DEVICE FOR VARYING THE VERTICAL SEPARATION AND THE RELATIVE LONGITUDINAL INCLINATION OF THE SITTING SURFACES OF SEATS

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The following statement is a full description of this invention, including the best method of performing it known to us:
The invention relates to a device for varying the vertical separation and relative inclination of two plate members, and may form a device for adjusting the sitting surface of seats in automotive vehicles.

In the known devices a purely vertical adjustment of the position of the sitting surface requires that two adjustment elements be manipulated simultaneously and to the same extent. Smooth adjustment of both adjustment elements therefore demands some care if a longitudinal tilt once set is not to be altered while the vertical position of the sitting surface is adjusted. A more serious drawback in the case of vehicle seats is that vertical adjustment of the sitting surface can only be carried out when the vehicle is stationary since the driver needs both hands to operate the adjusting mechanism.

According to the present invention I provide a device for varying the vertical separation and relative inclination of two plate members, comprising two such plate members, tandem pairs of levers pivotally interconnecting said plate members, adjustment means connecting the pivotal levers of one said tandem pair and attachment means attaching said adjustment means to one of said plate members, said adjustment means comprising a mechanism for effecting (a) relative closure and separation of the points of connection of the levers and adjustment means, and (b) in combination with said attachment means, pivoting of the levers of said tandem pair relative to the plate members whilst maintaining a fixed separation between the points of connection of the levers and adjustment means.
When such a device is installed for adjusting vehicle seats the driver can readily vary the vertical position of his seat with the use of one hand while the vehicle is moving.
The synchronous pivoting of the pivotal levers provided by the invention for the purpose of altering the inclination has the advantage that the desired change in inclination may be effected much more rapidly than with the known adjustment devices.

There exists a number of possibilities of realising the concept of the invention. In one particularly advantageous embodiment it is contemplated that the adjustment means be a threaded spindle connected to the lower end of one of the pivotal levers of the pair via a lefthand thread and to that of the other pivotal lever of the pair via a righthand thread, that the threaded spindle be supported, via the internal thread of a threaded sleeve so as to be rotatable but adjustably axially with respect to one of the two plate members, the threaded sleeve being selectively rotatable together with or separately from the threaded spindle. This embodiment has the special advantage that virtually only a single adjustment element is present for adjusting both the vertical position and the inclination.

In a second embodiment of the device according to the invention a pressure cylinder supported, preferably between the pivotal levers and one of the plates is provided as adjustment means, the cylinder possessing two piston rods adapted to be driven in opposite directions and acting on the pivotal levers, preferably at the lower ends thereof. By actuating the pistons in one or the other opposite sense the pivotal levers are oppositely pivoted relative to one another and the vertical position of the sitting surface is thereby altered.

In order that the invention may be better understood the
following description is given of one preferred embodiment of the invention reference being made to the accompanying drawings in which:-

Figure 1 is a schematic illustration, in perspective, of one embodiment of the invention; and

Figure 2 is a partial longitudinal section taken along line II-II of Figure 1.

Figure 1 shows only the essential elements of a device according to the invention and which may be used for adjusting the vertical position and the longitudinal inclination of the seat in an automotive vehicle. Most of those parts which are not essential for the invention, such as sitting surface, back rest and details of the support in the vehicle, have been omitted though a pivotal linkage 1 to a securing framework 2 of the automotive vehicle is indicated in dot-dash lines, the linkage 1 containing the necessary springing and shock absorbing elements.

To the pivotal linkage 1 there is connected a base plate 3 above which a plate 4 is disposed by way of sitting surface carrier. To this plate 4 a seat dish or the like containing the seat cushioning is attached in a manner not shown. The longitudinal sides of the plate 4 are at a downward angle. At the rearward end of the device in each of these angle sections there is a slot 5 which extends parallel to the surface of the plate, while registering apertures 6 are present in the front ends. The connection between the plate 4 and the base plate 3 is established by means of a total of four pivotal levers 8, the two shown in the foreground in Figure 1 being in the form of bellcranks pivotally mounted at their elbows, by means of bearing pins.
7 or the like, to a longitudinal surface of the base plate 3. The background pivotal levers 8, located oppositely to those in the foreground in Figure 1, are rigidly connected thereto via tubular axles 9.

