

(19)



(11)

**EP 2 845 662 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**11.03.2015 Bulletin 2015/11**

(51) Int Cl.:  
**B21D 5/01 (2006.01)**      **B21D 5/02 (2006.01)**  
**B21D 11/08 (2006.01)**      **B21D 22/21 (2006.01)**  
**B21D 53/88 (2006.01)**

(21) Application number: **13182920.2**

(22) Date of filing: **04.09.2013**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA ME**

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Remarks:  
Amended claims in accordance with Rule 137(2) EPC.

(54) **Pressing method, press, profile and vehicle**

(57) A pressing method (40) for pressing a profile (20) with at least one web (21) and one flange (22), a press (10) for carrying out the pressing method (40), a profile (20) and a vehicle (30) including the profile are provided. In the pressing method (40) a workpiece (13) is bent by the press (10) comprising an upper die (11) and a lower die (12). According to the present invention before bending the workpiece (13) the workpiece (13) is fixed by at least one bulge (16) of the upper die (11) while moving the upper die (11) in a pressing direction (41).

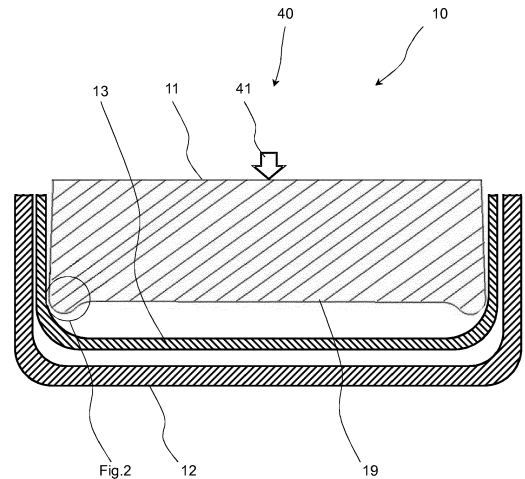


Fig. 1

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## Description

**[0001]** The present invention relates to a pressing method for pressing a profile, a press for performing the pressing method, a profile and a vehicle including this profile.

**[0002]** It is known and widely used to generate a profile from a sheet metal by using a press comprising an upper die and a lower die. The dies transfer their contours to the workpiece while closing the press.

**[0003]** In known methods there is the risk of a spring-back of the workpiece. It can lead to a lack of size accuracy.

**[0004]** It is an objective of the present invention to provide an improved pressing method and an improved press for generating a profile with smaller tolerances.

**[0005]** According to the present invention, this objective is achieved by a pressing method as claimed in claim 1, by a press as claimed in claim 6, by a profile as claimed in claim 9 and by a vehicle as claimed in claim 11. The depending claims contain further developments of the invention.

**[0006]** According to a first aspect of the present invention a pressing method for generating a profile with at least one web and one flange is provided. In pressing method a workpiece is bended by a press comprising an upper die and a lower die. According to the present invention, before bending the workpiece, the workpiece is fixed by at least one bulge of the upper die while moving the upper die in a pressing direction. This measure prevents from a springback of the workpiece and allows generating a profile with smaller tolerances. Additional processes are not necessary for achieving the desired shape. Thus, costs can be reduced.

**[0007]** In a further development of the inventive pressing method after bending at a junction portion of the profile at least one impression is pressed in by the bulge. A deviance from a desired contour increases with the distance to the junction portion. The impression at the junction portion increases the hardness of the junction portion. Thus, the junction portion is less elastic.

**[0008]** In a still further development of the inventive pressing method the impression is pressed in at an inner side of the profile. By this measure, the impression can be generated by the at least one bulge of the upper die. Thus, the bulge has two functions. Additional means for fixing the workpiece are not necessary. Costs can be reduced.

**[0009]** In a still further development of the inventive pressing method a U-profile including one web and two flanges is formed from the workpiece. By this measure, a U-profile can be produced by the inventive method. U-profiles are used in many products, for example in the frame of vehicles.

**[0010]** In a still further development of the inventive pressing method an impression is pressed into the U-profile at each junction portion. By this measure, both of the flanges of the U-profile benefit from the effect of the

impressions.

