed ends of the sickle-shaped space longitudinally of the latter.

In order to displace the intermediate lock means 107 from its locking position shown in FIGS. 4 and 5 to its unlocking position, and then back to its locking position, the stationary component 101 supports for turning movement a manually operable means formed by a rotary shaft 111 having at its upper end an angularly extending free end portion carrying a handle 112 which is accessible to the operator. A forked shifting member 127 is welded to and extends radially from the rotary shaft 111, and the free end of the shifting member 127 extends into an annular groove formed in a pin 128 which is fixed centrally to the intermediate lock means 107. A coil spring 113 is coiled about the shaft 111 and is fixed at its opposite ends to the shaft 111 and the stationary component 101 so as to tend to turn the shaft 111 in a clockwise direction about its axis, as viewed in FIG. 5, so that the spring 113 forms a means urging the intermediate lock means 107 into its locking position.

It is to be noted that the opposed edge surfaces of the intermediate lock means 107, which are directed away from each other, are also oppositely beveled and have an inclination matching that of oppositely beveled lock surfaces 125' and 126', so that a transverse wedging action is achieved between the intermediate lock means 107 and the pair of outer lock means 104 and 105. However, these beveled lock surfaces greatly facilitate the displacement of the lock member 107 away from its locking position. This displacement of the intermediate lock means away from its locking position to its unlocking position can easily be carried out even when the lock member 107 is tightly clamped between the lock members 125 and 126.

In the event that a pair of segments **125** and **126** are not provided and instead the intermediate lock means **107** enters directly into the space between the gears **104** and **105**, it is then desirable to provide along the opposed lock surfaces of the intermediate lock means **107** a coating of an elastic material of high strength, so that the pressure can be distributed over a greater surface area of the teeth which in this case form the lock surfaces of the pair of outer lock means **104** and **105**. It is also possible, however, to achieve a desired distribution of the pressure by providing the tips of the gear teeth with oppositely beveled end surface portions corresponding to the opposite inclinations of the opposed lock edges of the intermediate lock means **107**.

FIGS. 6 and 7 illustrate another embodiment of a device of the type shown in FIGS. 1–3 where the pair of intermediate lock members are displaced longitudinally of the sickle-shaped space. In this case the outer lock means **204**, in the form of a ring having inner gear teeth, is not fixed to the swingable component **202** for turning movement therewith. Instead the toothed outer ring **204** is fixed to the stationary component **201** while concentrically surrounding the pivot pin carried by the latter. The circular plate **206** of the guide means, which is eccentrically mounted on the pivot pin, also supports the other outer lock means **205** for free rotary movement, this lock means **205** having its outer teeth meshing with the inner teeth of the ring **204**. In this case, however, the plate **206** is fixed to the swingable component **202** for turning movement therewith about the central pivot pin, so that the eccentric plate **206** also swings about the pivot pin and the lock means **205** planetates with respect to the outer lock means **204** which acts as a sun gear. The pair of curved wedge-shaped intermediate lock members **207** and **208** the configurations of which correspond to the portions of the sickle-shaped space in which they are located, respectively, form the intermediate lock means of this embodiment, and their inner wider ends which are directed toward each other are respectively formed with notches which respectively receive the opposed ends of a coil spring **228** which is under compression and which forms a means continuously urging the pair of intermediate lock members away from each other to their locking positions.

In order to displace the intermediate lock members toward each other to their unlocking position, this embodiment is provided, as in the case of FIGS. 1–3, with a cam means including a rotary cam plate **209** formed with camming slots **219** and **220**. The cam means includes the cam-follower pins **207'** and **208'** which are respectively fixed to and extend perpendicularly from the intermediate lock members **207** and **208** and which are respectively received in the camming slots **220** and **219**. As is apparent from FIG. 6, the width of the camming slot **219** is somewhat greater than the diameter of the cam follower pin **208'** while the follower pin **207'** is situated without any appreciable play within the slot **220**. As a result of the play provided for the follower pin **208'**, there is an assurance that even with relatively large manufacturing tolerances the intermediate lock members **207** and **208** will be reliably displaced between their locking and unlocking positions. In order to turn the cam **209** a manually operable means **229** in the form of a hand wheel is coaxially fixed to the plate **209** for rotary movement therewith.

Thus, the embodiment of FIGS. 6 and 7 will operate in the same way as the embodiment of FIGS. 1–3 except that in this case the sickle-shaped space, without changing its configuration, planetates together with the gear **205** and the components situated within the space about the axis of the stationary ring gear **204** during swinging of the component **202**. The hand wheel **229** forms the manually operable means of the embodiment of FIGS. 6 and 7.