The upper end of each of the two pivotal levers at the rear (left hand end as viewed in Figure 1) of the device is articulated to a slide member 11 via a bearing pin 10, the slide member 11 being secured in the slot 5 so as to be longitudinally movable therein. The upper end of the forward pivotal levers 8 on the other hand is journalled by means of a pin connection 12, in the apertures 6 of the angle sections. While the lower ends of the background pivotal levers 8 are merely articulatedly coupled to the base plate 3 in the axial line of the bearing pins 7, the lower ends of the bellcranks 8 carry transverse shafts 13 which are rotatably journalled in U-shaped trunnion portions of the bellcranks 8. The transverse shafts 13 have registering cross bores provided with threads into which a threaded spindle 14 is screwed. The rearward end of the threaded spindle 14 carries a lefthand thread 15 for example while substantially the front half of the threaded spindle is provided with a righthand thread 16. A bracket 17 is welded to the front end of the base plate 3 and contains a mounting orifice 18 (Figure 2) registering with the cross headed bores of the transverse shafts 13. A hexagonally threaded sleeve 19 is rotatably mounted in this mounting orifice 18. To this end the threaded sleeve 19 is reduced to a little less than the diameter of the mounting orifice 18 and car-
ries an external thread in the end region of the reduced portion. At either side of the facial rims of the mounting bore 18 a respective washer 20 of bearing metal, brass or the like is fitted on the reduced portion of the threaded sleeve 19 and this mounting is set and fixed by means of a nut 21.
The threaded sleeve 19 further has an internal thread into which the righthand thread 16 of the threaded spindle 14 threadedly engages to such an extent that the leading spindle end projects somewhat beyond the threaded sleeve 19. A hexagonal nut 22 is positioned on this spindle end and secured by means of a cross pin 23. A spacer sleeve 24 is located between the front end of the threaded sleeve 19 and the hexagonal nut 22.

A control grip or rotatable handle 25 having a hexagonal bore 26 is mounted on the front end of the threaded sleeve 19 for axial displacement thereon. Between the end of the sleeve and an internal flange 27 formed in the hexagonal bore 26 there is supported a prestressed compression spring 28 which urges the control grip 25 towards the right, as seen in Figure 2, and thus urges the internal flange 27 to contact the hexagonal nut 22. In this position the hexagonally faceted nut 22 is situated interiorly of the hexagonal bore 26. Adjoining the portion of the hexagonal bore 26 which is occupied by the nut 22 the internal space of the control grip 25 widens to form a cylindrical bore 29 the diameter whereof is larger than the circle containing the corners of the hexagonal bore 26.

The device according to the invention is operated as follows. When only the vertical position of the plate 4 and thus of the not illustrated sitting surface is to be parallely adjusted, then the control grip 25 is turned while in the position shown in Figure 2. Since the hexagonal bore 26 is in positive engagement with both the outer surface of the threaded sleeve 19 and the nut 22, they are both turned simultaneously, so that no relative rotation takes place.
between the righthand thread 16 and the internal thread of
the threaded sleeve 19. Since the bellcranks 8 are of
mutually symmetric design and arranged at the base plate 3,
their lower ends will be moved towards one another or away
from each other dependent on the direction of rotation of
grip 25 as a result of the effect of the lefthand thread
15 and the righthand thread 16. The resulting pivoting of
the pivotal levers 8 leads to a vertical adjustment of the
plate 4, the slide member 11 sliding in the slot 5 of the
angle section.