**[0011]** According to a second aspect of the present invention a press is provided. The press includes an upper die and a lower die. According to the present invention, the upper die comprises at least one bulge at a front section. By this measure, the workpiece to be treated can be fixed in a certain position before bending. The workpiece is prevented from a spring-back.

**[0012]** In a further development of the inventive press the at least one bulge is convexly formed. The convex contour prevents from increasing tensions inside the profile and from the formation of cracks.

**[0013]** In a still further development of the inventive press the at least one bulge is arranged at an edge of the upper die. By this measure, an impression can be generated in a junction portion of the profile for achieving the above mentioned advantages.

**[0014]** According to a third aspect of the present invention a profile is provided. The profile includes at least one web and at least one flange, wherein the flange is substantially arranged transversal to the web. According to the present invention the profile comprises at least one impression accommodated at a junction portion. In particular the profile is U-shaped. By this measure, the profile is dimensionally very accurate. Thus, a subsequent processing is greatly simplified. Products made from the profile show a higher quality. In particular the production of trucks is simplified by using inventive profiles.

**[0015]** According to a fourth aspect of the present invention a vehicle is provided. The inventive vehicle includes at least one inventive profile, in particular as a side member. Thus, the benefits of the inventive profile will benefit the vehicle.

**[0016]** Further features, properties and advantages of the present invention will become clear from the following description of embodiments in conjunction with the accompanying drawings.

Figure 1 shows an inventive press while an inventive pressing method.

Figure 2 shows a detail of an upper die of the press.

Figure 3 shows an inventive profile.

Figure 4 shows an inventive vehicle.

**[0017]** The present invention will now be described, by way of example, with reference to the accompanying drawings, in which Fig. 1 shows an inventive press 10 while performing an inventive pressing method 40.

**[0018]** The inventive press 10 includes an upper die 11 and a lower die 12. Between the upper die 11 and the lower die 12 a workpiece 13 is provided for performing the inventive pressing method 40. In particular the workpiece 13 is a thick sheet metal. For closing the press 10 the upper die 11 is moved in a pressing direction 41. For treating the workpiece 13 the upper die 11 is moved in

the pressing direction 41. Thus, the upper die 11 moves into the space enclosed by the lower die 12. The workpiece 13 is forced to change its shape according to the shape of the upper die 11 and the lower die 12. After the pressing method 40 performed by the press 10 the workpiece 13 becomes an inventive profile 20.

**[0019]** In the shown embodiment the press 10 is designed so as to form a U-profile 20. However, it is also conceivable that the press 10 is designed for forming an I-profile or a T-profile etc. According to the present invention the profile 20 includes at least one web 21 and at least one flange 22, wherein the web 21 is substantially accommodated transversal to the flange 21.

**[0020]** The upper die 11 of the inventive press 10 comprises a front section 19. An exemplary embodiment of the front section 19 is shown in Fig. 2. According to the present invention the upper die 11 comprises at least one bulge 16. In particular the at least one bulge 16 is accommodated at an edge of the front section 19.

**[0021]** The bulge 16 has a height 15. The bulge 16 protrudes from an intermediate portion 26 of the upper die 11 with the height 15. The upper die 11 comprises a sidewall 27. In particular the sidewall 27 is inclined in a wall angle 14 as compared to the pressing direction.

**[0022]** In the present embodiment the bulge 16 is convexly formed with a bulge radius 17. The present bulge 16 merges into a transition radius 18 at the intermediate portion 26 of the upper die 11. In particular the bulge radius 17 and the transition radius 18 have a ratio in a range of 2/3 to 1/2. The bulge radius 17 may be 9 mm, for example. The transition radius 18 may be 15 mm, for example. The height 15 of the bulge 16 may be 7.5 mm, for example. The wall angle 14 may be 2°, for example.

**[0023]** In the inventive pressing method 40 the upper die 11 is moved toward the workpiece 13 while the workpiece 13 is arranged on the lower die 12. The front section 19 of the upper die 11 shows in the pressing direction 41. When the upper die 11 is moved the at least one bulge 16 of the upper die 11 contacts the workpiece 13 first. The bulge 16 fixes the workpiece 13 before the bending process starts by continuing the movement of the upper die 11 in pressing direction 41. The bulge 16 strains the workpiece 13. Thus, the workpiece 13 is held in position and prevented from a springback. The bulge 16 touches and squeezes the workpiece 13 slightly. By continuing the closing of the press 10 the workpiece 13 is completely formed by the upper die 11. The height 15 of the bulge 16 projects into the inside contour of the workpiece 13. Thereby, an impression 25 is generated in the workpiece 13 while closing the press 10.