FIGS. 8 and 9 illustrate an embodiment of the invention where there is no transmission of movement between the pair of outer lock means. With this embodiment the stationary component **301** forms part of the lower stationary seat portion of an automobile, for example. The swingable component **302** is connected to and forms part of the swingable backrest and is pivotally connected with the stationary component **301** by way of the pivot pin **303**. One of the outer lock means of this embodiment is formed by the segment **304** of a circular ring, this segment **304** being fixed to the swingable component **302** and concentrically extending around the pin **303**. The angular length of the segment **304** corresponds to the desired range of swinging movement of the component **302**. The outer edge surface **304'** of the outer lock means **304** forms the lock surface thereof, and in the illustrated example it is formed with notches, knurling, or the like, so as to have a series of alternating projections and depressions.

The other outer lock means of this embodiment is formed by a ring segment **305** which also forms part of a circular ring. This outer lock means **305** is fixed to the stationary component **301** at such a distance from the pin **303** that an elongated space of predetermined configuration is defined between the lock surface **305'** of the outer lock means **305** and the lock surface **304'** of the outer lock means **304**. The radius of curvature of the lock surface **305'** is greater than and has its center spaced from the center of the radius of curvature of the lock surface **304'**. As a result the lock surfaces **304'** and **305'** are closest to each other at the central region of the lock surface **305'** which is stationary, and the space between the pair of outer lock means becomes gradually wider in opposed directions away from the central region of this space. Thus, in this case also there are oppositely directed tapered gaps, but in the embodiment of FIGS. 8 and 9 these oppositely directed tapered gaps taper toward each other, while in the embodiment of FIGS. 1–3 the oppositely directed tapered gaps taper away from each other. It will be noted also that the oppositely directed tapered gaps are symmetrically arranged with respect to each other. As is apparent from FIG. 8, the angular length of the ring segment **305** is substantially less than that of the ring segment **304**. Furthermore, since the lock surface **304'** extends concentrically about the axis of the pin **303**, the configuration of the space between the pair of outer lock means does not change during swinging of the component **302**.

The intermediate lock means of this embodiment includes a pair of lock members **307** and **308** the configuration of which corresponds to the configuration of the oppositely tapered gaps between the outer lock means **304** and **305**. When the pair of intermediate lock members **307** and **308** are in their locking positions they reliably hold the swingable component **302** in an adjusted angular position with respect to the stationary component **301**. In their locking positions, the identically constructed intermediate lock members **307** and **308** are symmetically positioned with respect to the narrowest central portion of the space between the pair of outer lock means **304** and **305**. The intermediate lock means **307, 308** has opposed outer lock surfaces directed away from each other and pressing against the lock surfaces **304'** and **305'** in the locking position of the intermediate lock means **307, 308**. The inner lock surfaces of the lock members **307** and **308** are knurled, notched, or the like, so as to have projections and depressions meshing with those of the lock surface **304'**. During a tendency of the component **302** to swing in one direction or the other, when the intermediate lock means is in its locking position, there will be a tendency for one of the other of the intermediate lock members **307** and **308** to be displaced toward the center of the space between the pair of outer lock means **304** and **305** so that a wedging action is achieved inasmuch as the intermediate lock members **307** and **308** are substantially rigid bodies,

and in this way swinging movement of the component **302** is prevented.

The pair of intermediate lock members **307** and **308** are connected by suitable transversely extending headed pins with lugs **327** which are fixed to and extend radially from a rotary manually operable shaft **311** which is supported for rotary movement on the stationary component **301**. The free end of the shaft **311** which is nearest to the operator is angularly curved and is provided with a hand grip or knob **312**. When the shaft **311** is turned in a counterclockwise direction, as viewed in FIG. 9, the intermediate lock means **307, 308** is displaced away from its locking position out of the space between the pair of outer lock means **304** and **305** to an unlocking position. When the manually operable means **311** is released, a spring **313** acts to turn the shaft **311** automatically in a clockwise direction, as viewed in FIG. 9, so as to return the intermediate lock means to its locking position. The spring **313** is coiled about the shaft **311** and has its ends respectively connected with the shaft **311** and the component **301** so as to urge the shaft **311** to turn in a clockwise direction, as viewed in FIG. 9.

