Abstract: A seat-belt arrangement is disclosed which includes a seat-belt (2) which initially extends from a lower position (1) to an upper position (4) adjacent to the side of the vehicle seat (10). The seat-belt arrangement also incorporates a mechanism which is responsive to the seat being occupied by an occupant to move at least the lower part of the seat-belt (2) forwardly relative to the seat (10).
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
"A SEAT-BELT ARRANGEMENT"

THE PRESENT INVENTION relates to a seat-belt arrangement and more particularly relates to a seat-belt arrangement intended for use in a motor vehicle such as a motor car.

The three point seat-belt is now a common feature in a motor vehicle such as a motor car. The seat-belt, when in use, incorporates a lap strap which extends across the lap of the seat occupant and a diagonal strap which extends diagonally across the chest or torso of the occupant. Typically the seat belt, before being put on by a seat occupant, presents a strap portion which extends substantially vertically from a point adjacent the floor of the vehicle to a pillar loop mounted at or above shoulder height on a post of the vehicle or on part of the seat itself, part of the seat-belt then extending to a retractor mechanism. When the seat belt is to be applied, a tongue which is slideably mounted on the seat belt is grasped by the occupant, and is moved across the body of the occupant to be engaged with a buckle which is mounted, to receive the tongue, either on the seat itself or on the floor of the vehicle adjacent the seat.

The initial movement of the occupant, in putting on the seat-belt, therefore, is to grasp the tongue, which is located on a portion of a seat-belt which extends substantially vertically adjacent the seat occupant from the floor
to the pillar loop adjuster. Because of the desired geometry of the seat-belt, when in use, this part of the seat-belt is located adjacent a rear part of the seat, almost in alignment with the spine of the seat occupant. Typically the seat-belt is grasped, by the occupant, using the hand which is "inboard" the vehicle, that is to say the hand which is initially furthest from the seat-belt.

An increasing proportion of the population are now overweight or obese. It is often very difficult for an overweight or obese person actually to move the "outboard" hand across their torso and then back to a position almost in alignment with their spine. Consequently there is a temptation for such people not to wear a seat-belt.

The present invention seeks to provide an improved seat-belt arrangement.

According to the present invention, there is provided a seat belt arrangement, the seat belt arrangement including a seat belt which initially extends from a lower position to an upper position adjacent the side of a vehicle seat, the seat belt arrangement incorporating a mechanism responsive to the seat being occupied by an occupant to move at least the lower part of the seat belt forwardly relative to the seat.

Preferably an elongate element is provided which extends across the seat, one end of the elongate element being anchored to the side and the other end extending from the seat, the elongate element being configured to be partly drawn into the seat when the seat is occupied by an occupant, the elongate element being connected to the said mechanism.
Advantageously wherein the mechanism comprises a substantially rigid sleeve surrounding part of the seat-belt, the sleeve being mounted for pivotal movement in response to the elongate element being drawn into the squab of the seat.

Alternatively, the mechanism comprises a substantially rigid element connected to the seat-belt, the substantially rigid element is mounted for pivotal movement in response to the elongate element being drawn into the squab of the seat.

Conveniently a sensor is provided responsive to the weight of the seat occupant, the sensor being configured to actuate the said mechanism.

Preferably the mechanism incorporates a substantially rigid sleeve surrounding at least the lower part of the seat-belt, and a mechanism incorporating an electric motor actuated by the sensor, actuation of the motor causing pivoting of the sleeve to move said part of the seat-belt forwardly.

Alternatively, the mechanism incorporates a substantially rigid element connected to the seat-belt, and a mechanism incorporating an electric motor actuated by the sensor, actuation of the motor causing pivoting of the substantially rigid element to move part of the seat-belt forwardly.

Preferably, said substantially rigid element is pivotally connected to the seat-belt.

Advantageously, said substantially rigid element is telescopic.
Advantageously the motor drives a pinion which engages a rack associated with the sleeve.

