June 6, 1972 HIDEAKI YASUI ET AL 3,667,804

SEAT RECLINER

Filed May 27, 1970 2 Sheets-Sheet 1

Fig. 1.

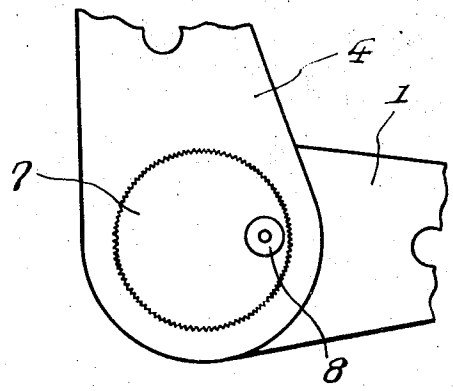

Fig. 2.

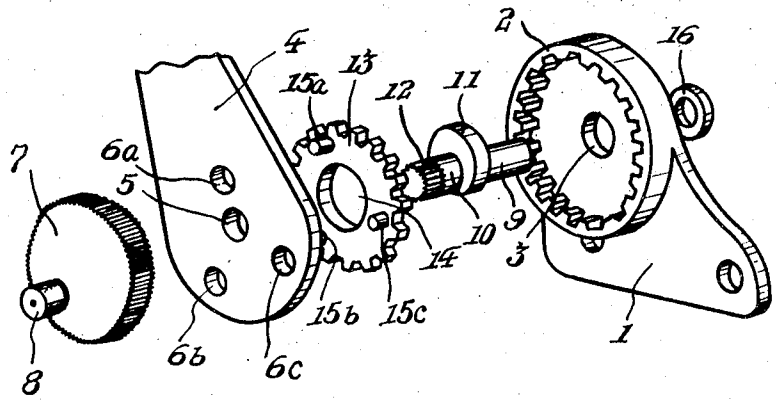

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Fig. 3

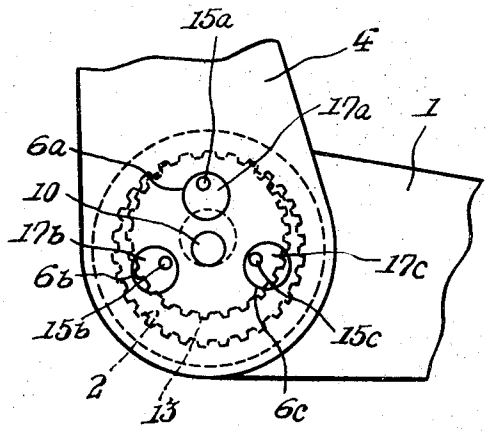


Fig. 4

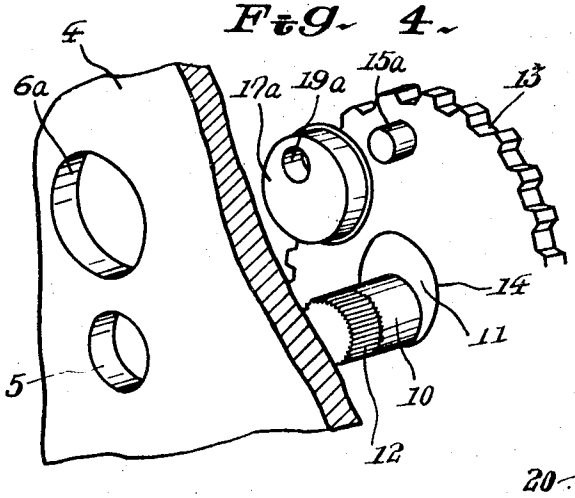
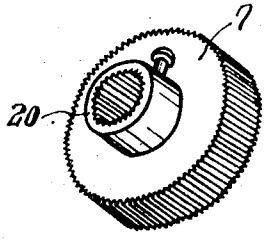


Fig. 5



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United States Patent Office 3,667,804
Patented June 6, 1972

3,667,804

SEAT RECLINER

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Filed May 27, 1970, Ser. No. 40,871
Claims priority, application Japan, June 25 ,1969, 44/59,553
Int. Cl. A47c *1/024*
U.S. Cl. 297—362 1 Claim

