Abstract: A crash box (11) has a closed profile designed to be attached to a side rail of a vehicle by being inserted into the side rail and fastened by means of through bolts (27). The portion (24) intended to be inserted into the side rail has reduced width and has an essentially rectangular section with bolt holes on its narrow horizontal sides (18, 19). The inserted portion of the crash box takes up at most half the width of the side rail.
A crash box and the attachment of a crash box to a side rail of a vehicle

Field of the invention
This invention relates to a crash box with a closed profile designed to be attached to a side rail of a vehicle by being inserted into the side rail and fastened by means of through bolts and it also relates to the attachment of a crash box with a closed cross section to a side rail of a vehicle, wherein the crash box is inserted into the side rail with a vertical fit to the side rail and fastened by means of through bolts and nuts.

Background of the invention
In an attachment of this kind, use is made of a stiffener in the form of a sleeve around the bolts so that the side rail and crash box are not deformed when the bolts are tightened. The aim of the invention is to simplify the crash box and the mounting thereof. Attachment of this kind is obtained when the inserted portion of the crash box takes up at most half the width of the side rail. The crash box is designed in such a manner that the portion intended to be inserted into the side rail is tapered and has an essentially rectangular section with mounting holes on its narrow sides. The invention is defined by the claims.

Brief description of the drawings
Figure 1 is a perspective view of an upper member of a three-part crash box according to the invention shown as one embodiment of the invention.
Figure 2 is a perspective view of a lower member of the crash box.
Figure 3 is a perspective view of a third member of the crash box.
Figure 4 is a perspective view of the crash box according to Figures 1-3 assembled and attached to a bumper beam.
Figure 5 shows the crash box according to Figure 4, without the bumper beam, attached to a side rail of a vehicle.

Detailed description of the preferred embodiment shown
Figure 4 shows a crash box 11 the outer end of which is adapted to the profile of a bumper beam 12 and is attached thereto, advantageously welded to the bumper member. The crash box 11 consists of three members, as shown in Figures 1-3, an upper member 13, a lower
member 14 and a third member 15. These three members are made of sheet metal, advantageously by cold-forming high-strength sheet steel. The upper member and the lower member are welded together to form a closed profile. However, their attachment ends are provided with recesses 16, 17 so that one of the members, the upper member, has only a narrow flat upper side 18 at its attachment end, while the other member, the lower member, has a narrow flat underside 19. These sides have bolt holes 20-23. The third member has a straight portion 29 and a curved portion 30 and covers the recesses 16, 17 and is welded to the upper member and the lower member. The vertical straight portion 29 has bent edges 31, 32.

The attachment end 24 of the crash box (Fig. 4) thus has a closed rectangular profile which has a tall, but narrow portion 18, 19, 29 with bolt holes 20-23 on the narrow horizontal sides for through bolts and a transition portion 34 which, via a soft curve, becomes wider and is adapted to the width of the side rail.

Figure 5 shows the outer end of a side rail 25 of a vehicle. The side rail shown is a conventional one with a closed rectangular profile. The end 24 of the crash box is inserted into the side rail. The bumper beam is not shown in this figure. The side rail has bolt holes 26 which match the bolt holes 20-23 of the crash box and are located close to one vertical side 35 of the side rail. The crash box is fastened to the side rail by means of through bolts (bolts and nuts). A bolt 27 is shown in one of the bolt holes 26. The bolts are located close to one side of the side rail. One of the vertical sides 35 of the side rail is thus situated at one side of the bolts and close to the bolts and the vertical side 29 of the crash box is situated at the other side of the bolts and close to the bolts. The bolts can be fastened tightly and the joint is strong because the crash box has a vertical fit relative to the side rail, and because the crash box is narrow and has the flat end portion 29 of the third member 15 which forms a vertical side of the crash box in the region of the bolts and up to the bolts. The inserted portion 24 of the crash box takes up at most half the width of the side rail in the region of the bolts 27.