Conveniently said mechanism is configured to move said part of the seat belt forwardly in response to the seat being occupied by an occupant exceeding a predetermined weight.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic view of the principle parts of a seat-belt arrangement in accordance with the invention;

FIGURE 2 is a view of part of the squab of a vehicle seat;

FIGURE 3 is a view corresponding to Figure 2 showing the seat when occupied by a heavy occupant;

FIGURE 4 is a diagrammatic view illustrating part of one embodiment of the invention;

FIGURE 5 is a diagrammatic view illustrating an alternative embodiment of the invention;

FIGURE 6 is a diagrammatic view similar to that of Figure 4, but illustrating another alternative of the invention; and
FIGURE 7 is a diagrammatic view corresponding generally to that of Figure 6 illustrating a further variant of the invention.

Referring initially to Figure 1 of the accompanying drawings, some of the main components of a three point seat belt are illustrated. Figure 1 shows a lower anchoring point 1 mounted in position adjacent the floor of a motor vehicle. Extending upwardly from the lower anchoring point 1 is a seat belt 2. Mounted on the seat belt 2, for sliding movement along the seat belt, is a tongue 3. The seat belt 2 extends upwardly to a pillar loop 4. The seat belt passes slidingly through the pillar loop and then extends to a retractor mechanism 5. The seat belt, as thus far described, is conventional and is intended to be mounted in position with the anchoring point 1 and the pillar loop 4 being located substantially in alignment with the backrest of a seat.

As will become clear, from the following description, in embodiments of the invention a mechanism is provided which, when actuated, serves to move the lowermost part of the seat belt 2, that is to say the part just above the anchoring point 1, in a forward direction as indicated by the arrow 6. The forward movement may be as much as 300 mm. It is envisaged that if the lowermost part of the seat belt is moved forwardly in this way when the associated seat is occupied by an occupant, particularly one who is overweight or obese, it will facilitate the use of the seat belt by such an occupant.

The forward movement may, as will be described, be effected in many different ways.

Referring now to Figure 2 of the accompanying drawings, part of a vehicle seat 10 is illustrated. Figure 2 illustrates the lower part of the backrest 11 of a seat and shows, in section, part of the squab 12 of the seat. A belt or
strap 13 passes through the squab 12 extending from an anchoring point 14 on one side of the seat through a slot or channel formed in the upholstery of the seat, the strap 13 emerging from the far side of the seat.

As will be understood by considering Figure 3, should a person, especially an overweight or obese person, sit on the seat, the upholstery of the squab 12 will be deflected downwardly or sag. As a consequence, part of the belt 13 will be drawn into the squab 12 of the seat, as the length of the belt 13 will not increase.

Figure 4 illustrates, again, the squab 12 of the seat, showing the squab from the side and also showing the strap 13 emerging from the squab 12 of the seat. The strap 13 is connected to a wire or cable 14 which passes around a pulley 15, with the wire or cable 14 then extending substantially horizontally adjacent to the side of the seat 2.

The wire or cable 14 is connected to a rigid sleeve 16. The rigid sleeve 16 is pivotally connected to an anchor point 17 at the lower end of sleeve and the lower part of the seat-belt 2 passes through the rigid sleeve 16, also being connected to the anchor point 17.

It is to be understood, therefore, that when a heavy or obese person sits on the seat of Figure 2, the strap 13 will be drawn into the squab 12 of the seat as shown in Figure 3 thus applying a tension to the cable 14, which will, in turn tend to cause the sleeve 16 to rotate, as shown by the arrow 18, about the anchoring point 17. This will cause the lowermost part of the seat belt 2 to move forwardly so that the seat belt 2 will have a configuration generally as shown in phantom in Figure 1.
Figure 5 illustrates an alternative embodiment of the invention. In the embodiment of Figure 5 the squab 12 of the seat is provided with a sensor 20. The sensor 20 is responsive to the weight of the seat occupant. The sensor 20 is adapted to control an electric motor 21 when the sensor 20 detects the presence in the seat of an occupant exceeding a predetermined weight. The motor 21 drives a toothed wheel 22 which engages a toothed rack 23 mounted on a sleeve 16, corresponding to the sleeve 16 described above. The sleeve 16 and the associated lower part of the seat belt 2 will therefore pivot when the electric motor is energised in response to an actuation signal from the sensor 20, as indicated by the arrow 18, about the anchoring point 17 again moving the seat-belt to the configuration shown in Figure 1.

