



(51) International Patent Classification:
E06C 1/12 (2006.01)

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(21) International Application Number:
PCT/EP2014/066026

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(22) International Filing Date:
25 July 2014 (25.07.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PA201300456 9 August 2013 (09.08.2013) DK
PA201300686 11 December 2013 (11.12.2013) DK

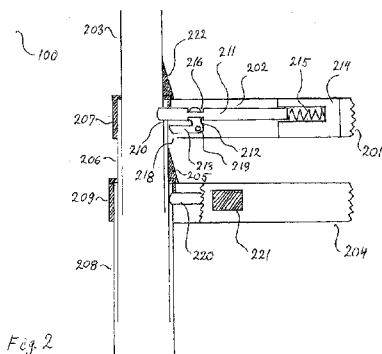
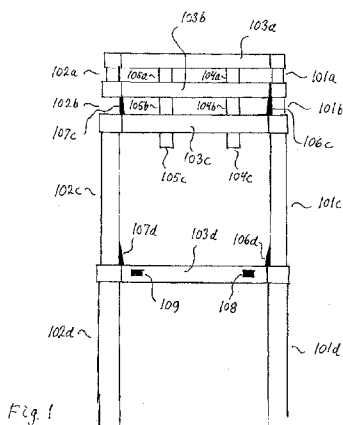
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(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

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(54) Title: COLLAPSIBLE LADDER



(57) Abstract: There is provided a collapsible ladder comprising several collapsible ladder sections, each or at least part of the ladder sections comprising two hollow ladder bars arranged parallel to each other and interconnected at an upper end by a rung, and each collapsible ladder section being telescopically inserted into a lower ladder section. Each ladder bar of a collapsible ladder section has a locking hole adjacent the lower end part of the ladder bar and an extension below the locking hole. Retaining mechanisms are provided in at least part of the rungs for locking the collapsible ladder sections relative to one another when the collapsible ladder sections are extended, each of or part of said retaining mechanisms comprising a locking pin, which can be brought into an extended and locked position in order to engage a corresponding locking hole provided in the ladder bar of a ladder section positioned there above, and each of or part of said retaining mechanisms further comprising a release part with a release lever or arm for retracting the locking pin from the locked position into the un-locked position. For at least one lower ladder section two actuating elements are provided on top of the rung of the lower ladder section with one actuating element at each end of the rung, each said actuating element being arranged for actuating a release lever of a retaining mechanism provided in the rung of an above positioned ladder section, and each of said actuating elements having an inner side face extending in a direction along a corresponding ladder bar of the above positioned ladder section. It is preferred that an upper part of an outer side face of the actuating element is inclined inward towards the ladder bar resulting in an acute angle α of not above 45° between the ladder bar and the upper part of the outer side face of the actuating element. Thus, the actuating element may urge the fingers or a body part of a user to be displaced laterally when the rung of the above ladder section is moving downwards when collapsing the ladder. It is also preferred that the release levers or arms of the above positioned ladder section has an at least partly inclined or convex end part for contacting the inclined upper part of the corresponding actuating elements of the lower ladder section.



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG). **Published:**

— with international search report (Art. 21(3))

COLLAPSIBLE LADDER

FIELD OF INVENTION

- 5 The present invention relates to a collapsible ladder of the type comprising U-shaped ladder sections being telescopically inserted in each other.

BACKGROUND OF THE INVENTION

- 10 Ladders having collapsible and expandable ladder sections are used in order to make the ladder smaller for storage and transport purposes.

In the European patent EP-B1-0 527 766 a collapsible ladder is described comprising ladder bars divided into sections interconnected by rungs. In each ladder section is
15 provided retaining or locking mechanisms, designed to automatically release the upper ladder sections, when a rung reaches a lower rung. This means, that subsequent to the release of the lowermost ladder section, the following ladder sections are automatically released, whereby the ladder collapses. However, when collapsing the ladder, the rungs are collapsing on top of each other, thereby generating a safety problem for the users
20 hands and fingers.

