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(71) Applicant *(for all designated States except US)*: **GESTAMP HARDTECH AB** [SE/SE]; Box 828, S-971 25 Luleå (SE).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **BODIN, Hans** [SE/SE]; Tunnlandsvägen 8, S-954 42 Södra Sunderbyn (SE).

(74) Agent: **ÅSLUND, Roland**; Gestamp Hardtech AB, Box 828, S-971 25 Luleå (SE).

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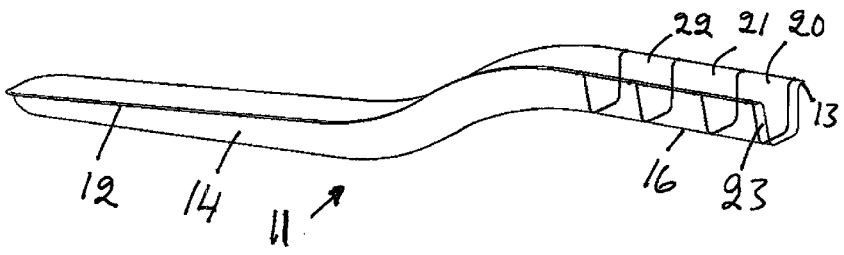
(54) Title: ENERGY ABSORBING SIDE RAIL FOR A VEHICLE

FIG 1



(57) Abstract: A side rail for vehicles has a tensile strength in excess of 1400 MPa and has one end (16) projecting from the safety cage of the vehicle and adapted to carry a bumper. The end projecting from the safety cage has lower strength with a yield point of less than 1000 MPa over a length of at least 0.4 m. It has an outer portion with a length of at least 0.2 m and a tensile strength below 800 MPa and an inner portion with a higher tensile strength than the outer portion.

Energy absorbing side rail for a vehicle

Field of the invention

The invention relates to a side rail for vehicles having a tensile strength in excess of 1400 MPa, said side rail having one end projecting from the safety cage of the vehicle and adapted to carry a bumper.

Prior art

Vehicles, e.g. passenger cars, generally have side rails both at the front and at the rear welded to the bottom panel of the vehicle, these side rails carrying the bumper. US 6 820 924 B2 describes a passenger car with a front side rail for carrying the bumper, this side rail having a plurality of narrow, soft portions which are supposed to act as deformation triggers for axial deformation of the side rail in the event of a collision. The soft portions trigger deformation of the hard portions.

Object of invention and brief description of the invention

The aim of the invention is to allow for controlled deformation resulting in high energy absorption even in the case of side rails made of high-strength steel. This is achieved in that the end of the side rail projecting from the safety cage has lower strength with a yield point of less than 1000 MPa over a length of at least 0.4 m. The projecting end advantageously has an outer portion with a length of at least 0.2 m and a tensile strength below 800 MPa and an inner portion with a higher tensile strength than the outer portion. Both the inner portion and the outer portion may include two or more portions with a tensile strength gradually increasing inwards the vehicle.

The invention is defined by the claims.

Brief description of the drawings

Figure 1 is a perspective view showing a short side rail for a vehicle.

Figure 2 shows a side rail according to Figure 1, having a cover giving a closed profile.

Description of the example of the invention shown.

Figure 1 is a perspective view showing a short front side rail with an open U-shaped cross section and narrow side flanges 12, 13. The side rail is attached to the vehicle in that the side flanges 12, 13 of the rear portion 14 are welded to the bottom panel of the vehicle, i.e. to the floor of the vehicle or to members on the underside thereof. As a pair of side rails is supposed to carry a bumper, the side rail has an S-bend 15 so that its front end will be at the correct height for the bumper. The end of the side rail may advantageously have a welded end plate (not shown) and the bumper can be bolted to this plate. A vehicle has what is referred to as a safety cage and deformation zones in front of and behind the safety cage. The safety cage normally extends from the cowl wall at the front end of the vehicle and past the fuel tank at its rear end. The rear portion 14 of the side rail and its S-bend 15 belong to the safety cage, whereas the front portion 16 of the side rail belongs to the front deformation zone.

