COMMONWEALTH of AUSTRALIA
PATENTS ACT 1952
APPLICATION FOR A STANDARD PATENT

We

TRW Repa GmbH,
of Industriestrasse 20,
7077 Alfdorf,
FEDERAL REPUBLIC OF GERMANY.

hereby apply for the grant of a Standard Patent for an invention entitled:

"RESTRAINT SYSTEM FOR VEHICLE OCCUPANTS"

which is described in the accompanying specification.

Details of basic application(s):

<table>
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<th>Number</th>
<th>Convention Country</th>
<th>Date</th>
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<tr>
<td>G 86 11 919.2</td>
<td>FEDERAL REPUBLIC OF GERMANY</td>
<td>30th April 1986</td>
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<td>(Utility Model)</td>
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The address for service is care of DAVIES & COLLISON, Patent Attorneys, of 1 Little Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

Dated this 30th day of April 1987

To: THE COMMISSIONER OF PATENTS

(a member of the firm of DAVIES & COLLISON for and on behalf of the Applicant).

Davies & Collison, Melbourne and Canberra.
In support of the Application made for a patent for an invention entitled: RESTRAINT SYSTEM FOR VEHICLE OCCUPANTS

1. Wolf-Dieter Klink
   TRW Repa GmbH
   of Industriestrasse 20
   7077 Alfdorf, Fed.Republic of Germany

do solemnly and sincerely declare as follows:

   1. (a) I am the applicant for the patent.

   or (b) I am authorized by TRW Repa GmbH

   the applicant for the patent to make this declaration on its behalf.

2. (a) Artur FÖHL
   of Auf der Halde 28
   7060 Schorndorf, Fed.Republic of Germany

   is the actual inventor of the invention and the facts upon which the applicant is entitled to make the application are as follows:

   The applicant is the assignee of the actual inventor.

3. The basic application as defined by Section 141 of the Act was made in the Fed. Rep. of Germany on the 30th April, 1986 by TRW Repa GmbH.

4. The basic application referred to in paragraph 3 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.

Declared at Alfdorf this 10th day of April, 1987

DAVIES & COLLISON, MELBOURNE and CANBERRA.

Signature of Declarant(s) (no attestation required).

Note: Initial all alterations.
1. A restraint system for vehicle occupants comprising a safety belt retractor having a reel, and a belt tightening means having a pyrotechnical gas generator, a piston/cylinder arrangement drivable by said gas generator, a pulley, coupling means for selectively coupling said pulley to said reel for joint rotation upon energization of said gas generator and a cable engaging the periphery of the pulley and connected to the piston of the piston/cylinder arrangement, wherein the safety belt retractor is secured by means of a fitting to a vehicle seat, the gas generator is arranged with the piston/cylinder arrangement separately from the safety belt retractor and the cable is surrounded by a compression resistant cover and arranged to form at least one arc or bow, the safety belt retractor and the belt tightening means forming separate assemblies operatively connected by said cable and cover.
Name of Applicant: TRW Repa GmbH

Address of Applicant: Industriestrasse 20, 7077 Alfdorf, FEDERAL REPUBLIC OF GERMANY

Actual Inventor(s): Artur FOHL

Address for Service: DAVIES & COLLISON, Patent Attorneys, 1 Little Collins Street, Melbourne, 3000.

Complete Specification for the invention entitled:
"RESTRAINT SYSTEM FOR VEHICLE OCCUPANTS"

The following statement is a full description of this invention, including the best method of performing it known to us.
The present invention relates to a restraint system for vehicle occupants comprising a safety belt retractor and a belt tightening means having a pyrotechnical gas generator driving a piston/cylinder arrangement, a pulley selectively coupled to the reel of the retractor and a cable engaging the periphery of the pulley and connected to the piston of the piston/cylinder arrangement.

In conventional restraint systems of this type the safety belt retractor is combined with the gas generator and the piston/cylinder arrangement to provide an assembly which
is usually accommodated in the B column of a motor vehicle.

