(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 900 910 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.03.1999 Bulletin 1999/10

(51) Int. Cl.[6]: **E06C 5/04**, E06C 1/12

(21) Application number: **98116696.0**

(22) Date of filing: **03.09.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **05.09.1997 DE 19738886**

(71) Applicant: **IVECO MAGIRUS AG**
D-89079 Ulm (DE)

(72) Inventors:
- **Keller, Paul**
  89601 Schelklingen (DE)
- **Hörsch, Heiner**
  89179 Beimerstetten (DE)

(74) Representative:
Jorio, Paolo et al
STUDIO TORTA S.r.l.,
Via Viotti, 9
10121 Torino (IT)

(54) Ladder assembly for fire brigade ladders

(57) In a fire brigade ladder with telescopic ladder sections (10,12,14,16,18,20) the bottom booms comprise two separately produced welded-together self-contained hollow rolled profile (56,58). The hollow rolled profiles form the necessary vertical and horizontal outer surfaces for the support of guide rollers and the mounting of the rungs (38,40,42,44,46,48), and also the diagonal struts (24) of the lateral railings. Moreover, the hollow rolled profiles form a guide strip (90) for the next higher ladder section. The hollow rolled profiles (56,58) are so designed that the complete structure formed by welding the hollow rolled profiles has internally diagonally arranged bracing walls for reinforcement.

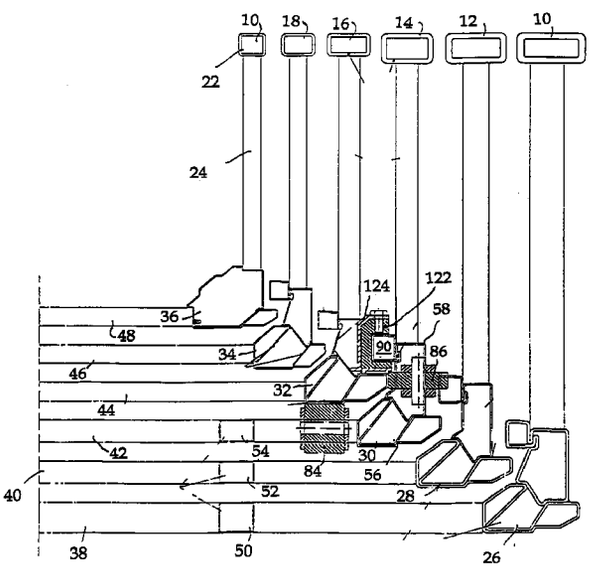

Fig. 1

EP 0 900 910 A1

Description

[0001] The invention relates to a ladder assembly for fire brigade ladders having a number of ladder sections which are guided in one another and can be telescopically extended, each of which ladder sections has two bottom booms, a number of rungs joining the latter, two top booms and also diagonal struts on both sides between the bottom booms and the top booms.

[0002] Extending ladder assemblies of this type have long been used for fire and emergency protection, since they offer the possibility of operating at great heights, in particular at high buildings. The individual ladder sections are of generally similar U-shaped cross-section but decreasing in size from one ladder section to the next, and have two bottom booms, which are joined by rungs, and two top booms which are connected with the bottom booms via generally diagonally arranged struts. Known fire brigade ladders of this type are illustrated, for example, in the Applicant's DE 36 25 298 or in DE 42 06 448 C2. The known designs differ, inter alia, in respect of the booms generally formed as a hollow section, the arrangement of roller and sliding guides, and the type of connection between the individual booms, rungs and struts.

[0003] Despite numerous improvements which have been brought about in recent years the ratio of rigidity to weight and production costs is, as before, unsatisfactory. The mutual guidance of the individual ladder sections is inaccurate. The ladders necessitate high labour costs for painting, maintenance and lubrication.

[0004] Therefore, the invention is based on the object of devising a ladder assembly of the initially mentioned type, which has high rigidity with relatively low weight, while the production costs are relatively low.

[0005] In a ladder assembly of the initially mentioned type this object is achieved in that the bottom booms comprise two separately produced, interconnected and self-contained hollow rolled profiles, and in that the profile cross-sections of the hollow rolled profiles are so formed that diagonally extending reinforcing webs are provided in the interior of the joined-together bottom boom.

[0006] Modern cold rolling processes make it possible to produce even complicated profile cross-sections which can be optimised for the respective application, directly by cold rolling and without further finishing work. Whereas conventional profiles for the bottom booms of fire brigade ladders were generally simple box sections, the invention offers the possibility of providing profiles which in each partial zone are specially cut to size according to the respective loading. For example it is possible to produce zones with particular pressure loading capacity by surface doubling or additionally reinforcing effects can be achieved by diagonally arranged surfaces. The drawback in respect of production engineering that the bottom boom profiles have to be assembled from two hollow rolled sections is largely compensated by the advantages obtained. The use of two hollow rolled sections also offers the possibility of producing individual zones of the bottom boom profile in different wall thicknesses. This satisfies the general requirement for light construction. The multiple voluminous box structure of the bottom boom is so rigid that unlike previous structures it is possible to carry out butt-welding of rungs and diagonal struts.

[0007] Preferably, the first hollow rolled profile is of generally U-shaped cross-section with lateral webs which, in relation to the ladder, are directed outwardly inclined and are formed as hollow profiles, the outer and inner material layers of which are connected over the bottom surface of the U-section, and the second hollow rolled profile comprises two substantially box-like profile zones, the lower of which for support and mounting on the upper ends of the lateral webs of the U-shaped first hollow rolled profile has corresponding support surfaces and the second of which is arranged on the upper end of the inner surface of the first zone, in relation to the ladder, and the wall material of which merges into the wall material of the first zone via a plurality of strips of material folded over one another several times.