If an alteration of the inclination of the plate 4 is
to be carried out, then the control grip 25 is axially urged
toward the rear, counter to the action of the compression
spring 28, until the nut 22 disengages from the hexagonal
bore 26. When now the control grip 25 is rotated while in
this displaced position, then only the threaded sleeve 19
rotates in the mounting bore 18 of the bracket 17. The
threaded spindle 14 does not turn but as a result of the
meshing of the internal threads of sleeve 19 and the threads
16 on the spindle, the spindle is urged axially through the
orifice 18. The bellcranks 8 are thereby pivoted forward
or rearward without the mutual distance of their lower ends
changing and the longitudinal inclination of the plate is
thus altered, as is indicated in phantom in Figure 1.

In accordance with a further desirable embodiment of
the invention the adjustment means is again a threaded
spindle connected via a lefthand thread to the lower end of
one pivotal lever and via a righthand thread to that of the
other pivotal lever. In this embodiment however the threaded
spindle is rotatably but axially immovably mounted in attach-
The attachment means of the base plate and the attachment means in turn is adjustable to vary the axial position of the spindle along a guidance of the base plate. The attachment means may be an externally threaded sleeve which is screwed into a bracket of the base plate, a rotatable handle or control grip being provided which can be selectively brought into rotational connection with the threaded spindle or with the threaded sleeve. When the rotatable handle, which may be mounted in a manner similar to that described for the above embodiment, is held in one position, then it is only linked to the threaded spindle. When the handle is turned, then the threaded spindle rotates in the threaded sleeve without moving longitudinally and thus shifts the lower ends of the pivotal levers in opposite sense. Upon turning with the rotatable handle in the other position the threaded sleeve moves relative to the bracket without the threaded spindle rotating and thus displaces the threaded spindle in one or the other direction, dependent on the direction of turning. The lower ends of the pivotal levers are thereby synchronously entrained.

The structural design of this last-mentioned embodiment of the device, which is not illustrated, resembles the illustrated embodiment as to the manner of arrangement of the control grip. But the threaded sleeve of this last-mentioned embodiment has no internal thread and merely serves as radial and axial bearing for the threaded spindle. The axial mounting may be effected by suitable flanges or rings inserted in annular grooves and supported at the end faces of the threaded sleeve. The threaded sleeve, the forward region whereof may also be hexagonally faceted for accommodation of the control grip, on the other hand has an
external thread whereby the sleeve can be threadedly engaged in a corresponding threaded bore of the bracket secured to the base plate. The dimensions of the control grip are so chosen that the hexagonal bore of the grip is in engagement only with the threaded sleeve in one terminal position and only with the hexagonal nut of the threaded spindle in the other terminal position. Thus, when the control grip is turned in that condition in which it is positively engaged with the hexagonal nut, then only the threaded spindle is rotated and pivots the bellcranks relative to each other. Because the threaded sleeve remains stationary the spindle is prevented from moving axially. When on the other hand the control grip is turned when in a position in which it is only in engagement with the threaded sleeve, then the threaded sleeve only will be rotated and thus screws through the threaded bore of the bracket. The threaded spindle is thus entrained via the axial mounting at the threaded sleeve so that the bellcranks pivot synchronously.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A device for varying the vertical separation and relative inclination of two plate members, comprising two such plate members, tandem pairs of levers pivotally interconnecting said plate members, adjustment means connecting the pivotal levers of one said tandem pair and attachment means attaching said adjustment means to one of said plate members, said adjustment means comprising a mechanism for effecting (a) relative closure and separation of the points of connection of the levers and adjustment means, and (b) in combination with said attachment means, pivoting of the levers of said tandem pair relative to the plate members whilst maintaining a fixed separation between the points of connection of the levers and adjustment means.

2. A device according to claim 1, wherein the pivotal levers are pivoted to fixed points on the first of said plate members, one lever in each pair being in addition pivoted at a fixed location on the other said plate member, and the other lever of each pair being provided with an engagement member which slides within a slot provided in the said other plate member.