**[0024]** Fig. 3 shows an embodiment of an inventive profile 20 in a cross-sectional view. The inventive profile 20 comprises at least one web 21 and one flange 22. The web 21 is substantially accommodated transversal to the flange 21. In particular the profile 20 has a U-shape as shown in Fig. 3.

**[0025]** The area where the web 11 and the flange 22 merge is defined as a junction portion 28. The inventive

profile 20 comprises at least one impression 25 at the junction portion 28. In particular the at least one impression 25 is accommodated at an inner side 23 of the profile 20. The inner side 23 is defined as the side enclosed by the flange 22. The outer side 24 is defined as the side, which is not enclosed by a flange 22. Thus, a double T-profile comprises two inner sides 23 and no outer side 24. In particular the profile 20 includes one web 21, two flanges 22, two junction portions 25 and two impressions 25 as shown in Fig. 3.

**[0026]** Fig. 4 shows an exemplary embodiment of the inventive vehicle 30. The inventive vehicle 30 includes at least one inventive profile 20. The profile 20 may be arranged in a frame 32 of the vehicle. In particular the profile 20 is a side member of the frame 32.

**[0027]** In particular the vehicle 30 is a lorry respectively a truck. The present vehicle 30 according to Fig. 4 is a truck including a lead frame 32 and a passenger cabin 31. The shown vehicle 30 comprises also wheel guards 33 fixed to the lead frame 32.

#### List of reference numerals

#### **[0028]**

10	Press
11	Upper Die
12	Lower Die
13	Workpiece
14	Wall Angle
15	Height
16	Bulge
17	Bulge Radius
18	Transition Radius
19	Front Section
20	Profile
21	Web
22	Flange
23	Inner Side
24	Outer Side
25	Impression
26	Intermediate Portion
27	Sidewall
28	Junction Portion
30	Vehicle
31	Passenger Cabin
32	Frame
33	Wheel Guard
40	Pressing Method
41	Pressing Direction

#### **Claims**

1. A pressing method (40) for generating a profile (20) with at least one web (21) and one flange (22), wherein a workpiece (13) is bended by a press (10)

- comprising an upper die (11) and a lower die (12), **characterised in that** before bending the workpiece (13) the workpiece (13) is fixed by at least one bulge (16) of the upper die (11) while moving the upper die (11) in a pressing direction (41). 5
2. The pressing method (40) as claimed in claim 1, wherein after bending at a junction portion (28) of the profile (20) at least one impression (25) is pressed in by the bulge (16). 10
3. The pressing method (40) as claimed in claim 2, wherein the impression (25) is pressed in at an inner side (23) of the profile (20). 15
4. The pressing method (40) as claimed in claim 2 or 3, wherein a U-profile (20) including one web (21) and two flanges (22) is formed from the workpiece (13). 20
5. The pressing method (40) as claimed in claim 4, wherein an impression (25) is pressed in the U-profile at each junction portion (25). 25
6. A press (10) including an upper die (11) and a lower die (12), **characterised in that** the upper die (11) comprises at least one bulge (16) at a front section (19). 30
7. The press (10) as claimed in claim 6, wherein the at least one bulge (16) is convexly formed. 35
8. The press (10) as claimed in claim 6 or 7, wherein the at least one bulge (16) is arranged at an edge of the upper die (11). 40
9. A profile (20) including at least one web (21) and at least one flange (22), wherein the flange (22) is substantially arranged transversal to the web (21), **characterised in that** the profile (20) comprises at least one impression (25) accommodated at a junction portion (28). 45
10. The profile (20) as claimed in claim 9, wherein the profile (20) is U-shaped. 50
11. A vehicle (30) including at least one profile (20) as claimed in claim 9 or 10.
12. The vehicle (10) as claimed in claim 11, wherein the at least one profile (20) is a side member. 55

**Amended claims in accordance with Rule 137(2) EPC.**

1. A press (10) including an upper die (11) and a lower die (12), wherein the upper die (11) comprises at

least one bulge (16) at a front section (19), wherein the bulge (16) protrudes from an intermediate portion (26) and is convexly formed with a bulge radius (17), wherein the bulge (16) merges into a transition radius (18) at the intermediate portion (26), wherein the bulge radius (17) and the transition radius (18) have a ratio in a range of 2/3 to 1/2.