[0008] In view of the complexity of the cross-sectional shape of the two hollow rolled profiles reference is now made to the accompanying drawings which will be explained subsequently. The profiles are produced solely by rolling. In this process the first hollow rolled profile, which in the composite structure of the two hollow rolled profiles is situated at the bottom, on the one hand is designed for high rigidity but, on the other hand, is also intended to offer a horizontal and vertical running surface for guide rollers, as will also be explained subsequently. The second area of the second hollow rolled profile, which is preferably of almost square cross-section, forms the guide strip for sliding guides of the next higher ladder section. The second area of the second hollow rolled profile is subject to substantial upwardly directed forces via the sliding guides, so that there is a danger of it being deformed. Therefore, the two areas of the second hollow rolled profile are so joined together in a form-locking manner at their transition by profile edges of hook-shaped cross-section that the second area is braced against deformation upwardly on the first zone, as will be illustrated below in the description of one example of embodiment.

[0009] The individual ladder sections will be described below with reference to their position in an erected ladder. The first or outer ladder section mounted on a so-called erecting carriage is designated as the lower ladder section and the opposite inner and final ladder section is designated as the upper ladder section. In the description of the hollow rolled profiles the terms upper and lower are also used with reference to the ladder erected to a greater or lesser extent. The terms inner and outer are to be used from the view point of an observer standing on the ladder, unless otherwise defined.

[0010] Preferably, the inner web of the first hollow rolled profile, in relation to the ladder, has a vertical inner surface for directly accommodating the rungs and a horizontal upper surface as connecting surface for the second hollow rolled profile, and the inner surface and the upper surface are connected via two substantially parallel diagonal surfaces. Therefore, it is possible for the rungs to be directly butt-welded at the vertical inner surface. In conventional ladders additional connecting straps or angle members are generally required.

[0011] The outer web of the first hollow rolled profile, in relation to the ladder, has, going in clockwise direction, an inner surface directed obliquely upwards and outwards, a horizontal upper surface for connection to the second hollow rolled profile, a vertically downward directed outer surface, an outer diagonal surface directly obliquely downwards and inwards, and horizontal bottom surfaces. The vertical outer surface serves as a running surface for guide rollers. Similarly, the horizontal base surface of the U-section of the first hollow rolled profile, which is formed from two superimposed material layers, serves as a running surface for guide rollers. Since this surface has to accommodate the occasionally very high vertical forces, the doubling of the material layers has been found to be especially advantageous.

[0012] Preferably, the second zone of the second hollow rolled profile, excluding on the side facing the first zone, is covered by a substantially U-shaped covering profile, in particular of stainless steel. Together with a plastics sliding guide to be explained below this covering profile makes it possible to dispense with grease lubrication. The cost of cleaning and maintenance are thereby considerably reduced. Moreover, the covering makes possible complete surface protection by painting, plastic coating or zinc-plating. Without protection by the covering it would not be possible to achieve long-lasting surface protection of this type because of the high surface pressures.

[0013] Preferably, the second zone of the second hollow rolled profile is provided on the mutually opposite sides covered by the covering profile with indented beads in which the inwardly salient edge beads of the covering profile engage. Furthermore, since the covering profile has a certain degree of preloading uniting the webs on both sides of the cross-section, the covering profile can be clipped on to the second hollow rolled profile. No further fastening is then necessary.

[0014] The already mentioned sliding guide is preferably situated at the lower end of the ladder sections following the lower ladder section. This sliding guide is so formed that it embraces the covering profile on the second zone of the second hollow rolled profile at the respectively next lower ladder section. The sliding guide can be retained in a mounting, in particular consisting of a steel casting, welded to the rear end of the respective corresponding bottom boom.

[0015] In addition to these sliding guides, the ladder sections, excluding the last or top ladder section, have at their upper ends rollers which are situated opposite the base surfaces of the U-section of the first hollow rolled profile of the next higher ladder section.

[0016] Furthermore, these ladder sections have rollers with a vertical axis, which are situated opposite the vertical outer surface of the outer web of the first hollow rolled profile.

[0017] As already mentioned, the rungs are preferably butt-welded to the vertical inner surface of the first hollow rolled profile.

[0018] In the interests of rational production, there are used for the individual ladder sections partly identical hollow rolled profiles and partly hollow rolled profiles which are similar but adjusted in size.

[0019] For the decrease in stages in the cross-sections of the bottom booms from the lower to the upper ladder section it is generally sufficient in each stage to replace only one of the two hollow rolled profiles with a smaller one, whereas one of the hollow rolled profiles can be used for two consecutive ladder sections. In this case, as will be evident from the example of embodiment illustrated in the drawing, six different profiles are required, for example, for five ladder sections which can slide telescopically into one another and which decrease in stages in cross-section. Instead of or in addition to a variation in the dimensions of the individual hollow rolled profiles in stages, it is also possible for the wall thicknesses of the material to be varied. Preferably, a simplified hollow rolled profile can be used for the top ladder section.

[0020] The guide rollers at the upper ends of the ladder sections have to accommodate substantial forces which result in high surface pressures on the booms. Therefore, in the case of relatively large ladders generally four guide rollers are used on both sides. In the interests of uniform loading of the associated running surface and the rollers, the guide rollers are as a rule mounted in a running gear and then sometimes on lower running gear. This results in high construction costs and a bulky design. According to the invention, the lower running gear is completely eliminated. All four rollers are disposed one behind the other in the only running gear provided. In this running gear the axes of the two outer guide rollers of a four-roller assembly are disposed slightly higher than those of the two inner guide rollers, that is in such a way that when the maximum expected loading occurs by deformation of the fillets the running surfaces of all four rollers are situated substantially in one plane. Therefore, the load is distributed uniformly to all four rollers. When using a suitable resilient material, the lateral fillets can be precisely designed and dimensioned so that the aforementioned desired deformation takes place. This gives rise to structural simplification and a considerable reduction in construction costs. Furthermore, an essential advantage arises in that the suspension according to the invention is considerably shorter than a conventional suspension with four

rollers and two lower running gear sets. Therefore, the roller guide according to the invention can be installed in the free space between two consecutive ladder rungs.