In order to be able to displace the intermediate lock means **307, 308** away from its locking position even when it is clamped between the pair of outer lock means **304** and **305**, the opposed edges of the intermediate lock members **307** and **308**, which form the lock surfaces thereof, are oppositely beveled, while the lock surfaces **304'** and **305'** are also oppositely beveled so that the space between the pair of outer lock means is transversely tapered and the pair of opposed lock surfaces of the intermediate lock means, which are directed away from each other, provide the intermediate lock means with a corresponding wedge-shaped configuration considered transversely. In this way there is a transverse wedging action in the space between the pair of outer lock means provided for the intermediate lock means **307, 308**. However, as a result of the oppositely beveled lock surfaces it is a simple matter to displace the intermediate lock means **307, 308**, even when tightly clamped between the pair of outer lock means, away from its locking position to an unlocking position where the lock surfaces of the intermediate lock means are respectively spaced from the lock surfaces of the pair of outer lock means.

While with all of the embodiments described above, a structure suitable for angular positioning of the backrest of an automobile seat or the like is provided, so that rotary movement of one component relative to another is illustrated in the drawings and described above, the invention is equally applicable to a component which moves in translation with respect to a stationary component. For example, in the embodiment of FIGS. 6 and 7 where the outer lock means **104** is fixed to the stationary component **201**, it is possible to provide only a segment of the ring **204** with a straight shiftable component which is longitudinally movable across flat ends of the segment to define with the ring segment a space which has the configuration of part of a circle, the space having an outer curved periphery corresponding to the circumference of the circle and a flat straight limiting edge corresponding to achord of the circle. With such a construction the movable component can be moved in translation back and forth along a straight bath while the intermediate lock means would also include a pair of intermediate lock members having configuration corresponding to that of the ends of the space defined between the pair of components and coacting therewith precisely as described above.

It is apparent with the embodiment of FIGS. 8 and 9 when the component **302** tends to turn in a clockwise direction, as viewed in FIG. 8 for example, the intermediate lock member **308** will be radially compressed between the segments **304** and **305** to provide the interlocking type of action, while a tendency of the component **302** to swing in a counterclockwise direction, as viewed in FIG. 8, will provide a substantially radial compression on the intermediate lock member **307** to achieve the interlocking type of action through the lock member **307** in this case.

Thus, with the embodiment of FIGS. 8 and 9 as well as with the other embodiments it is possible to provide a stepless type of adjustment having an infinite number of possible selected positions within the complete range of adjustment while at the same time providing an interlocking action with the lock structure, as distinguished from a pressure type of friction action. It is to be noted that in all embodiments the intermediate lock means is clamped between a pair of outer lock means which is characteristic of the interlocking type of action, as distinguished from a pressure type of frictional coaction where a pair of surfaces press against each other without clamping of one member between a pair of outer members to provide an interlocking type of lock action. Because of this type of locking action achieved with the structure of the invention the force required to move the movable component, when the lock structure is in its unlocking position, is relatively low.

As compared to conventional self-locking types of drives, the device of the invention provides, in addition to its simple construction, the advantage of enabling the selected position to be quickly achieved because the movable component can be very quickly moved through a large distance when the device is in its unlocking position. Such quick adjustment is of particular desirability in connection with many different types of devices such as, for example, the backrest on an automobile seat.

On the other hand, the self-locking action which achieves an even tighter locking pressure when the movable component tends to move in either direction from its adjusted position assures retaining the adjusted component in its adjusted position. However, an intermeshing engagement such as that provided between the lock surfaces **304'** of FIG. 8 and the coacting lock surfaces of the intermediate lock members **307** and **308** is desirable in some cases.

It is to be noted that a pair of separate intermediate lock members is not essential since, as is shown in FIGS. 4 and 5, a single intermediate lock member **107** will suffice in some cases. Also, as is apparent from the embodiments described above, the intermediate lock means can move either longitudinally of the space between the pair of outer lock means or transversely with respect thereto. This latter possibility is particularly available when relatively large areas of engagement are provided between the lock surfaces, and such an arrangement is particularly suitable in the case where a force in the direction of relative movement of the components is present.

As is apparent from FIGS. 6 and 7, it is not essential to have the means which urges the pair of intermediate lock members to their locking positions act on the intermediate lock means through the manually operable means, but instead the means can act directly on the pair of intermediate lock members.

The provision of play between one of the cam follower pins and the cam slot which receives it, as shown in FIG. 6, is also highly desirable to take care of relatively large manufacturing tolerances. Thus, it may happen that due to relatively large tolerances one intermediate lock member has already reached its locking position while the other has not reached its locking position. The play provided with the embodiment of FIG. 6 for the cam follower pin **208'** eliminates this possibility and guarantees that both lock members will be displaced all the way to their locking positions. Of course, instead of such a play it is also possible to provide an elastic structure for the same purpose or to mount the cam **209** in an elastic bearing.

The provision of a pair of cam slots in a single cam plate permits the simultaneous movement of both of the

intermediate lock members to be achieved from a single cam plate.

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.