3. A device according to claim 1 or 2 wherein each said pivotal lever is in the form of a bell crank pivoted at its elbow to the first plate member and being operatively connected by means of one of its arms to the other plate member.
4. A device according to claim 1, 2 or 3 wherein the adjustment means comprises a spindle having formed thereon first and second axially spaced threaded portions, a first of said threaded portions having a left-hand thread and the second thread having a right-hand thread, and wherein threaded orifices are provided in conjunction with the lever of said pair to co-operate with the said threaded portions of the spindle, so that rotation of the spindle will vary the mutual separation of the two threaded orifices.

5. A device according to claim 3 and claim 4, wherein the spindle interconnects the other arms of the bell cranks of said pair.

6. A device according to any one of the preceding claims, and including a shaft attached to the two levers of said pair with a fixed length of bar therebetween, and wherein said adjustment means includes a shaft securing arrangement associated with the attachment means and co-operable with the shaft for regulating the axial position of the shaft with respect to the first plate member.

7. A device according to claim 6, and either claim 4 or claim 5, wherein the shaft is constituted by the spindle.

8. A device according to claim 7 wherein said attachment means is provided with an orifice through which one of the threaded portions of the shaft passes, and the shaft securing arrangement comprises a lock-nut assembly co-operable with the one said threaded portion, and further including means for rotating the lock-nut assembly firstly in register with said shaft and secondly independently of said shaft.
9. A device according to claim 8, wherein said lock-nut assembly comprises an internally threaded sleeve mating with the one said threaded portion of the shaft and having a first externally threaded end portion dimensioned to pass through the orifice in said attachment means and a second externally faceted annular end portion dimensioned not to pass through the said orifice, said sleeve being threaded onto the shaft such that the length of said one threaded portion thereof projects entirely through said sleeve, and said lock-nut assembly further including a nut engageable on the externally threaded portion of the sleeve on that side of the attachment means remote from the faceted portion of the sleeve to secure the sleeve axially with respect to the attachment means.

10. A device according to claim 9, wherein said lock-nut assembly and the means for effecting rotation thereof are located at one end of said threaded shaft.

11. A device according to claim 9 or 10, and including a bolt head portion rigidly secured to the length of the threaded portion of the shaft projecting through the threaded sleeve and wherein the means for rotating the lock-nut assembly comprises a handle displaceable between the first position in which it engages both the faceted portion of the lock-nut and the bolt portion of the shaft so as to permit simultaneous rotation of said sleeve and said shaft, and a second position in which it engages with the faceted portion of the lock-nut alone so as to permit rotation of the sleeve relative to the shaft.
12. A device according to claim 11, and including a spring biasing said handle to said first position.

13. A device according to claim 7, wherein said attachment means is provided with a threaded orifice and wherein said shaft securing arrangement comprises an externally threaded sleeve disposed about said shaft so as to be freely rotatable thereabout but axially secured with respect thereto and to be engageable within said threaded orifice of the attachment means.

14. A device according to claim 13, and including means for rotating firstly said externally threaded sleeve independently of said shaft and secondly said shaft independently of said externally threaded sleeve.

15. A device according to any one of claims 1 to 3, wherein the adjustment means comprises a double-acting piston and cylinder arrangement supported by said attachment means adjacent one of said plate members and having two pistons with associated piston rods drivable in opposition to one another and connected to respective ones of said pair of levers, such that selective operation of said pistons will effect variation in both the vertical separation and relative inclination of the two plate members.

16. An adjustable seat, particularly for use in vehicles comprising a device according to any one of the preceding claims and wherein the first plate member constitutes a base, and the other of said plate members is provided with a seating surface, the device serving to vary the elevation and inclination of the seating surface relative to the base plate.
17. A device for varying the vertical separation and relative inclination of two plate members such device being substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

18. A seat incorporating the device of claim 17, for varying the elevation and inclination of the seating surface.