Thus, there is a need for a collapsible ladder, which allows the ladder sections to be automatically released by release of the lowermost ladder section, but which provides a safety distance between the rungs to avoid injuries of a users hands or fingers.
25

SUMMARY OF THE INVENTION

According to the present invention there is provided a collapsible ladder comprising:
several collapsible ladder sections, each or at least part of the ladder sections
30 comprising two hollow ladder bars arranged parallel to each other and interconnected at an upper end by a rung, and each collapsible ladder section being telescopically inserted into a lower ladder section;

wherein each ladder bar of a collapsible ladder section has a locking hole adjacent the lower end part of the ladder bar and an extension below the locking hole;

wherein retaining mechanisms are provided in at least part of the rungs for locking the collapsible ladder sections relative to one another when the collapsible ladder sections are extended, each of or part of said retaining mechanisms comprising a locking pin, which can be brought into an extended and locked position in order to engage a
5 corresponding locking hole provided in the ladder bar of a ladder section positioned there above, and each of or part of said retaining mechanisms further comprising a release part with a release lever or arm for retracting the locking pin from the locked position into the un-locked position; and

wherein for at least one lower ladder section two actuating elements are provided
10 on top of the rung of the lower ladder section with one actuating element at each end of the rung, each said actuating element being arranged for actuating a release lever of a retaining mechanism provided in the rung of an above positioned ladder section, and each of said actuating elements having an inner side face extending in a direction along a corresponding ladder bar of the above positioned ladder section.

15

It is preferred that an upper part or at least the upper part of an outer side face of the actuating element is inclined inward towards the ladder bar resulting in an acute angle α of not above 45° between the ladder bar and said upper part of the outer side face of the actuating element, or resulting in an acute angle α of not above 45° between the inner
20 side face of the actuating element and said upper part of the outer side face of the actuating element.

Hereby the actuating element may urge the fingers or a body part of a user to be displaced laterally when the rung of the above ladder section is moving downwards when
25 collapsing the ladder.

It is also preferred that the inner side face of an actuating element extend fully along the corresponding ladder bar of the above positioned ladder section.

30 It is within one or more embodiments of the invention that the release levers or arms of the retaining mechanisms of the above positioned ladder section has an at least partly inclined or convex end part for contacting the inclined upper part of the corresponding actuating elements of the lower ladder section.

According to an embodiment of the invention then at least part of the collapsible ladder sections are provided with means for maintaining a safety distance between two adjacent rungs when collapsing the ladder. It is preferred that the height of the actuating elements is larger than or equal to the safety distance held between adjacent rungs of the collapsed ladder. The safety distance may be is at least 15 mm, such as at least 20 mm, or such as at least 25mm. According to an embodiment of the invention, then at least part of the collapsible ladder sections may have spacers provided at the bottom of the rungs for maintaining said safety distance between two adjacent rungs when collapsing the ladder. Thus, the rung spacers may have a height of at least 15 mm, such as at least 20 mm, or such as at least 25 mm, and the distance between a ladder bar and a rung spacer may be at least 80 mm. According to another embodiment of the invention, then the safety distance between two adjacent rungs of two adjacent collapsible ladder sections, a lower and an upper ladder section, may be provided by a stopper plug being arranged at the bottom of each ladder bar of the lower and upper ladder sections, whereby the stopper plug of a ladder bar of the upper ladder section is stopped by the stopper plug of the ladder bar of the lower ladder section when collapsing the ladder. Here, the safety distance may be defined by the length of the ladder bars and the stopper plugs.

It is preferred that the acute angle α of the upper part of the actuating element is not above 40° , such as not above 35° , or such as not above 30° .

It is within one or more embodiments of the invention that a locking pin is spring biased towards the extended position in order to engage the corresponding locking hole provided in the ladder bar of the ladder section positioned there above.

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The present invention also covers embodiments wherein a connector is provided at each end of the rung of a collapsible ladder section for interconnecting the rung with the two ladder bars. The actuating elements of a ladder section may be hold by a connector at the end of the rung. The connectors and the actuating elements may be made of plastic.