2. The press (10) as claimed in claim 1, wherein the at least one bulge (16) is arranged at an edge of the upper die (11).

3. A profile (20) including at least one web (21) and at least one flange (22), wherein the flange (22) is substantially arranged transversal to the web (21), wherein the profile (20) comprises at least one impression (25) accommodated at a junction portion (28), wherein the profile (20) is generated by a press as claimed in claim 1 or 2.

4. A vehicle (30) including at least one profile (20) as claimed in claim 3.

5. The vehicle (30) as claimed in claim 4, wherein the at least one profile (20) is a side member.

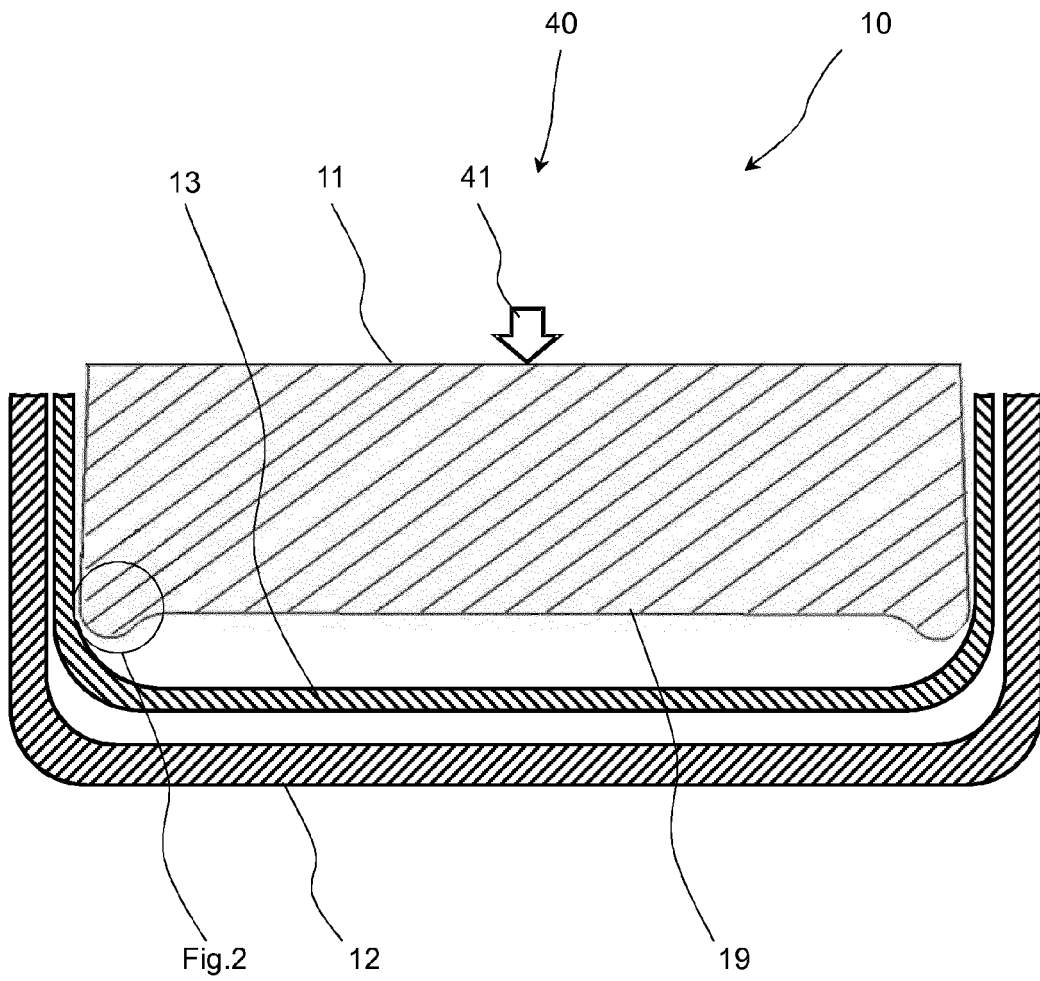


Fig. 1