ABSTRACT OF THE DISCLOSURE

This invention relates to a seat recliner for controlling an angle of reclination of a back-rest of a seat, which is characterized, among others, by the facts that no controlling spring is used as in the conventional devices, and that a shock absorber is incorporated so as to prevent propagation of vibrations produced in the chassis floor to the back-rest, and in which an internal gear is carried on a base arm fixed to a seat and several round holes are formed in a back arm fixed to the back-rest, with a resilient packing being rotatably fitted into each of said holes, and an external gear with teeth less in number than said internal gear is coupled to and supported by said resilient packings through swingable pins. Said external gear is meshed with said internal gear, and in the center hole of said external gear is fitted a cam provided on a cam shaft, the latter carrying at its end a grip. In accordance with rotation of said grip, the external gear is also rotated in meshed relation with the internal gear through the cam, and in response to this rotating motion of the external gear, said swingable pins are swung along a constant locus within the respective round holes through the resilient packings to thereby transmit the movement of said external gear to the back arm, so as to impart an inclination to the back arm corresponding to the gear ratio between the internal gear and the external gear.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side view of a seat recliner of the present invention showing a grip side; FIG. 2 is a perspective view of the seat recliner in an exploded manner to show the component parts of its construction; FIG. 3 is a side view similar to FIG. 1, but the grip portion being taken away from a cam shaft; FIG. 4 is a perspective view of external thread gear-swinging means consisting of a swingable pin shaft of the external thread gear, its locus hole and a resilient packing material; and FIG. 5 is a perspective view of the grip portion as seen from its back side.

DETAILED DESCRIPTION OF THE INVENTION

This invention relates to improvements in a seat recliner for controlling an angle of reclination in a desired position of a seat in automobiles, railway vehicles and the like.

The seat recliner of the known type generally has teeth on its back arms threaded in three or four steps in predetermined angles, pawls engaging with said teeth at an operative lever end, in which a back-rest of the seat is urged to have a normal angle by spring. Accordingly, the seat recliner of the conventional structure provides the control of an angle of reclination afforded through operation of the lever for release of a pawl from engagement with the teeth on the back arm, with the back-rest being inclined contrary to the urging force of spring, by engagement of the pawl to teeth threaded in several steps at angles as predetermined, whereby the back-rest of the reclining seat can be set up at an inclined position. In the conventional type of the seat recliner as described,

the drawbacks have been encountered as follows. The back-rest should be applied a force in the direction of inclination resisting to the force of spring which acts to return the back-rest always to its normal angular position. The back-rest also cannot be inclined at a position of small angle between pitches of teeth except in fixed angles as provided by the number of teeth meshing with the pawl of the lever. Usually the lever can recover the back-rest from an inclined position to normal position by releasing the pawl out of the teeth. Then the back rest is rapidly brought into its normal position by the action the spring, resulting in the shock and impulsive sounds producing quite uncomfortableness. The differential gearing of the internal and external gears in the prior art has also a drawback of causing vibration when the back-rest is adjusted of its angle.

The present invention provides a seat recliner which affords improvements over such conventional devices.

A feature of the present invention resides in the provision of a seat recliner in use of a grip instead of a spring for the recovery of the back-rest from an inclined position to its normal position, which grip is adapted to resolve so as incline or restore the back-rest to the initial position with a quiet, swift, and very pleasant movement.

Other feature of the invention is to provide a seat recliner which permits very fine control of the back-rest. Here, the back-rest can be set up in position at a preferred angle of inclination by rotary operation of the grip.

Still other feature of the invention is to provide a seat recliner in which the back-rest can be controlled free from vibration and the resonance transmitted to the back-rest from the vehicle floor can well be damped to retain a pleasant seat condition.

According to the invention having such features as described, the construction of the device will now be described.

There is provided a base arm fixed to a seat in the vehicle. The arm has an internal gear. An external gear is provided at a back arm fixed to the back-rest through a swinging pins. The external gear has teeth less in number than the internal gear. Said external gear is in mesh with said internal gear. In the center hole of the external gear is fitted a cam provided on a cam shaft. By rotation of the grip attached at the end of the cam shaft the rotary movement of the external gear meshing with the internal gear is transmitted to the back arm through the swinging pins so as to impart an inclination to the back arm corresponding to the ratio of threaded teeth of the internal gear and the external gear.

The swinging pins connect the external gear to the back arm through a resilient packing fitted into a round hole provided in the back arm. Said swinging pins are provided to swing along a constant locus within the round hole corresponding to the swing movement of the external gear through the cam.

Particulars of the seat recliner according to the invention will now be described with reference to the accompanying drawings.

In the drawings, reference numeral **1** denotes a base arm fixed at the seat side. The base arm is provided with an internal gear **2**, having at the center thereof a support hole **3** for a cam shaft. Numeral **4** designates a back arm fixed to a back-rest, which is also provided with a support hole **5** to journal the cam shaft. There are provided three round holes **6***a*, **6***b*, **6***c* spaced at equal intervals along a circumferential locus around the support hole **5**. These holes are fitted with resilient packings **17***a*, **17***b*, **17***c* made of, for example, rubber, synthetic resin or the like. Numeral **13** designates an external gear which is formed with teeth less in number than those of the internal gear **2**.