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It is preferred that there is no retaining mechanism in the uppermost rung. It is also preferred that the ladder bars are formed of circular tubing, which may be Aluminium tubing.

35 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view of a partly collapsed ladder according to a first embodiment the present invention,

5 Fig. 2 shows part of a cut-through upper rung with retaining mechanism for locking the above ladder section and part of a lower rung with an actuating element for un-locking the retaining mechanism of the upper rung according to an embodiment of the invention,

Figs. 3a and 3b illustrate two different embodiments of a release part for use in the
10 retaining mechanism of Fig. 2 according to an embodiment of the invention,

Figs. 4a, 4b and 4c illustrate arrangements of the actuating element of Fig. 2 according to embodiments of the invention, and

15 Fig. 5 show a cut through of two collapsed ladder sections according to a second embodiment of the invention, where stopper plugs are arranged at the bottom of the ladder bars in order to provide a safety distance between the rungs of the collapsed sections.

20 DETAILED DESCRIPTION OF EMBODIMENTS

A collapsible ladder according to a first embodiment of the invention is illustrated in Fig. 1. Fig. 1 shows a partly collapsed ladder 100, where the ladder has a number of collapsible ladder sections with hollow ladder bars 101a,b,c, 102a,b,c, arranged parallel to each other
25 and interconnected at an upper end by a rung 103a,b,c. In Fig. 1 the two uppermost ladder sections are collapsed while the third uppermost ladder section is in an extended and locked position. Each collapsible ladder section is telescopically inserted into a lower ladder section. The lowermost ladder section, which is not a collapsible ladder section, also has a rung 103d for interconnecting the ladder bars 101d, 102d. Each rung 103a,b,c
30 of the collapsible ladder sections has two spacers 104, 105 provided at the bottom side of the rung 103a. The spacers 104, 105 will maintain a safety distance between the rungs 103a,b,c,d of the collapsed ladder. In a preferred embodiment the spacers 104, 105 have a height of 20 or 25 mm and the distance from a spacer 104 to the ladder bar 101c is at least 80 mm. Thus, when this ladder 100 is collapsed, there will be a safety distance

between the rungs 103a,b,c of 20 or 25 mm and a safety distance between the spacers 104, 105 and the ladder bars 101c, 102c of 80 mm.

Actuating elements 106c,d and 107c,d for un-locking an above ladder section are
5 arranged at the two lowermost ladder sections, with actuating elements 106d, 107d being arranged on top of the rung 103d and extending along or in the direction along the ladder bars 101c, 102c, respectively, of the above ladder section. Similarly, actuating elements 106c, 107c are arranged on top of the rung 103c and extending along or in the direction along the ladder bars 101b, 102b, respectively, of the above ladder section. There is no
10 need for actuating elements of the upper rungs 103b and 103a, as the uppermost ladder section with rung 103a will be un-locked by the actuating elements 106c and 107c.

As the actuating elements 106, 107 for un-locking an above ladder section are arranged at the top of the rung 103 of a lower ladder section, then subsequent to un-locking a lower
15 ladder section, the above ladder sections may automatically be released, whereby the ladder sections collapses, while at the same time keeping a safety distance between the collapsed rungs. The rung 103d of the lowermost ladder section has no spacers but has release activating means 108, 109, which may be arranged on the front side of the rung 103d. If the ladder is fully extended, then activation of the release activating means 108,
20 109 will release the above ladder section, which then collapses and the actuating elements 106d, 107d un-lock the above ladder section, thereby releasing the next ladder section and so on until the ladder is fully collapsed.