In certain restraint means, for example the so-called passive safety belt systems, in which an end fitting of the safety belt can be moved by means of a slide member guided in a rail between a belt fastening position and a belt unfastening position, the safety belt retractor is preferably attached to a vehicle seat. The spatial accommodation of an assembly consisting of a safety belt retractor, a pyrotechnical gas generator and a piston/cylinder arrangement on a vehicle seat presents however difficulties because of the relatively large dimensions of this assembly.

The object of the present invention is to provide an improved restraining system of the kind mentioned above wherein difficulties due to the overall size of conventional assemblies of safety belt automatic takeup means, pyrotechnical gas generator and piston/cylinder arrangement are avoided upon mounting to a vehicle seat.

According to the present invention, the safety belt retractor is secured by means of a fitting to a vehicle seat, the pyrotechnical gas generator is located with the piston/cylinder arrangement separately from the safety belt retractor, and the cable is surrounded by a compression resistant cover and arranged to form at least one arc or bow.

By the spatial separation provided in the restraint system according to the invention of the safety belt retractor on the one hand and the pyrotechnical gas generator with the piston/cylinder arrangement on the other hand and by the drive connection between these separate assemblies by means of a cable and a compression resistant cover surrounding the latter, it is achieved that the spatial
accommodation of the safety belt retractor and the assembly consisting of pyrotechnical gas generator and piston/cylinder arrangement presents no difficulties whatever because these separate assemblies can have any orientation relatively to each other. The cable with the compression resistant cover surrounding it can be laid on practically any path. Such a spatial separation was not considered hitherto because it was assumed that the extremely high tightening forces arising on actuation of the pyrotechnical gas generator could not be transmitted sufficiently loss-free and delay-free by means of such a drive connection. It has however surprisingly been found that even when the cable and cover or sheath are laid in a plurality of differently orientated arcs there are hardly any losses and delays, i.e. the tightening function is not impaired in any way.

According to an advantageous embodiment the pyrotechnical gas generator with the piston/cylinder arrangement is attached to the vehicle seat beneath the seat surface thereof. It is further advantageous to secure the safety belt automatic takeup means laterally to the frame of a vehicle seat.

A particularly preferable embodiment which permits various installation variants without changing the safety belt retractor resides in that a plurality of connection points leading to the periphery of the pulley is provided for the selective connection of cover or sheath and cable to various peripheral positions with respect to the pulley.

Further features and advantages of the invention will be apparent from the following description of examples of embodiment and from the drawings, to which reference is made.
In the drawings:

Fig. 1 is a schematic partial view of an embodiment with spatially separately disposed safety belt retractor and assembly consisting of pyrotechnical gas generator and piston/cylinder arrangement and connected to the safety belt retractor via a pulling cable and a sheath or cover surrounding said cable;

Fig. 2 is an embodiment in which the safety belt retractor is attached to the side of a vehicle seat and the pyrotechnical gas generator with piston/cylinder arrangement is attached to the vehicle seat beneath the seat surface;

Figs. 3, 4, 5 and 6 show various embodiments of the cover or envelope surrounding the pulling cable.

Figure 1 shows schematically a safety belt retractor 10 to the belt reel of which, on which the webbing 12 is coiled, a pulley 14 is connected via a coupling means (not shown). The safety belt retractor 10 is anchored by means of a fitting 16 and a threaded bolt 18 to a part of the vehicle. A pulling or tension cable 20 engages the periphery of the pulley 14. Said pulling cable 20 is led via a sleeve 22 out of the housing of the safety belt retractor 10. Connected to the sleeve 22 is a compression resistant flexible cover 24. The cover 24 with pulling cable 20 is laid in several adjoining arcs between which reversal points can be disposed and leads to a sleeve 26 and the housing of a piston/cylinder arrangement 28. Said piston/cylinder arrangement 28 is arranged separately from the safety belt retractor 10 at a suitable point of the vehicle. Connected to the piston/cylinder arrangement 28 in conventional manner is a pyrotechnical gas generator 30.
which in turn is connected via electrical lines to an actuating sensor 32.