[0021] The bottom booms according to the invention comprising two hollow rolled profiles have, above all, the advantage of high rigidity. This is based on the fact that the bottom booms are not only designed, as in the state of the art, as a more or less box-like hollow section but have additional diagonal inner bracing and, moreover, because of the arrangement of the different surfaces can be designed from many aspects to take the respectively prevailing loads into account. Therefore, the high degree of rigidity must in no way be gained at the expense high quantities of material. A very favourable ratio of rigidity to weight is achieved.

[0022] Preferred examples of embodiment of the invention will be illustrated in more detail below with reference to the accompanying drawings.

Fig. 1 is a schematic reduced section through a ladder assembly with six ladder sections;

Fig. 2 is an enlarged partial illustration of a cross-section of a bottom boom with its surroundings;

Fig. 3 is an exploded view in section of the upper partial zone of the bottom boom according to Fig. 2;

Fig. 4 is a schematic side view of a ladder assembly with two ladder sections;

Fig. 5 is a perspective view of a conventional roller guide with four guide rollers;

Fig. 6 shows a corresponding roller guide according to the invention.

[0023] The partial cross-section through a ladder assembly according to the invention shown in Fig. 1 has six ladder sections which are guided telescopically into one another and which will be designated from the bottom upwards or from the outside inwards also as the first to the sixth ladder section and bear the reference numerals 10,12,14,16,18,20. It is evident that Fig. 1 only shows the right-hand half of the cross-section. The left-hand half is formed symmetrically thereto and, therefore, needs neither to be illustrated nor explained. The individual ladder sections 10 to 20 have top booms 22 which decrease in stages in their cross-sectional area from the first to the sixth ladder section. The same applies to the dimensions of the diagonal struts 24 which brace the top booms 22 in the manner of railing struts against the bottom booms shown adjoining.

[0024] The individual ladder sections 10 to 20 have bottom beams 26,28,30,32,34,36 which are similar to one another in cross-section and configuration but differ in details, and to which the diagonal struts 24 are connected. On both sides of the ladder sections the bottom booms are connected by horizontal rungs 38,40,42,44,46,48. The rungs 38,40,42 of the three lower ladder sections 10,12,14 are joined together by longitudinal tubes 50,52,54 so that the effective rung width is shortened on both sides and the sturdiness of the rungs is increased.

[0025] With reference to Figs. 1 and 2 taking the example of the bottom boom 32 of the fourth ladder section 16, the construction of the bottom booms will be described in the following. The bottom boom 32 is assembled from a first hollow rolled profile 56 and a second hollow rolled profile 58 which are securely joined together to form a unit. The cross-sectional shape of the first hollow rolled profile 56 can very loosely be designated as being U-shaped. The two webs 60,62 of the U are in this case formed as hollow chambers inclined to the right in Figs. 1 and 2. The left-hand or inner web 60 comprises a vertical inner surface, to which the rung 44 is butt-welded, a horizontal upper surface 66 and two approximately parallel diagonal surfaces 68,70 connecting the ends of the two surfaces 64 and 66. The right-hand web 62 comprises a vertically ascending inner surface 72, a horizontal upper top upper surface 74 following in clockwise direction, a vertically downwards directed outer surface 76, a diagonal surface 78 directed therefrom obliquely inwards and downwards, and a horizontal lower top surface 80.

[0026] As is evident in Figs. 1 and 2, the upper horizontal surface 66 of the inner web 60 of the first hollow rolled profile 56 is situated substantially higher than the horizontal upper surface 74 of the outer web 62.

[0027] A double-layer base surface 82 is created in the vicinity of the bottom of the U-section of the first hollow rolled profile described here, since the wall material of the two webs is drawn downwards within the U-section up to the base surface 82. The doubling of the material layer in the vicinity of the base surface is wholly intentional, since this base surface 82 forms the running surface for the roller guide 84 which is mounted in the next lower ladder section 14. A further roller guide 86 with a vertical axis of rotation bears on the vertical outer surface 76 of the hollow rolled profile 56.

[0028] The second hollow rolled profile 58 will be described in the following. This second hollow rolled profile 58 comprises two substantially box-like zones 88 and 90. The first zone 88 is connected with the first hollow rolled profile 56, whereas the second zone 90 serves as a guide strip for the next higher ladder section, as will be described in more detail below. In the embodiment according to Fig. 2, the first zone 88 of the second hollow rolled profile 58 has firstly a horizontal upper surface 92, to which the diagonal struts 24 are butt-welded.

[0029] Starting from this horizontal upper surface 92 there follow, going in clockwise direction, a vertical outer surface 94, an obliquely downward and inwardly

directed diagonal surface 96, an obliquely inward but upwardly directed diagonal surface 90, a horizontal surface 100 and a slightly outwardly directed inner surface 102. The diagonal surface 96 and the horizontal surface 100 serve for support on the upper surfaces 66 and 74 of the two webs 60,62 of the first hollow rolled profile. In the embodiment illustrated in Fig. 2 the contact surfaces between the two hollow rolled profiles 56,58 are relatively small. Fig. 1 shows that in the outer bottom booms 26,28,30 subject to greater loading the surface contact between the two hollow rolled profiles is more extensive. Advantageously, the two hollow rolled profiles are welded using laser technology.

[0030] Since the inner web 60 of the first hollow rolled profile 56 is substantially higher than the outer web 62, the diagonal surface 98 of the second hollow rolled profile 58 extends diagonally to the principal support and guide surfaces and the principal force directions of the bottom booms.