The principle of operation of locking and un-locking of a collapsible ladder section of the
25 ladder of Fig. 1 is described in connection with Fig. 2. Fig. 2 shows part of a cut-through upper rung 201, which upper rung 201 in each side end has a retaining mechanism 202 for locking a ladder bar 203 of the above ladder section. Fig. 2 also shows part of a lower rung 204 with an actuating element 205 for un-locking the retaining mechanism 202 of the upper rung 201. The rung 201 is connected to a ladder bar 206 by a connector 207 and
30 the rung 204 is connected to a ladder bar 208 by a connector 209. The ladder bar 203 is inserted in the ladder bar 206, and ladder bar 206 is inserted in the ladder bar 208.

The ladder bar 203 has a locking hole 210 and the retaining mechanism 202 has a corresponding locking pin 211, which can be brought into an extended and locked position
35 in order to engage the locking hole 210. The retaining mechanism 202 also has a release

part 212 with a release lever or arm 213 for bringing the locking pin 211 into a retracted and un-locked position.

The retaining mechanism 202 further comprises a shell 214, being press-fitted into the
5 rung 201, where the shell 214 receives the locking pin 211. The locking pin 211 is
displaceably mounted in the shell 214 and is in one end biased by a spring 215. The
locking pin 211 is provided with a waist or recess portion 216 in the mid portion of the
locking pin 211. The waist or recess portion 216 serves to receive the release part 212.

10 The release part 212 with the release lever or arm 213 may be pivotally mounted with a
pivot or axis 219 to the rung 201, and the upper part of the release part 212 is a
connecting part, which may be forked shaped, and which claps or jams about the waist or
recess 216 of the locking pin 211.

15 At the end of the bottom of the rung 201, there is a recess 218, and the end part of the
release lever or arm 213 extends within the recess 218, thereby enabling the actuating
element 205 of the lower rung 204 to contact the release lever 213, pushing the release
lever 213 upwards, which makes the upper part of the release part 212 pushing the
locking pin 211 against the spring 215 and out of the locking hole 210, thereby un-locking
20 the ladder bar 203.

The actuating element 205 is arranged on top of the rung 204 with an inner side face
extending along the ladder bar 206 of the above positioned ladder section. It is preferred
that the actuating element 205 is connected to or part of the connector 209.

25

The lower rung 204 also holds a retaining mechanism with locking pin 220, which can be
brought into an extended and locked position in order to engage a locking hole (not
shown) of ladder bar 206. The retaining mechanism of rung 204 is a conventional type of
retaining mechanism, where the locking pin 220 can be brought into an un-locked position
30 by pressing a release button 221, which is arranged at the front side of the rung 204. An
actuating element 222 is also provided on top of the rung 201 with an inner side face
extending along the ladder bar 203 of the above positioned ladder section. Also here it is
preferred that the actuating element 222 is connected to or part of the connector 207.

The actuating elements 106c,d and 107c,d of Fig. 1 and 205 and 222 of Fig. 2 are formed so that an upper part of the outer side face of each of the actuating elements, 106, 107, 205, 222, is inclined inward towards the corresponding the ladder bar, 101b,c and 102 b,c of Fig. 1 and 206 and 203 of Fig. 2, resulting in an acute angle α of not above 45°

5 between the ladder bar, 101b,c and 102 b,c and 206 and 203, and the upper part of the outer side face of the actuating element, 106, 107, 205, 222, whereby the actuating element, 106, 107, 205, 222, may urge the fingers or a body part of a user to be displaced laterally when the rung of the above ladder section, 103b,c of Fig. 1 and 201 of Fig. 2, is moving downwards when the ladder section is un-locked for collapsing the ladder.

10 The present invention also covers embodiments wherein the acute angle α is not above 40°, such as not above 35°, or such as not above 30°.

By having actuating elements, 106, 107, 205, 222, arranged on the lower rungs, 103, 204, 201, then it is possible to un-lock the above ladder sections and still maintain a safety

15 distance between two adjacent rungs when collapsing the ladder. In order to un-lock an above ladder section, then the height of the actuating elements, 106, 107, 205, 222, shall be larger than or equal to the safety distance held between adjacent rungs of the collapsed ladder. If the release lever or arm 213 is fully inside the rung 201, then the actuating element 205 should be higher than the safety distance.