What is claimed is:

1. In an adjusting device, a pair of components which are to be releasably fixed, at a selected position with respect to each other, and which are movable one relative to the other, a pair of outer lock means respectively carried by said components and respectively having lock surfaces directed toward each other and defining a space of predetermined configuration between themselves, guide means coacting with said pair of outer lock means for guiding at least one of said lock means for movement relative to the other of said lock means without changing the configuration of said space, intermediate lock means having a pair of outer lock surfaces directed away from each other and pressing against said lock surfaces of said pair of said outer lock means when said intermediate lock means is in a locking position in said space, said intermediate lock means when in said locking position thereof having at least an interlocking coaction with said pair of outer lock means, and manually operable means coacting with said intermediate lock means for displacing the latter between said locking position thereof and an unlocking position where said outer lock surfaces of said intermediate lock means are spaced from said lock surfaces of said pair of outer lock means.

2. The combination of claim 1 and wherein said intermediate lock means has a self-locking coaction with said pair of outer lock means, when said intermediate lock means is in said locking position thereof, providing a tighter locking action between all of said lock means when one outer lock means tends to move with respect to the other outer lock means while said intermediate lock means is in said locking position thereof.

3. The combination of claim 1 and wherein at least one of said lock surfaces of one of said outer lock means has depressions and projections while the lock surface of said intermediate lock means which coacts therewith has intermeshing depressions and projections.

4. The combination of claim 3 and wherein said depressions and projections are in the form of knurling.

5. The combination of claim 1 and wherein said pair of outer lock means each have a pair of lock surface portions spaced from each other with one of said pair of lock surface portions of one of said outer lock means respectively directed toward the other of said pair of lock surface portions of the other outer lock means and defining a pair of spaced gaps therewith, said intermediate lock means including a pair of intermediate lock members respectively situated in said gaps in engagement with said lock surface portions when said intermediate locks means is in said locking position thereof.

6. The combination of claim 5 and wherein each of said spaced gaps tapers.

7. The combination of claim 6 and wherein said gaps respectively become gradually narrower in opposed directions.

8. The combination of claim 6 and wherein said intermediate lock members are respectively movable longitudinally along said gaps.

9. The combination of claim 6 and wherein said intermediate lock members are respectively movable transversely with respect to said gap.

10. The combination of claim 6 and wherein said pair of outer lock means respectively have a common turning axis while said lock surfaces thereof are curved and have different radii and centers of curvature.

11. The combination of claim 6 and wherein said outer lock means are movable in translation one with respect to the other.

12. The combination of claim 9 and wherein each pair of opposed lock surfaces of said pair of outer lock means which are directed toward each other are oppositely beveled to provide said gaps with a transversely tapering configuration, and said intermediate lock means having its outer locking surfaces also oppositely beveled so as to have a transverse wedging engagement with respect to said lock surfaces of said pair of outer lock means.

13. The combination of claim 6 and wherein said pair of outer lock means include an outer ring having inner teeth and an inner gear having outer teeth meshing with said inner teeth so that said outer ring and inner gear coact with each other in the manner of a sun wheel and planetary gear, respectively, the tips of the teeth of said ring and gear forming the lock surfaces of said pair of outer lock means, and the center of said inner gear being displaced from the center of said ring so that the teeth of said outer ring and inner gear, where they do not engage each other, define between themselves a curved space which gradually tapers toward its opposite ends to form said gaps and which is of a substantially sickle-shaped configuration.

14. The combination of claim 13 and wherein said intermediate lock means is of a curved wedge-shaped configuration conforming to the configuration of said space.

15. The combination of claim 13 and wherein the outer ring with the inner teeth is connected with that one of the components which moves with respect to the other component and is guided by said guide means for turning movement about its center, while the inner gear is eccentrically situated with respect to the ring and is supported by said guide means for rotary movement about a stationary axis, said other component supporting said guide means and said guide means having a stationary circular plate around which said inner gear is freely turnable, and said other component carrying a cam means which coacts with said intermediate lock means for displacing the latter between said locking and unlocking positions thereof.

16. The combination of claim 15 and wherein said intermediate lock means includes a pair of curved elongated wedge members respectively situated in gaps of said space and said cam means having a pair of camming portions respectively coacting with said curved wedge members for moving them equally and oppositely.

17. The combination of claim 16 and wherein an urging means coacts with said pair of curved wedge members for urging them apart from each other longitudinally of said gaps into locking positions, and said cam means having a substantial play with respect to at least one of said wedge members.

18. The combination of claim 15 and wherein said pair of wedge members respectively have pins projecting therefrom while said cam means is formed with camming slots which respectively receive said pins.

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