It is to be appreciated that many alternative mechanisms may be used to move the lower part of the seat belt forwardly. Instead of a motor which acts on a rack, a motor might be used to drive a pulley wheel which winds in a wire or cable such as the cable 14. Alternatively, an extensible arm may be provided which moves, in a telescopic fashion from a retracted position to an extended position, the arm, as it moves to the extended position, engaging part of the seat belt and moving the seat belt forwardly.

Turning now to consider Figure 6, there is illustrated a further proposed embodiment of the present invention, in which the rigid sleeve 16 provided in the arrangement shown in Figure 4, has been replaced with an elongate, substantially rigid element 26 such as, for example, a rigid plate. However, it should also be appreciated that the substantially rigid element 26 could take the form of a rod or stiff wire cable. The substantially rigid element 26 is pivotally connected to the anchor point 17 at its lower end and is pivotally connected at its opposite end, via pivot 27, to the end of the seat-belt 2. The wire or cable 14
connected to the strap 13 and passing around the pulley 15 is connected to the substantially rigid element 26.

It is to be understood, therefore, that when a person sits on the seat of Figure 6, the strap 13 will be drawn into the squab 12 in the same manner as described above in connection with the previous embodiments, thus applying a tension to the cable 14 which will, in turn, tend to cause the rigid element 26 to rotate, as shown by the arrow 28 in Figure 4, about the anchoring point 17. This will cause the lowermost part of the seat-belt 2 to move forwardly so that the seat-belt 2 will have a configuration generally as shown in phantom in Figure 1.

Whilst the arrangement of Figure 6 has been described with the rigid element 26 being pivotally connected to the seat-belt 2, it should be appreciated that this pivotal connection between the rigid element 26 and the seat-belt 2 is not essential. However, the pivotal connection 27 provides an advantage, in that it prevents undesirable twisting of the seat-belt 2 as the rigid element 26 pivots around the anchor point 17.

Figure 7 illustrates an alternative embodiment of the invention, which is based closely on the arrangement described above with reference to Figure 6. In the arrangement of Figure 7, the substantially rigid element 26 of Figure 6 has been replaced with a telescopic element 29 which comprises a plurality of substantially rigid parts 30, 31, 33 which are arranged to be telescopically received within one another. In such an arrangement, it will therefore be appreciated that as the seat-belt 2 is moved forwardly due to the pivotal movement of the telescopic rigid element 29, the element 29 will extend in length.
Optionally, it is also possible for the sleeve 16 of the arrangements described above with reference to Figures 4 and 5, and the elongate elements 26, of Figures 6 and 7, to each be combined with or to form an integral part of a load-limiting device or a seat-belt pre-tensioning device.

In the present Specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".
CLAIMS:

1. A seat-belt arrangement, the seat-belt arrangement including a seat belt 2 which initially extends from a lower position to an upper position adjacent the side of a vehicle seat 10, characterised in that the seat-belt arrangement incorporating a mechanism responsive to the seat 10 being occupied by an occupant to move at least the lower part of the seat-belt 2 forwardly relative to the seat 10.

2. A seat-belt arrangement according to Claim 1 wherein an elongate element 14 is provided which extends across the seat 10, one end of the elongate element 14 being anchored to the side and the other end extending from the seat 10, the elongate element 14 being configured to be partly drawn into the seat 10 when the seat is occupied by an occupant, the elongate element 14 being connected to the said mechanism.

3. An arrangement according to Claim 2 wherein the mechanism comprises a substantially rigid sleeve 16 surrounding part of the seat-belt 2, the sleeve 16 being mounted for pivotal movement in response to the elongate element 14 being drawn into the squab 12 of the seat 10.