20

It is not preferred that the actuating elements, 106, 107, 205, 222, shall bear the load of the collapsed ladder sections in order to maintain the safety distance. According to a first embodiment of the invention spacers, 104, 105, as shown in Fig. 1, may be provided at the bottom of the rungs of the above ladder sections in order to bear the load of the

25 collapsed ladder sections. According to a second embodiment of the invention, stopper plugs may be provided at the bottom of the ladder bars, where the bottom of a stopper plug may rest on the top of a below stopper plug, and thereby bear the load of the collapsed ladder section. This is explained further in connection with Fig. 5.

30 Figs. 3a and 3b illustrates two different embodiments of a release part 212a,b for use in the retaining mechanism 202 of Fig. 2. The release part 212a of Fig. 3a has a release lever or arm 213a with an inclined or at least partly inclined end part, and the release part 212b of Fig. 3b has a release lever or arm 213b with a convex end part. By having a release lever 213a,b with an inclined or convex end part, then a better contact is obtained

to the inclined upper part of the corresponding actuating element 205 of the lower ladder section to thereby un-lock the next above ladder section.

Figs. 4a, 4b and 4c illustrate arrangements of the actuating element 205 of Fig. 2. In Figs. 5 4a-4c the actuating element 205a, 205b, 205c is part of the connector 209, which connects the rung 204 (not shown in Figs. 4a-4c) to the upper end of the ladder bar 208. In Fig. 4a the actuating element 205a is formed and arranged so that the inner side face fully extends along the ladder bar 206 of the above ladder section, where the ladder bar 206 is inserted into the ladder bar 208. In Fig. 4b the actuating element 205b is formed 10 and arranged so that the inner side face extends in a direction along the ladder bar 206, but the inner side face of the element 205 may be arranged at a small distance to ladder bar 206. The top end of the actuating element 205a, 205b, 205c may have no rounded end or plane upper part as shown by element 205a in Fig. 4a, but the top end may also be rounded as shown by element 205b of Fig. 4b, or the top end may have a cut off or plane 15 upper part as shown by element 205c in Fig. 4c. It is preferred that the top end or an upper part of the element 205a, 205b, 205c is tapering upwards and forming the acute angle α between the inner side face and the outer side face of the actuating element, where α is not above 45° , such as not above 40° , such as not above 35° , or such as not above 30° .

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Fig. 5 shows a cut through of two collapsed ladder sections according to a second embodiment of the invention, where stopper plugs are arranged at the bottom of the ladder bars in order to provide a safety distance between the rungs of the collapsed sections. In Fig. 5, a lower ladder section holds a lower rung 501 and a lower ladder bar 25 502, while an upper ladder section holds an upper rung and an upper ladder bar 504. A lower stopper plug 505 is provided at the bottom of the lower ladder bar 502, and an upper stopper plug 506 is provided at the upper ladder bar 504. When in the collapsed condition as shown in Fig. 5, the bottom of upper stopper plug 506 is stopped or resting on the top of the lower stopper plug 505, leaving a safety distance d between the lower 30 rung 501 and the upper rung 503. The safety distance d is defined by the length of the ladder bars 502, 504 and the length of the stopper plugs 505, 506. It is preferred that the safety distance d is at least 20 mm, such as at least 25 mm.

For the ladders of the present invention, a connector 207 is provided at each end of the 35 rung 201 of a collapsible ladder section for interconnecting the rung 201 with the two

ladder bars 206. The actuating elements 222 of a ladder section may be hold by the connector 207 at the end of the rung 201. The connectors 2207 and the actuating elements 222 may be made of plastic. For the retaining mechanism 202, it is preferred that the locking pin 211 is made of stainless steel, while the release part 212 with the
5 release lever or arm 213 and the shell 214 are made of plastic.

It is preferred that the ladder bars 203, 205 are formed of Aluminium tubing, which may be circular tubing. It is further preferred that the rungs 201, 204 are made of Aluminium.