[0031] The second zone 90 of the second hollow rolled profile forms a cavity which is entirely separated from the first zone 88. The cross-section of the second zone 90 is rectangular or even approximately square. It comprises an inner surface 104 which is vertical with respect to the ladder assembly, upper and lower substantially horizontal surfaces 106,108 and an outer surface 110, with which the zone 90 adjoins the first zone 88. At the transition between the first zone 88 and the second zone 90 the wall material is folded over on both sides. A downwardly directed profile strip 109 of hook-like cross-section is thereby formed at the transition between the horizontal surfaces 92 and 106 of the first and second zones 88,90, whereas a corresponding upwardly directed profile strip 111, formed by superimposition of the material, is formed at the transition between the horizontal lower surface 108 of the second zone 90 and the inner surface 102 of the first zone 88. It is evident in particular in Fig. 3 that the upwardly directed profile strip 111 engages behind the downwardly directed profile strip 109, so that the second zone 90 is additionally braced against upwardly directed forces at the first zone. Any deformation of the second zone 90 serving as a guide strip is further prevented thereby and effects an additional form-locking support.

[0032] The above-described construction of the bottom booms from the first hollow rolled profile 56 and the second hollow rolled profile 58 ensures that diagonally arranged partitions are disposed inside the closed profile, namely the diagonal surfaces 70,72 and 98. This inner bracing contributes substantially to the reinforcement of the bottom booms.

[0033] Indented beads 112,114 are formed in the upper and lower surfaces 106,108 of the second zone 90. These beads serve to locate a covering profile 116 of substantially U-shaped cross-section, which has inwardly drawn beads 118,120 at both edges, which make it possible for the covering profile 116 to engage on the second zone 90 of the second hollow rolled profile and to be located in form-locking manner in the beads 112,114. Further fastening means are then no longer required. For example, the covering profile 116 consists of stainless steel. It serves to protect the surface of the second zone 90 of the second hollow rolled profile which serves as a guide strip for the next higher ladder section.

[0034] Guidance takes place by means of a sliding guide 122 in the form of a block of U-shaped cross-section, which externally embraces the zone 90 with the covering profile 116. The sliding guide may consist of a suitable plastics material which together with stainless steel has a low coefficient of friction, so that it is possible to dispense with conventional grease lubrication. Since the sliding guide 122 slides exclusively on the covering profile 116, no damage to the surface of the two hollow rolled profiles 56,58 of the bottom boom can occur. Any corrosion protection applied is retained permanently and does not need to be continuously renewed. Therefore, maintenance costs are low.

[0035] The lower boom 36 of the smallest inner ladder section 18 is of simplified profile which, in particular, is designed for a large cross-section and thus with high torsional and bending stiffness. In general, there are two aspects in respect of the strength of the bottom booms of the present type, namely, on the one hand, the so-called global stiffness of the bottom boom in its totality with respect to accommodating bending and torsional loads and, on the other hand, the local stability in relation to loads which are applied within closely defined areas. Since the bottom boom 36 of the inner ladder section is not loaded by the upwardly directed forces exerted by a sliding guide of a following ladder section, the relatively expensive inner bracing of the other bottom booms is not required. However, the inner bottom boom 36 is provided with material doubling by superimposed layers in the undesignated bottom surface which bears against the rollers of the next lower ladder section. Moreover, a running surface supported by inner bracing is provided for the lateral guide rollers which subject the bottom boom to substantially lower loads.

[0036] Fig. 4 shows a schematic overall side view of the arrangement of the sliding guides 122 and the roller guides 84,86. Fig. 4 illustrates an outer or lower ladder section, for example the third ladder section 14 in Fig. 1, correspondingly designated 14 and illustrated in chain line, and the next higher ladder section accordingly bears the reference numeral 16. This ladder section is indicated in solid line. As is also illustrated in Fig. 1, the sliding guide 122 is secured to the bottom boom at the lower end of the upper or inner ladder section 16. As has already been described in detail, the bottom boom 32 is disengaged in this region and the sliding guide 22 is embedded in a mounting 124 which, in particular, consists of a steel casting. This sliding guide 122 is displaceable on the second zone 90 of the second hollow rolled profile 58, as indicated in Fig. 1. Fig. 1 also shows the lower roller guide 84 and the lateral roller guide 86,

which are disposed at the front end of the next lower ladder section 12, as is also evident in Fig. 4. The two roller guides and the sliding guide 122 make it possible to achieve a connection of the individual ladder sections substantially without play.

[0037] The lower roller guides 84 will be described below with reference to Figs. 5 and 6 for a preferred embodiment.

[0038] Because of the high forces and thus high loading of the individual guide rollers 126,128,130,132 these rollers are usually suspended in sliding gear so that the prevailing forces are automatically distributed uniformly. In a conventional roller guide 84 according to Fig. 5 two lateral fillets 134,136 are provided which can rotate about a rolling gear axis 138. In the end zones of the fillets 134,136 there are disposed further sliding gear axes 140,142 about which two lower rolling gear sets 144,146 can rotate. These rolling gear sets 144,146 each carry two of the guide rollers, that is, on the one hand, the guide rollers 126,128 and, on the other hand, the guide rollers 130,132. In a construction of this type all the guide rollers adjust themselves automatically according to the geometry of the associated running surface and the prevailing load. However, production costs are relatively high and the complete roller guide is bulky.

[0039] However, in the roller guide according to the invention, which is shown in Fig. 6 and also bears the reference number 84, only two lateral fillets 148,150 are provided which are connected by a rolling gear axis 152 and can pivot about the latter. Respective pairs of guide rollers 126,128,130,132 disposed immediately one behind the other are situated on either side of this rolling gear axis 152. As indicated by centre lines and arrows in Fig. 6, the axes of rotation 154,156 of the two outer guide rollers 126,132 are situated slightly higher than the axes of rotation 158,160 of the two inner guide rollers 128,130. It is evident from the preceding description and Figs. 1 and 2 in particular that the rollers which are mounted in the ladder section support from below the respectively inwardly following ladder section.