In the embodiment shown in Figure 2 the safety belt retractor 10 is secured to the side of a vehicle seat 34. In particular, the safety belt retractor 10 is articulately connected via an additional fitting 12 to the frame 35 of the vehicle seat 34. The assembly consisting of pyrotechnical gas generator 30 and piston/cylinder arrangement 28 is attached to the vehicle seat 32 beneath the seat surface thereof. Between said assembly 28, 30 and the safety belt retractor 10 a drive connection consisting of pulling cable 20 and cover 24 extends. A particular advantage of this construction is that the safety belt retractor is freely pivotal relatively to the assembly 28, 30 because the drive connection consisting of pulling cable 20 and cover or sheath 24 can easily follow these movements.

In the embodiment according to Figure 2 the one end of the safety belt 12 is connected to an end fitting 36 which is displaceable via a slide piece not shown in detail and a guide rail indicated in dashed line between a belt fastening position and a belt unfastening position. This is a so-called passive safety belt system.

A particular feature of the embodiment shown in Figure 1 is that offset from the sleeve 22 with respect to the periphery of the pulley 14 is a further sleeve 22A which permits a connection of the cover 24 and the pulling cable 20 to another peripheral point. In Figure 1 the cover is indicated in dashed line in this alternative connection position.

The embodiment of the cover 24 shown in Figure 3 consists of a round wire spiral 24A and a plastic sheath 40 disposed thereon.
The embodiment of the cover 24 shown in Figure 4 consists of a flat wire spiral 24B and a plastic sheath 40.

In the embodiments according to Figures 3 and 4 the sheath 24 with the pulling cable 20 forms a Bowden cable. In the embodiment according to Figure 5 the cover 24 consists of a flexible double block tube 24C and a plastic sheath 40 disposed thereon.

In the embodiment according to Figure 6 the cover 24 consists of a flexible tube 24D of a compression resistant plastic material with good sliding properties.

In the embodiments according to Figures 3, 4 and 5 the pulling cable 20 is preferably plastic coated to prevent sliding friction.

The safety belt retractor 10 and the piston/cylinder arrangement 28 are of conventional type and thus require no detailed description.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A restraint system for vehicle occupants comprising a safety belt retractor having a reel, and a belt tightening means having a pyrotechnical gas generator, a piston/cylinder arrangement drivable by said gas generator, a pulley, coupling means for selectively coupling said pulley to said reel for joint rotation upon energization of said gas generator and a cable engaging the periphery of the pulley and connected to the piston of the piston/cylinder arrangement, wherein the safety belt retractor is secured by means of a fitting to a vehicle seat, the gas generator is arranged with the piston/cylinder arrangement separately from the safety belt retractor and the cable is surrounded by a compression resistant cover and arranged to form at least one arc or bow, the safety belt retractor and the belt tightening means forming separate assemblies operatively connected by said cable and cover.

2. The restraint system of claim 1, wherein the cable and the cover are arranged to form two adjoining arcs with an inflection therebetween.

3. The restraint system of claim 1, wherein the gas generator and the piston/cylinder arrangement are attached to the vehicle seat beneath the seat surface.

4. The restraint system of claim 1, wherein the safety belt retractor is secured laterally to a frame of a vehicle seat.

5. The restraint system of claim 1, wherein the safety belt retractor comprises a plurality of connection
points leading to the periphery of the pulley for the
selective connection of cover and pulling cable to various
peripheral positions with respect to the pulley.

6. The restraint system of claim 1, wherein the cover
is formed from a wire spiral in the manner of a Bowden
cable.

7. The restraint system of claim 6, wherein the cable
is provided as a plastic-coated steel cable.

8. The restraint system of claim 1 wherein the
cover is formed from a compression resistant plastic tube.

9. The restraint system of claim 1, wherein the cover is
provided as a flexible block tube comprising two assembled
helically wound cover structures having identical pitch
and substantially identical diameter.

10. A restraint system for vehicle occupants
substantially as hereinbefore described with reference
to the drawings.

11. The steps or features disclosed herein or any
combination thereof.

Dated this 30th day of April 1987

TRW Repa GmbH

By its Patent Attorneys

DAVIES & COLLISON