- 10 Retaining mechanisms operating along the same principles as the retaining mechanism 202 of Fig. 2, but without the tapered actuating element 205, 222, have been described in US Patent No. 7,316,293 B2, which is hereby included by reference.

CLAIMS

1. A collapsible ladder comprising:
 - several collapsible ladder sections, each or at least part of the ladder sections
 - 5 comprising two hollow ladder bars arranged parallel to each other and interconnected at an upper end by a rung, and each collapsible ladder section being telescopically inserted into a lower ladder section;
 - wherein each ladder bar of a collapsible ladder section has a locking hole adjacent the lower end part of the ladder bar and an extension below the locking hole;
 - 10 wherein retaining mechanisms are provided in at least part of the rungs for locking the collapsible ladder sections relative to one another when the collapsible ladder sections are extended, each of or part of said retaining mechanisms comprising a locking pin, which can be brought into an extended and locked position in order to engage a
 - corresponding locking hole provided in the ladder bar of a ladder section positioned there
 - 15 above, and each of or part of said retaining mechanisms further comprising a release part with a release lever or arm for retracting the locking pin from the locked position into the un-locked position;
 - wherein for at least one lower ladder section two actuating elements are provided on top of the rung of the lower ladder section with one actuating element at each end of
 - 20 the rung, each said actuating element being arranged for actuating a release lever of a retaining mechanism provided in the rung of an above positioned ladder section, and each of said actuating elements having an inner side face extending in a direction along a corresponding ladder bar of the above positioned ladder section; and
 - wherein an upper part of an outer side face of the actuating element is inclined
 - 25 inward towards the ladder bar resulting in an acute angle α of not above 45° between the ladder bar and said upper part of the outer side face of the actuating element, or resulting in an acute angle α of not above 45° between the inner side face of the actuating element and said upper part of the outer side face of the actuating element.
- 30 2. A ladder according to claim 1, wherein the inner side face of an actuating element extend along the corresponding ladder bar of the above positioned ladder section.
3. A ladder according to claim 1 or 2, wherein the release levers or arms of the above positioned ladder section has an at least partly inclined or convex end part for contacting

the inclined upper part of the corresponding actuating elements of the lower ladder section.

4. A ladder according to any one of the claims 1-3, wherein at least part of the
5 collapsible ladder sections are provided with means for maintaining a safety distance between two adjacent rungs when collapsing the ladder.
5. A ladder according to claim 4, wherein the height of the actuating elements is larger than or equal to the safety distance held between adjacent rungs of the collapsed
10 ladder.
6. A ladder according to claim 4 or 5, wherein the safety distance is at least 20 mm.
7. A ladder according to any one of the claims 4-6, wherein at least part of the
15 collapsible ladder sections have spacers provided at the bottom of the rungs for maintaining said safety distance between two adjacent rungs when collapsing the ladder.
8. A ladder according to claim 7, wherein the rung spacers have a height of at least 20 mm, and wherein the distance between a ladder bar and a rung spacer is at least 80
20 mm.
9. A ladder according to any one of the claims 4-6, wherein the safety distance between two adjacent rungs of two adjacent collapsible ladder sections, a lower and an upper ladder section, are provided by a stopper plug being arranged at the bottom of each
25 ladder bar of the lower and upper ladder sections, whereby the stopper plug of a ladder bar of the upper ladder section is stopped by the stopper plug of the ladder bar of the lower ladder section when collapsing the ladder, and wherein the safety distance is defined by the length of the ladder bars and the stopper plugs.
- 30 10. A ladder according to any one of the claims 1-9, wherein the acute angle α is not above 40° , such as not above 35° , such as not above 30° .
11. A ladder according to any one of the claims 1-10, wherein a locking pin is spring biased towards the extended position in order to engage said corresponding locking hole
35 provided in the ladder bar of the ladder section positioned there above.

12. A ladder according to any one of the claims 1-11, wherein a connector is provided at each end of the rung of a collapsible ladder section for interconnecting the rung with the two ladder bars.