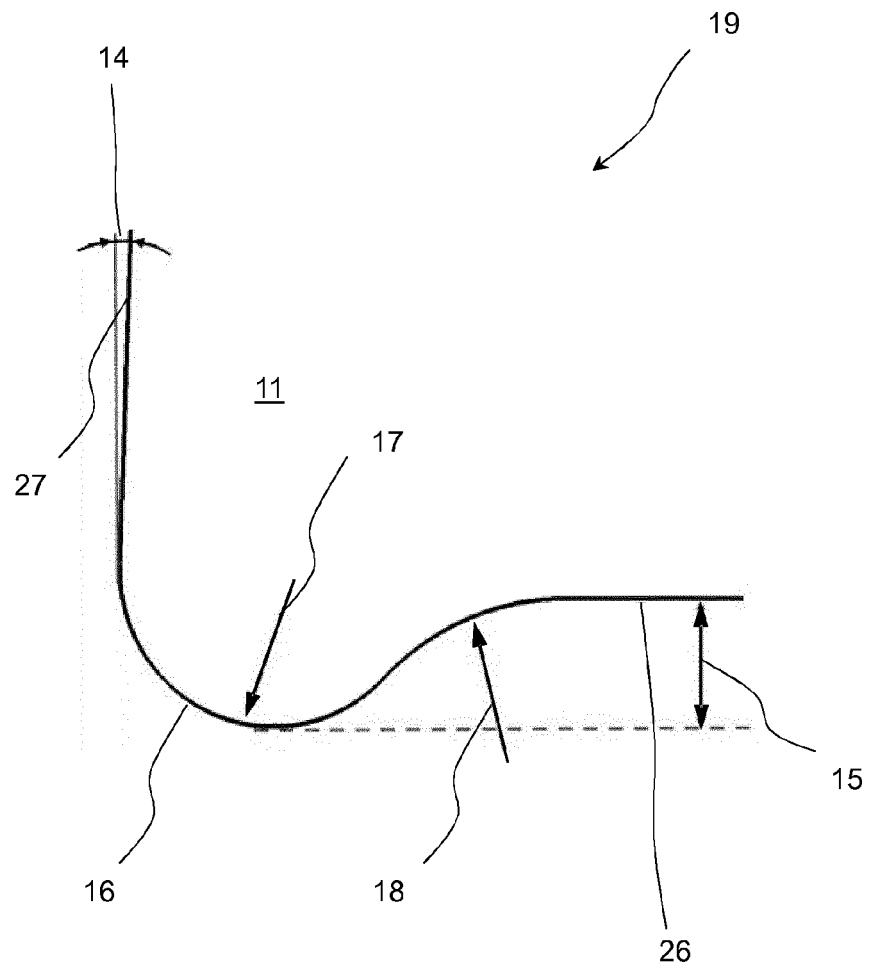


Fig. 2

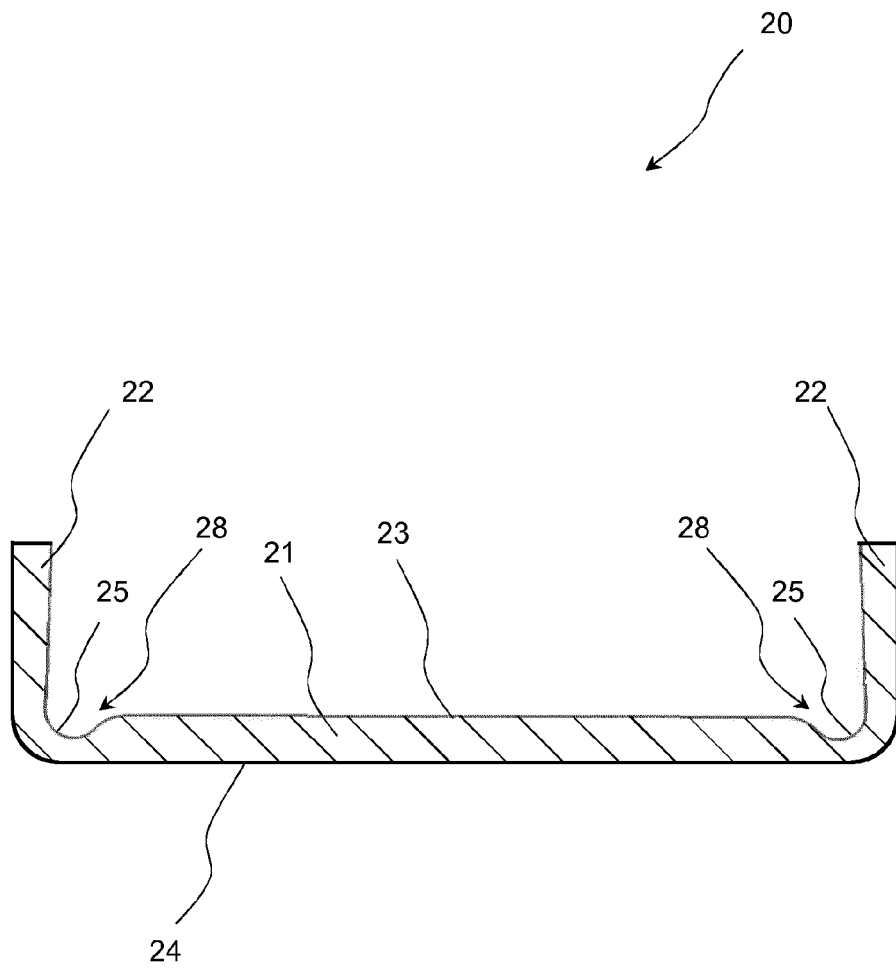


Fig. 3

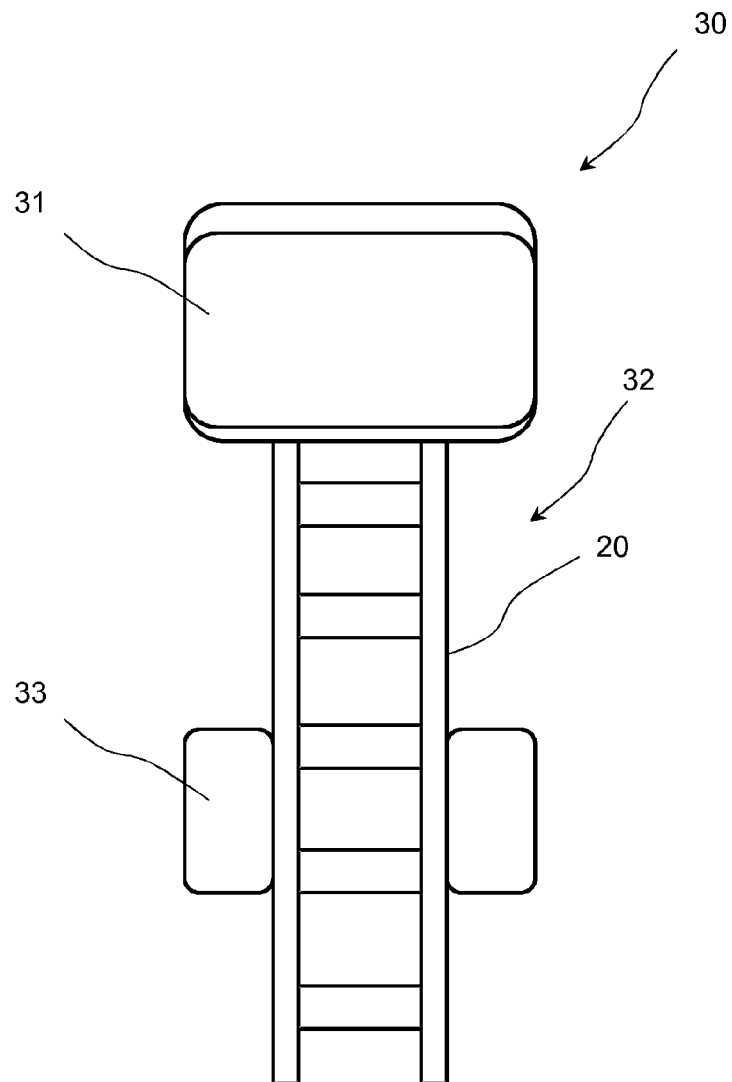


Fig. 4





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Application Number  
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 February 2014	Examiner Augé, Marc
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