The side rail is made of high-strength steel and can advantageously be manufactured by press hardening, i.e. a flat blank is heated to austenitising temperature and is moved in the heated state to a cooled tool pair where it is hot-stamped and then left in the tool pair for a few seconds until it has hardened. This method results in tensile strengths of more than 1400 MPa. Rapid cooling and therefore full hardening of specific portions of the product can be prevented in various ways, e.g. by providing gaps between the tool pair and the finished product or by heating selected portions of the otherwise cooled tool pair.

In the event of impact, e.g. in the event of a collision, high-strength steel tends to crack when it is deformed and the front portion 16 of the side rail shown in Figure 1 has three portions 20, 21, 22 which are softer, i.e. which have lower strength than the rest of the side rail. The portion 20 has the lowest strength, the portion 21 has higher strength and the portion 22 has even higher strength. The portion 22 has a tensile strength below 1000 MPa. The portion 16 has a breaking strength below 1000 MPa, i.e. significantly lower strength than the rest of the side rail, over a length of 0.4 m. The outermost end of the portion 16 may consist of a high-strength portion 25 with a tensile strength in excess of 1400 MPa. In total, the side rail has a tensile strength below 800 MPa over a length of at least 0.2 m.

In the event of a collision axially towards the end of the side rail, the softest portion 20 will be deformed first and absorb impact energy. Only once this portion has been deformed will the

portion 21 begin to be deformed and once the portion 21 has been deformed, the portion 22 will begin to be deformed.

The outermost end 25 of the side rail may be of high-strength as shown so as to counteract deformation in the event of low-speed collisions where the wish is for no damage at all to the side rails.

Short transition zones are formed between the portions 20, 21, 22. Alternatively, there may be short high-strength zones between the portions 20, 21, 22 and short transition zones are then formed on either side of the high-strength zones.

As a result of the fact that the S-bend 15 is made of high-strength steel and the front end 16 of the side rail has softer portions, the S-bend is not deformed until the soft portions have been deformed. The possibility of having a side rail with an S-bend made of high-strength steel simplifies the design of the vehicle.

Figure 2 shows the front end of a side rail 11 of the same type as that shown in Figure 1, but in this example the side rail 11 has a flat high-strength cover 27 welded to the side flanges. The cover has soft portions 28, 29, 30 corresponding to the soft portions 20, 21, 22 of the side rail. The cover gives the side rail a closed profile, thereby giving the side rail a more stable cross section and making the S-bend 15 stronger. If the cover 27 is instead made of steel with lower strength, the entire cover can be designed with the same strength. The cover does not have to be flat and can for example be inwardly bent.

The example shows a side rail with three soft portions having different strength, wherein a portion closer to the end has lower strength than its nearest soft portion. Alternatively, there may be two or more than three soft portions.

The invention has been described by way of the example of a front side rail, but may also be applied to a rear side rail

Claims

1. Side rail for vehicles having a tensile strength in excess of 1400 MPa, said side rail having one end (16) projecting from the safety cage of the vehicle and adapted to carry a bumper,
   characterised in that
   the end (16) projecting from the safety cage has lower strength with a yield point of less than 1000 MPa over a length of at least 0.4 m.

2. Side rail according to claim 1, **characterised in that** the projecting end has an outer portion with a length of at least 0.2 m and a tensile strength below 800 MPa and an inner portion with a higher tensile strength than the outer portion.

3. Side rail according to claim 2, **characterised in that** at least the said inner portion or the said outer portion includes two or more portions with a tensile strength gradually increasing inwards the vehicle.

4. Side rail according to any one of the preceding claims, **characterised in that** the projecting end has an outermost portion (25) with a tensile strength in excess of 1400 MPa.