At the thrust surface of the external gear **13** against the back-rest **4** are provided three swinging pins **15***a*, **15***b*, **15***c* with equal angular distances. These are located eccentrically relative to the round holes **6***a*, **6***b*, **6***c* provided on the back-rest. The swinging pins **15***a*, **15***b*, **15***c* are fitted to small holes **19***a*, **19***b*, **19***c* eccentrically provided of the resilient packings fitted to the above-described round holes **6***a*, **6***b*, **6***c* and the external gear **13** is attached to the back arm **4**.

Numeral **11** denotes a cam which is integrally formed on a cam shaft **9** or **10** provided eccentrically therewith. The cam **11** is loosely and rotatably fitted to a center hole **14** of the external gear **13**. On side **9** of the cam shaft is loosely carried in the support hole **3** provided on the base arm **1**, the end of which is caulked with a ring washer **16** fitted thereto. Another side **10** of the cam shaft is loosely carried in a support hole **5** provided at the back arm **4**. The external gear **13** is rotated with a portion of teeth meshed with the internal gear **2** by the above-mentioned cam **11**. The rotation of the external gear **13** is carried out in the amount of eccentric displacement of the cam **11** produced in the course in which the serration **12** at the end of the cam shaft **10** is operatingly connected to a central serration cylinder **20** of a grip **7** and the cam shaft **9** or **10** is rotated by rotation of the grip **7**. The grip **7** has a roller tip **8** at an eccentric position. The roller tip can be held to rotate the grip **7** if a rapid control is necessitated so as to obtain a swift and light operation.

In operation, the grip **7** may be rotated. Then the external gear **13** through the cam shaft **9** or **10** and cam **11** makes swing movement and, meshing with the internal gear **2**, rotates. With the rotation of the external gear **13** the resilient packings **17***a*, **17***b*, **17***c* fitted into round holes **6***a*, **6***b*, **6***c* of the back arm **4** rotate with the swinging pins **15***a*, **15***b*, **15***c* in the round holes **6***a*, **6***b*, **6***c* and impart an inclination angle to the back arm **4**. For instance, assume that the number of teeth of the external gear **3** is A and the number of teeth of the internal gear **2** B, then the inclination angle of the external gear **13** relative to the internal gear **2** may be expressed by the

$$\frac{A-B}{B}$$

rotation for one rotation of the grip **7**. Normally in ordinary differential gear mechanisms, the difference in the number of teeth of the internal and external gears is given in one tooth to obtain the higher yield strength against the torque and, consequently, the control speed of operation is too small so as to make difficult to adjust the back-rest through a large angle very speedily.

In accordance with the present invention, the eccentric wedge action of the resilient packings **17***a*, **17***b*, **17***c* may be most effectively used with large difference in the number of teeth between the external gear **13** and the internal gear **2**, wherein for instance the number of teeth of the external gear **13** may be 30 teeth and the number of teeth of the internal gear **2** 26 teeth, the difference of the teeth thus being 4 in the number. As a result, the angle of the back arm **4** with the base arm **1** in one rotation of the grip **7** can be displaced through about 56°. There may be obtained a stable control in the forward and rearward directions as well as fine control as desired. The external force from the back-rest can be set off by the eccentric wedge action of the packings **17***a*, **17***b*, **17***c* without movement of the back rest but surely in locked condition at a fixed position.

With the simple construction as heretofore described, the seat recliner of the invention provides a rapid and sure control of the inclination angle of the back-rest through rotation of the grip at a preferred angle in an infinite manner. The resilient packings serve to dampen the vibration and secure quiet and smooth control of the inclination angle consequent on a cheap and practical seat recliner.

We claim:

1. A seat back-rest recliner comprising a base arm connected to the seat, a back arm connected to the back-rest, said base arm being provided with an internal gear and a central opening, said back arm being provided with a plurality of round holes arranged on a circumferential locus around a supporting hole, resilient packings each being positioned in one of said round holes, an external gear meshing with said internal gear, but having a different number of teeth than said internal gear and having a central opening, pins projecting from said external gear and fitting eccentrically in said resilient packings, a cam shaft rotatably supported through said base arm central opening and said back arm supporting hole, a cam fixedly mounted on said cam shaft and rotatably positioned in said external gear central opening, means for rotating said cam shaft whereby said cam shaft can be rotated causing said external gear to swingingly rotate relative to said internal gear by the amount of eccentric displacement of said cam and said swinging rotation being transmitted to said back arm through said swinging pins so as to impart an inclination to said back arm by the difference in the number of teeth of said internal gear and said external gear.

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U.S. Cl. X.R.

297—366