[0040] Therefore, under low loading only the two outer rollers are load bearing, which have a sufficiently large distance apart so that any local overloading of the supported bottom boom is avoided. If the load increases, the lateral fillets 148,159 are bent by the downwardly directed forces applied via the outer rollers 126,132 and by the upwardly directed forces accommodated via the rolling gear axis 152 in such a way that, finally, all four rollers bear against the ladder profile to be supported. In this case the lateral fillets 148,150 are designed and calculated specifically with respect to the aforesaid bending. They consist of a material having a suitable modulus of elasticity with respect to the desired deformation. At maximum load all four rollers are thus uniformly loaded.

[0041] In this way the roller guide can overall be of shorter design than the roller guide according to Fig. 5 with two lower rolling gear sets and it is possible for the roller guide to be installed in the space between two consecutive rungs of a ladder section.

[0042] Furthermore, construction costs are considerably lower since it is possible to dispense with the two lower rolling gear sets together with these pivot axes. The weight of the ladder assembly is also reduced.

Claims

1. A ladder assembly for fire brigade ladders having a number of ladder sections (10,12,14,16,18,20) which are guided in one another and can be telescopically extended, each of which ladder sections has two bottom booms (26,28,30, 32,34,36) a number of rungs (38,40,42,44,46,48) joining the latter, two top booms (22) and also diagonal struts (24) on both sides between the bottom booms and the top booms, characterised in that the bottom booms (26,28,30,32,34,36) comprise two separately produced, interconnected and self-contained hollow rolled profiles (56,58), and in that the profile cross-sections of the hollow rolled profiles (56,58) are so formed that diagonally extending reinforcing webs (70,72,98) are provided in the interior of the joined-together bottom boom.

2. A ladder assembly according to Claim 1, characterised in that the first hollow rolled profile (56) is of generally U-shaped cross-section with lateral webs (60,62) which are directed outwardly inclined and are formed as hollow profiles, the outer and inner material layers of which are connected over the bottom surface (82) of the U-section, and in that the second hollow rolled profile (58) comprises two substantially box-like profile zones (88,90), the first of which for support and mounting on the upper ends of the lateral webs (60,62) of the U-shaped first hollow rolled profile (56) has corresponding support surfaces (96,100) and the second of which (90) is arranged as a guide strip for the next higher ladder section and on the upper end of the inner surface (102) of the first zone, in relation to the ladder, and the wall material of which merges into the wall material of the first zone (88) via a plurality of strips of material folded over one another.

3. A ladder assembly according to Claim 2, characterised in that at the transition between the first zone (88) and the second zone (90) the wall material is strengthened from the top and bottom to form double-layered profile strips (109,111), and in that the profile strips (109,111) engage one behind the other in hook-like manner for secure anchoring of the second zone (90) on the first zone (88).

4. A ladder assembly according to any one of Claims 1 to 3, characterised in that the inner web (60) of

the first hollow rolled profile (56), in relation to the ladder, has a vertical inner surface (64) for directly accommodating the rungs (38,40,42,44,46,48) and a horizontal upper surface (100) as connecting surface for the second hollow rolled profile (58), and in that the inner surface (64) and the upper surface (100) are connected via two substantially parallel diagonal surfaces (68,70).

5. A ladder assembly according to any one of the preceding Claims, characterised in that the inner web (60) is higher than the outer web (62).

6. A ladder assembly according to any one of the preceding Claims, characterised in that the outer web (62) of the first hollow rolled profile (56), in relation to the ladder, has, going in clockwise direction, an inner surface (72) directed obliquely upwards and outwards, a horizontal upper surface (74) for connection to the second hollow rolled profile (58), a vertically downward directed outer surface (76), an outer diagonal surface (78) directly obliquely downwards and inwards, and a horizontal bottom surface (80).

7. A ladder assembly according to any one of the preceding Claims, characterised in that the support surfaces (96,100) of the second hollow rolled profile (58) are situated at different heights according to the different heights of the webs (60,61) and are connected by a diagonal surface (98).

8. A ladder assembly according to any one of the preceding Claims, characterised in that the two hollow rolled profiles (56,58) are welded using laser technology.

9. A ladder assembly according to any one of the preceding Claims, characterised in that the second zone (90) of the second hollow rolled profile (58), excluding on the side facing the first zone (88), is covered by a substantially U-shaped covering profile (116), in particular of stainless steel.

10. A ladder assembly according to Claim 9, characterised in that the second zone (90) of the second hollow rolled profile (58) is provided on the mutually opposite sides (106,108) covered by the covering profile has indented beads (112,114) in which the inwardly salient edge beads (118,120) of the covering profile (116) engage.

11. A ladder assembly according to any one of the preceding Claims, characterised in that a sliding guide (122) is secured at the lower end of the ladder sections (12,14,16,18,20) following the first ladder section (10), which sliding guide embraces the second zone (90) of the second hollow rolled profile (58) in the vicinity of the covering profile (116) of the next outer ladder section.

12. A ladder assembly according to Claim 11, characterised in that the sliding guide (122) is retained in a mounting (124), in particular consisting of a steel casting, welded to the rear end of the respective correspondingly disengaged bottom boom (28,30,32,34,36).

13. A ladder assembly according to any one of the preceding Claims, characterised in that the ladder sections (10,12,14,16,18), excluding the top ladder section (20), have at their upper ends roller guides (84) which are situated opposite the base surface (82) of the first hollow rolled profile (56) of the next higher ladder section.

14. A ladder assembly according to any one of the preceding Claims, characterised in that the ladder sections (10,12,14,16,18), excluding the top ladder section (20), have at their upper ends roller guides (86) which are situated opposite the vertical outer surfaces (76) of the first hollow rolled profile (56).

15. A ladder assembly according to any one of the preceding Claims, characterised in that the rungs (38,40,42, 44,46,48) are butt-welded to the vertical inner surfaces (64) of the first hollow rolled profile of the bottom booms.