The third member 15 of the crash box may have a stiffener 28 which increases the bending resistance horizontally. This stiffener is designed as a reinforcing bulge which extends from the flat vertical portion 29 of the third crash box member and essentially to its outer end 36, which is located inside, but close to the end of the side rail.
The bumper beam 12 is produced complete with welded-on crash boxes and these are inserted into side rails of the vehicle and fastened by bolts. The mounting of the bumper member is thus very simple.
Claims

1. Attachment of a crash box (11) with a closed cross section to a side rail (25) of a vehicle, wherein the crash box is inserted into the side rail with a vertical fit relative to the side rail and fastened by means of through bolts and nuts (27), characterized in that the inserted part (24) of the crash box takes up at most half the width of the side rail in the region (18, 19, 29) of the bolts (27).

2. The attachment according to claim 1, characterized in that the inserted portion (24) of the crash box is located against one vertical side (35) of the side rail.

3. Crash box with a closed profile designed to be attached to a side rail (25) of a vehicle by being inserted into the side rail and fastened by means of through bolts (27), characterized in that the portion (24) intended to be inserted into the side rail is horizontally narrow relative to the rest of the crash box and has an essentially rectangular section with mounting holes (26) on its narrow horizontal sides (18, 19).

4. Crash box according to claim 3, characterized in that it consists of two longitudinal open crash box members (13, 14) which are fastened together and form a closed section, but have an open section on the narrow portion (24) designed to be inserted into the side rail (35), and a third curved crash box member (15) which is fastened to the other two members and covers the open portions thereof and forms one (29) of two broad vertical sides of a rectangular section.

5. Crash box according to claim 4, characterized in that the third crash box member (15) has a straight portion (29) with bent edges (30, 31) and a curved portion (30) adapted to the greater width of the two longitudinal crash box members (13, 14 on the portion of the crash box intended to be outside the side rail.
6. Crash box according to claim 5, **characterised in that** a reinforcing bulge (28) extends from the flat portion (29) of the third crash box member and essentially to the end (35) of the crash box member.
INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2008/000635

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
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)

IPC: 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

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<th>Relevant to claim No.</th>
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<td>JP 06099781 A, NISSAN MOTOR CO LTD, 1994-04-12: (abstract) Retrieved from: PAJ database; Original document: Fig. 1</td>
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<td>US 20060244274 A1 (FRANK ET AL), 2 November 2006 (02.11.2006)</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

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Date of the actual completion of the international search 11 February 2009

Date of mailing of the international search report 13-02-2009

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Form PCT/IS A/210 (second sheet) (July 2008)
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International patent classification (IPC)

B60R 19/34 (2006.01)

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Paper copies can be ordered at a cost of 50 SEK per copy from
PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.
INTERNATIONAL SEARCH REPORT

Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The following separate inventions were identified:

1: Claims 1 and 2 are directed to attachment of a crash box in which a part of the crash box inserted into a side rail of a vehicle takes up at most half the width of side region in the

   .../... ...

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2008)
Box III
region of bolts.

2: Claims 3-6 are directed to a crash box in which the portion intended to be inserted into a side rail of a vehicle is horizontally narrow relative to the rest of the crash box.

The present application has been considered to contain two inventions which are not linked such that they form a single general inventive concept, as required by Rule 13 PCT for the following reasons:

The single general concept of the present application is the teaching that a crash box with a closed cross section is inserted into the side rails of a vehicle and fastened by means of through bolts.

Document JP6099781 A discloses a crash box 7 with a closed cross section. The crash box is inserted into the side rails 27 of a vehicle and fastened by means of a through bolt 23. The single general concept differs from the crash box in document JP6099781 A D1 in that several through bolts are arranged. This is a slight constructional change which comes within the scope of the customary practice followed by persons skilled in the art.

Thus, the single general concept is obvious and cannot be considered as a single general inventive concept in the sense of Rule 13.1 PCT.

No other features can be distinguished which can be considered as the same or corresponding special technical features in the sense of Rule 13.2 PCT.

Thus, the application lacks unity of invention.
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