4. An arrangement according to claim 2, wherein the mechanism comprises a substantially rigid element 26 connected to the seat-belt 2, the substantially rigid element 26 is mounted for pivotal movement in response to the elongate element 14 being drawn into the squab 12 of the seat 10.

5. An arrangement according to Claim 1 wherein a sensor 20 is provided responsive to the weight of the seat occupant, the sensor 20 being configured to actuate the said mechanism.
6. An arrangement according to Claim 5 wherein the mechanism incorporates a substantially rigid sleeve 16 surrounding at least the lower part of the seat-belt 2, and a mechanism incorporating an electric motor 21 actuated by the sensor 20, actuation of the motor 21 causing pivoting of the sleeve 16 to move said part of the seat-belt 2 forwardly.

7. An arrangement according to claim 5 wherein the mechanism incorporates a substantially rigid element 26 connected to the seat-belt 2, and a mechanism incorporating an electric motor 21 actuated by the sensor 20, actuation of the motor 21 causing pivoting of the substantially rigid element 26 to move part of the seat-belt 2 forwardly.

8. An arrangement according to claim 4 or 7 wherein said substantially rigid element 26 is pivotally connected to the seat-belt 2.

9. An arrangement according to any one of claims 4, 7 or 8, wherein said substantially rigid element is telescopic 29.

10. An arrangement according to Claim 6 or 7 to 9 as dependent on claim 6, wherein the motor 21 drives a pinion 22 which engages a rack 23 associated with the sleeve 16.

11. A seat-belt according to any one of the preceding Claims wherein said mechanism is configured to move said part of the seat-belt 2 forwardly in response to the seat being occupied by an occupant exceeding a predetermined weight.
INTERNATIONAL SEARCH REPORT

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60R 22/03
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60R
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 5431446 A (Czarnecki et al), 11 July 1995 (11.07.1995), abstract</td>
<td>1,5,7,11</td>
</tr>
<tr>
<td>Y</td>
<td>--</td>
<td>9,10</td>
</tr>
<tr>
<td>X</td>
<td>US 4635963 A (Higuchi et al), 13 January 1987 (13.01.1987), column 5, line 1 - line 16, figures 1,3, abstract</td>
<td>1,5,6,11</td>
</tr>
<tr>
<td>Y</td>
<td>--</td>
<td>9</td>
</tr>
<tr>
<td>X</td>
<td>US 4679821 A (Yamamoto et al), 14 July 1987 (14.07.1987), column 1, line 21 - line 37, figure 1</td>
<td>1,5,7,8</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

Date of the actual completion of the international search
13 August 2004

Date of mailing of the international search report
July 08, 2004

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer
Hans Nordström / JA A
Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (January 2004)
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 6550805 B1 (Gyllenspetz ET AL), 22 April 2003 (22.04.2003), whole document</td>
<td>1, 5, 11</td>
</tr>
<tr>
<td>X</td>
<td>FR 2754225 A1 (Dupuy Pierre), 10 April 1998 (10.04.1998), page 2, line 16 - line 18, figure 1, abstract</td>
<td>1</td>
</tr>
<tr>
<td>Y</td>
<td>DE 3939051 A1 (Bayerische Motoren Werke AG), 29 May 1991 (29.05.1991), whole document</td>
<td>9</td>
</tr>
<tr>
<td>Y</td>
<td>US 5934759 A (Paschek ET AL), 10 August 1999 (10.08.1999), column 2, line 66 - column 3, line 9, figure 3, abstract</td>
<td>10</td>
</tr>
<tr>
<td>A</td>
<td>FR 2315878 A2 (Lasserre Athanase), 28 January 1977 (28.01.1977), whole document</td>
<td>1, 2</td>
</tr>
<tr>
<td>Country</td>
<td>Application Number</td>
<td>Priority Date</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>US</td>
<td>5431446</td>
<td>11/07/1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FR</td>
<td>2754225</td>
<td>10/04/1998</td>
</tr>
<tr>
<td>DE</td>
<td>3939051</td>
<td>29/05/1991</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FR</td>
<td>2315878</td>
<td>28/01/1977</td>
</tr>
</tbody>
</table>