16. A ladder assembly according to any one of the preceding Claims, characterised in that the bottom booms (26,28,30,32,34,38) consists of high-strength cold rolled strip.

17. A ladder assembly according to any one of the preceding Claims, characterised in that the hollow rolled profiles (56,58) of the ladder sections (10,12,14,16,18,20) are formed corresponding to one another in cross-section, with dimensions decreasing from the bottom to the top ladder section.

18. A ladder assembly according to Claim 17, characterised in that in the series of the ladder sections (10,12,14,16,18,20), in the case of two consecutive ladder sections, one of the hollow rolled profiles is of like dimensions and one is of different dimensions.

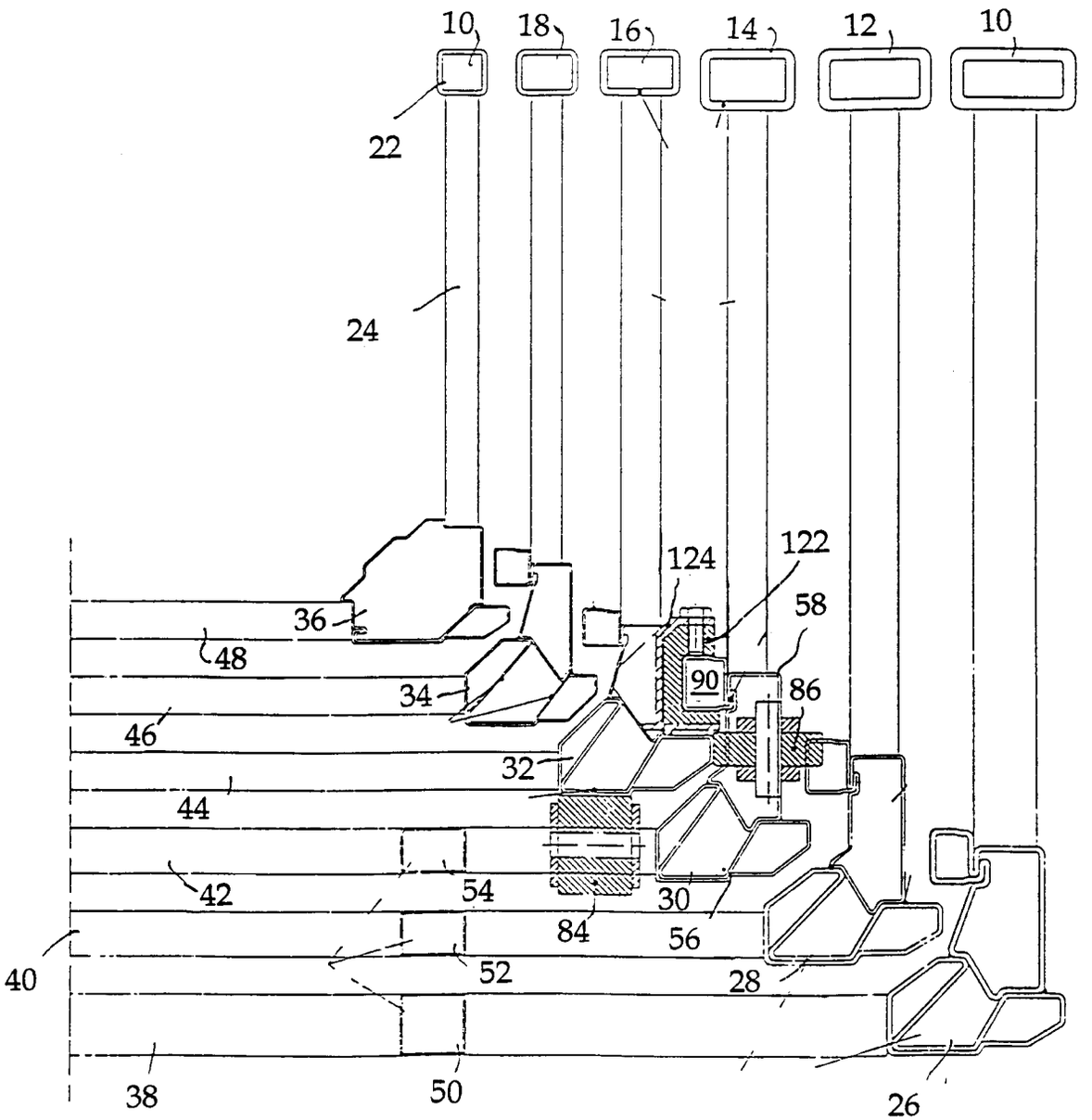
10
18
16
14
12
10
22
24
124
122
58
36
48
90
86
34
46
32
44
42
54
30
84
56
40
52
28
38
50
26