5. Side rail according to any one of the preceding claims, **characterised in that** it is a front side rail and includes a vertical S-bend (15) behind the projecting portion (16) and a rear portion (14) extending below the bottom panel and welded thereto, both the rear portion and the S-bend having a tensile strength in excess of 1400 MPa.

FIG 1

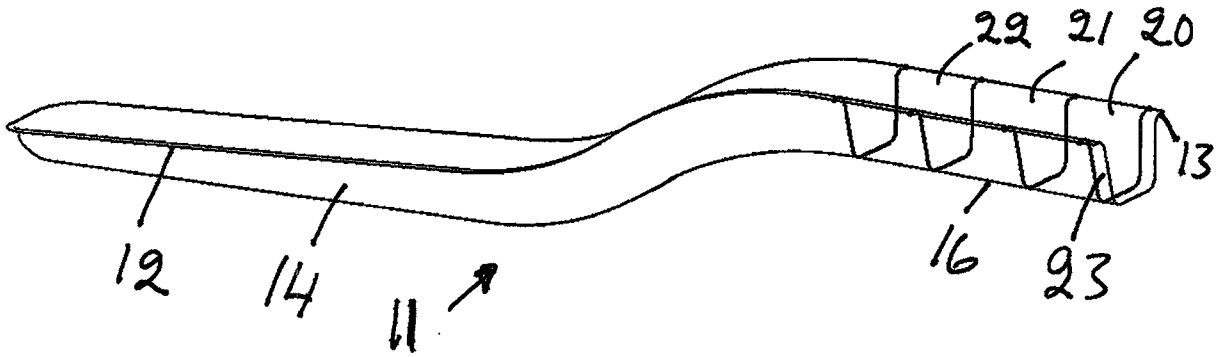
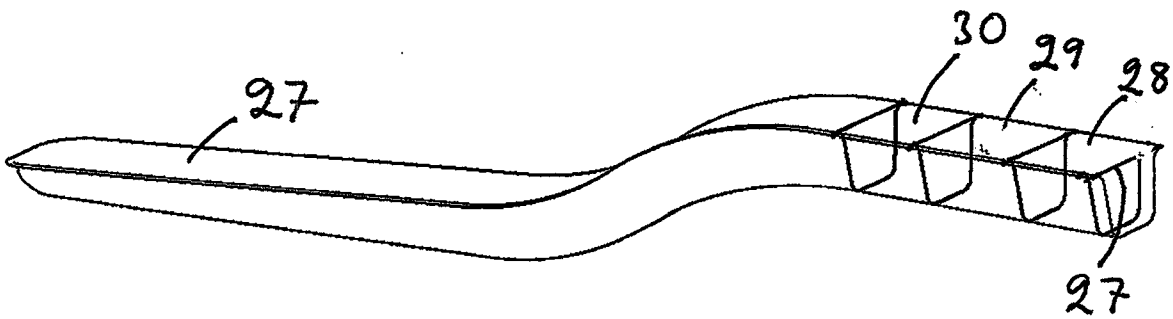


FIG 2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2010/000102

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, B62D, F16F

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5492207 A (CLAUSEN), 20 February 1996 (20.02.1996), column 2, line 12 - line 35; column 2, line 66 - column 3, line 40, figures 1,2, abstract --	1-5
Y	US 20020104591 A1 (GEHRINGHOFF ET AL), 8 August 2002 (08.08.2002), figure 3, abstract, paragraphs (0007),(0008),(0015) --	1-5
A	US 6820924 B2 (CALISKAN ET AL), 23 November 2004 (23.11.2004), column 2, line 39 - line 47; column 3, line 39 - line 58; column 6, line 8 - line 20, figure 10 --	1-5

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

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Date of the actual completion of the international search	Date of mailing of the international search report
28 July 2010	29-07-2010
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 Göran Magnusson / JA A Telephone No. +46 8 782 25 00

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2008123506 A1 (SUMITOMO METAL INDUSTRIES, LTD.), 16 October 2008 (16.10.2008), figure 23, abstract -- --------	1-5

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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.

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