Fig. 1

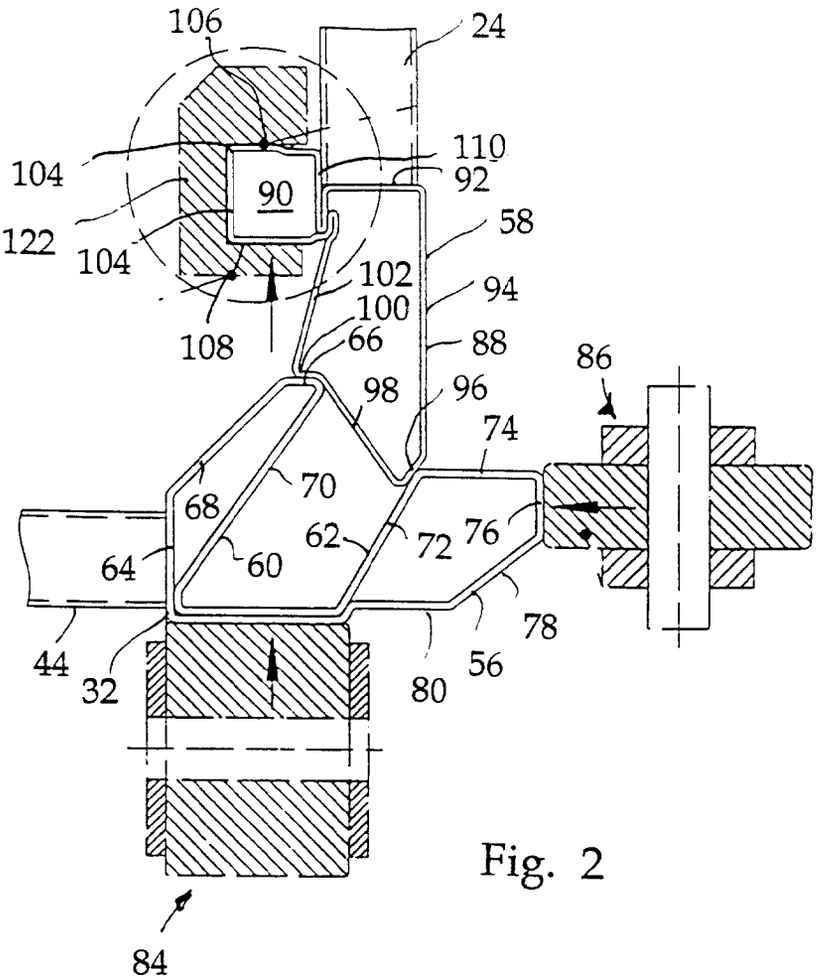
106
24
104
110
90
92
122
104
58
102
94
100
108
66
88
86
98
96
74
70
68
62
72
76
64
60
78
44
32
80
56
84

Fig. 2

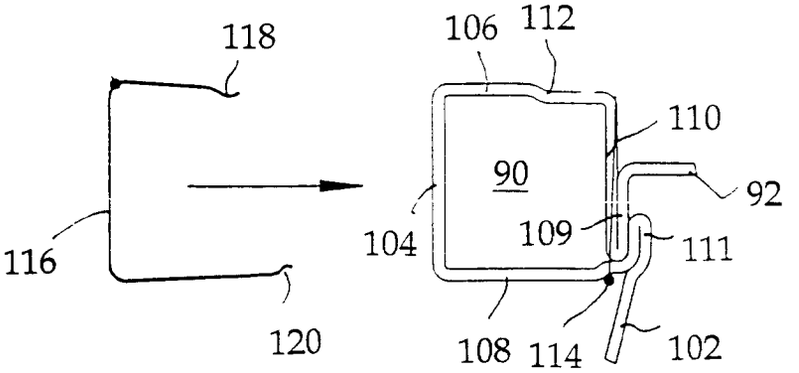
118
106
112
110
90
92
116
104
109
111
120
108
114
102

Fig. 3

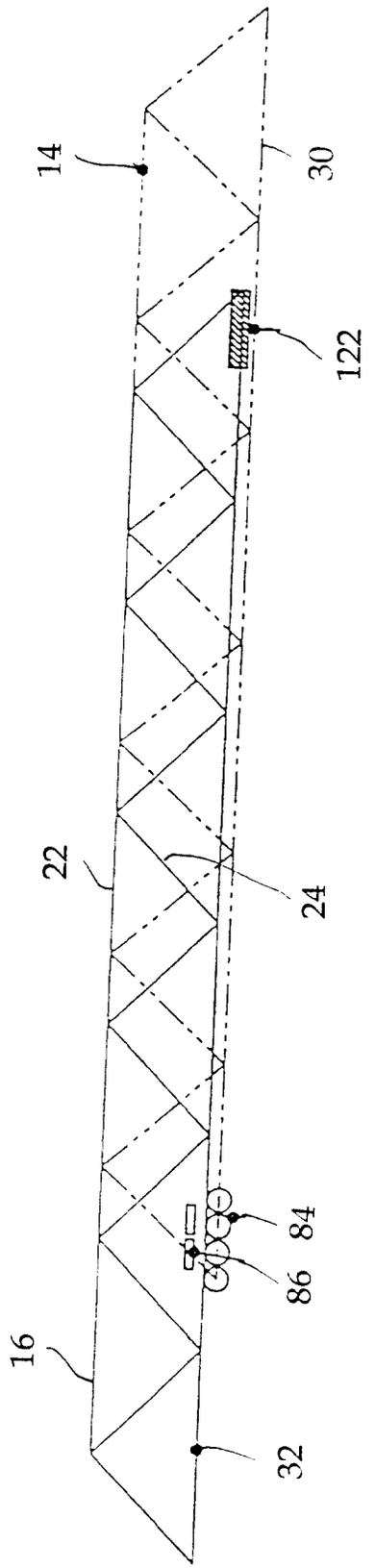

Fig. 4

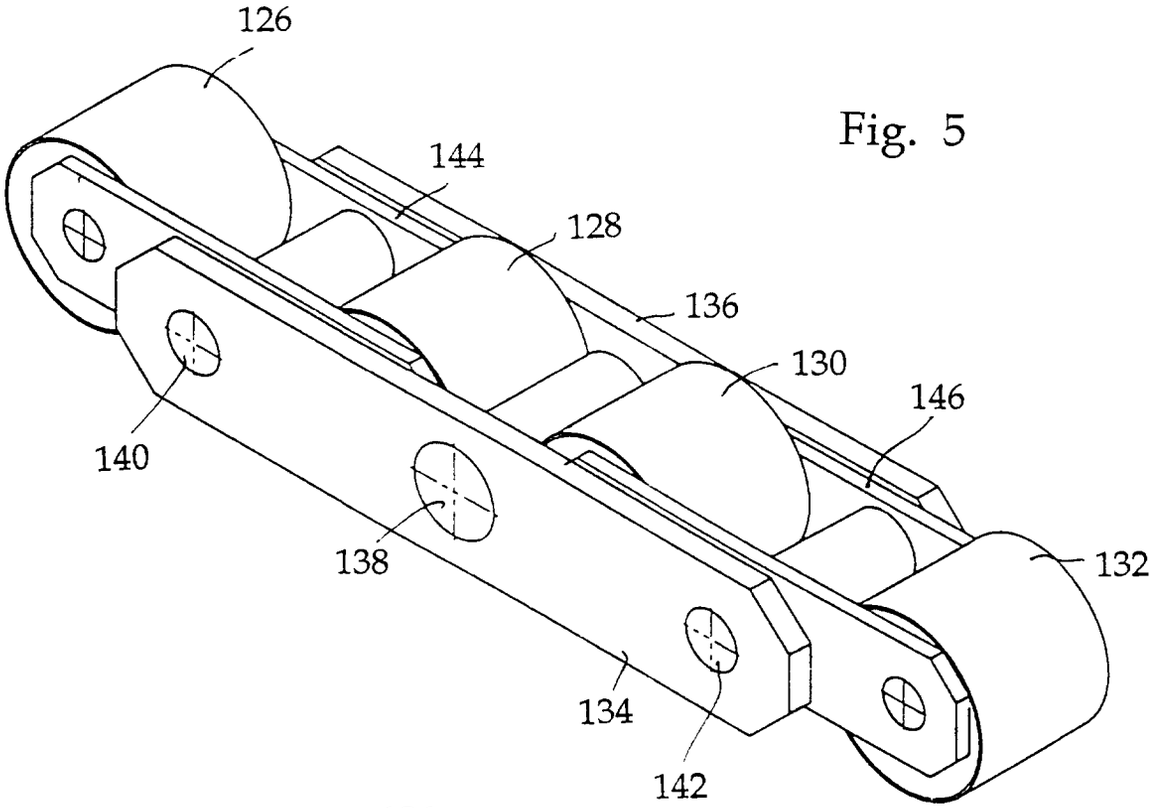
126
144
128
136
130
146
140
138
132
134
142

Fig. 5

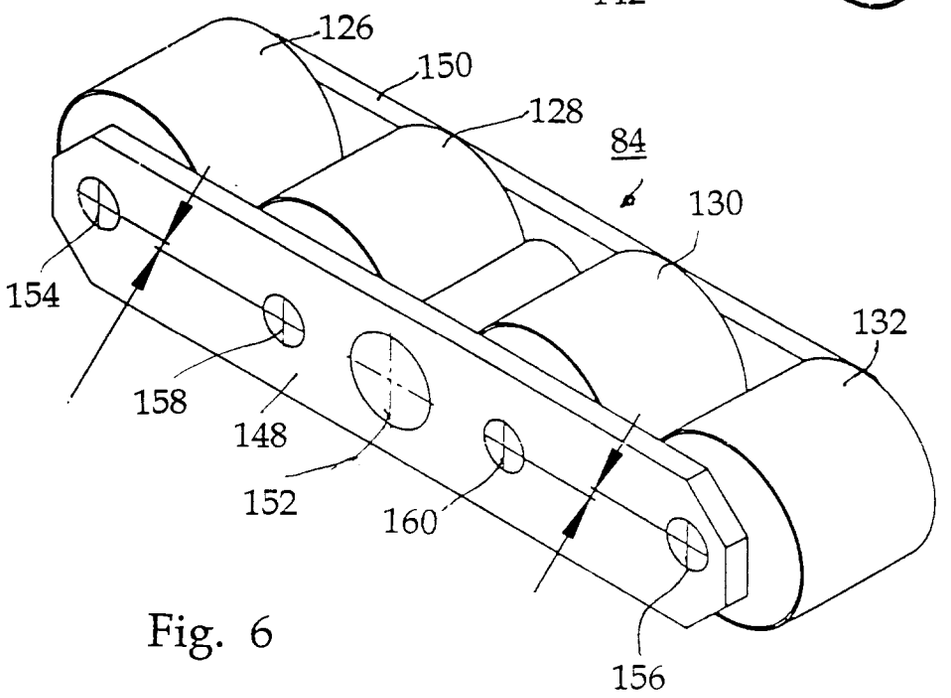
126
150
128
84
130
154
132
158
148
152
160
156

Fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 11 6696

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	DE 36 25 298 A (IVECO) 29 October 1987 * column 5, line 35 - line 60; figures *	1-18	E06C5/04 E06C1/12
A	EP 0 243 765 A (IVECO) 4 November 1987 * page 4, last paragraph - page 5, paragraph 1; figures *	1-18	
A	DE 28 44 439 A (MAGIRUS-DEUTZ) 17 April 1980 * page 4, paragraph 3 - paragraph 4; figures *	1	
A	DE 27 16 543 A (GMELIN) 14 December 1978 * page 7; figures *	1	
D,A	DE 42 06 448 A (FGL GMBH) 30 September 1993 * abstract; figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E06C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 October 1998	Righetti, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 11 6696

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-10-1998

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3625298 A	29-10-1987	EP 0244668 A	11-11-1987
		JP 2064782 C	24-06-1996
		JP 7103761 B	08-11-1995
		JP 62260985 A	13-11-1987
		DE 3625296 A	29-10-1987
		EP 0243765 A	04-11-1987
		JP 2109028 C	21-11-1996
		JP 8026738 B	21-03-1996
		JP 62260986 A	13-11-1987
EP 243765 A	04-11-1987	DE 3625296 A	29-10-1987
		DE 3625298 A	29-10-1987
		EP 0244668 A	11-11-1987
		JP 2064782 C	24-06-1996
		JP 7103761 B	08-11-1995
		JP 62260985 A	13-11-1987
		JP 2109028 C	21-11-1996
		JP 8026738 B	21-03-1996
		JP 62260986 A	13-11-1987
DE 2844439 A	17-04-1980	NONE	
DE 2716543 A	14-12-1978	NONE	
DE 4206448 A	30-09-1993	EP 0617192 A	28-09-1994

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82