5 13. A ladder according to claim 12, wherein the actuating elements of a ladder section are held by a connector at the end of the rung.

14. A ladder according to any one of the claims 1-13, wherein there is no retaining mechanism in the uppermost rung.

10

15. A ladder according to any one of the claims 1-14, wherein the ladder bars are formed of circular tubing.

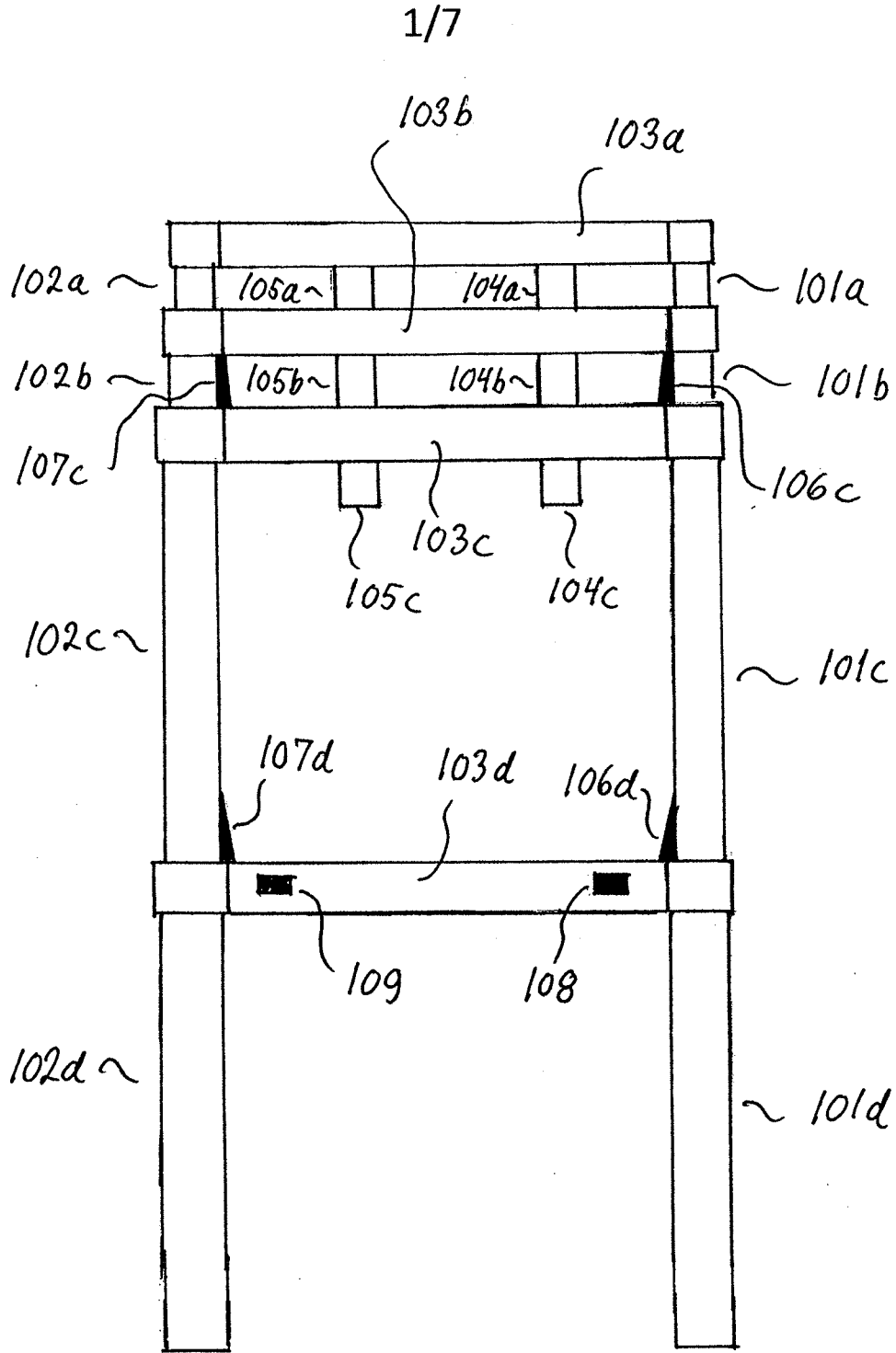


Fig. 1

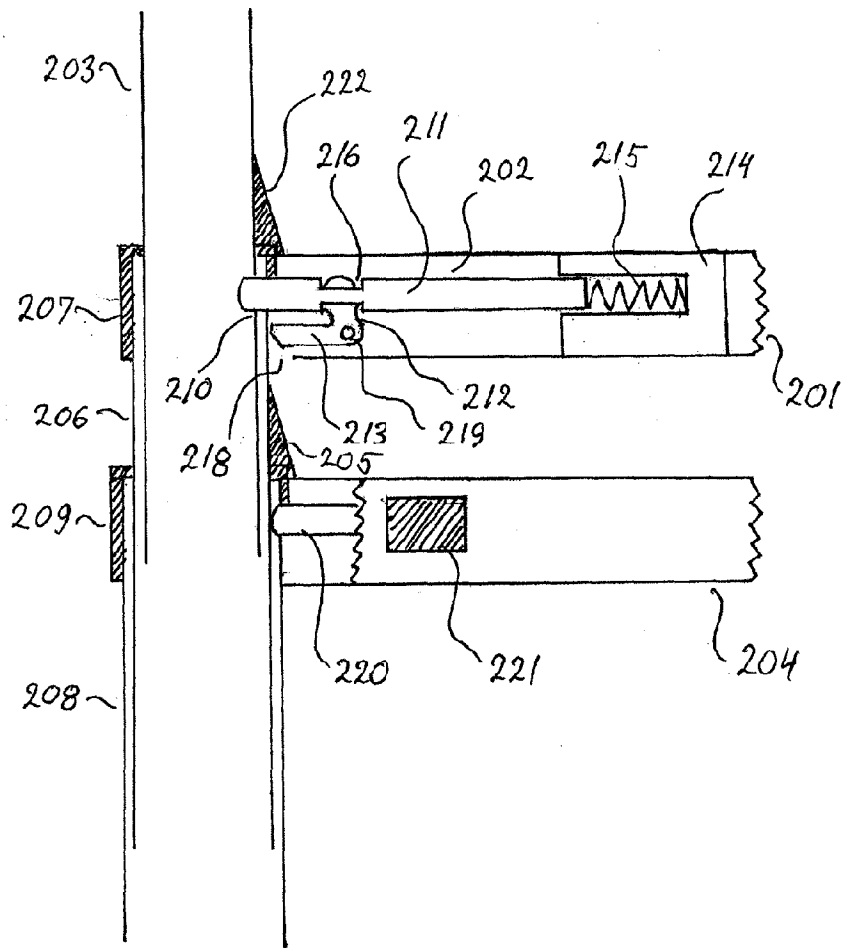


Fig. 2

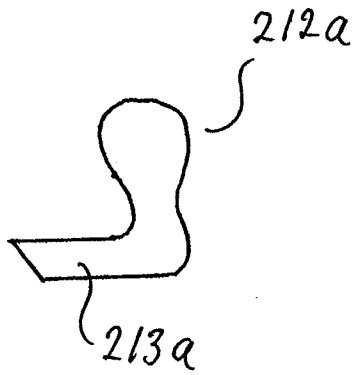


Fig. 3a

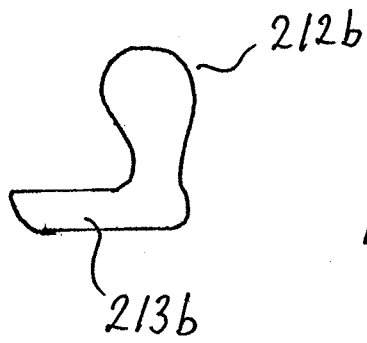


Fig. 3b

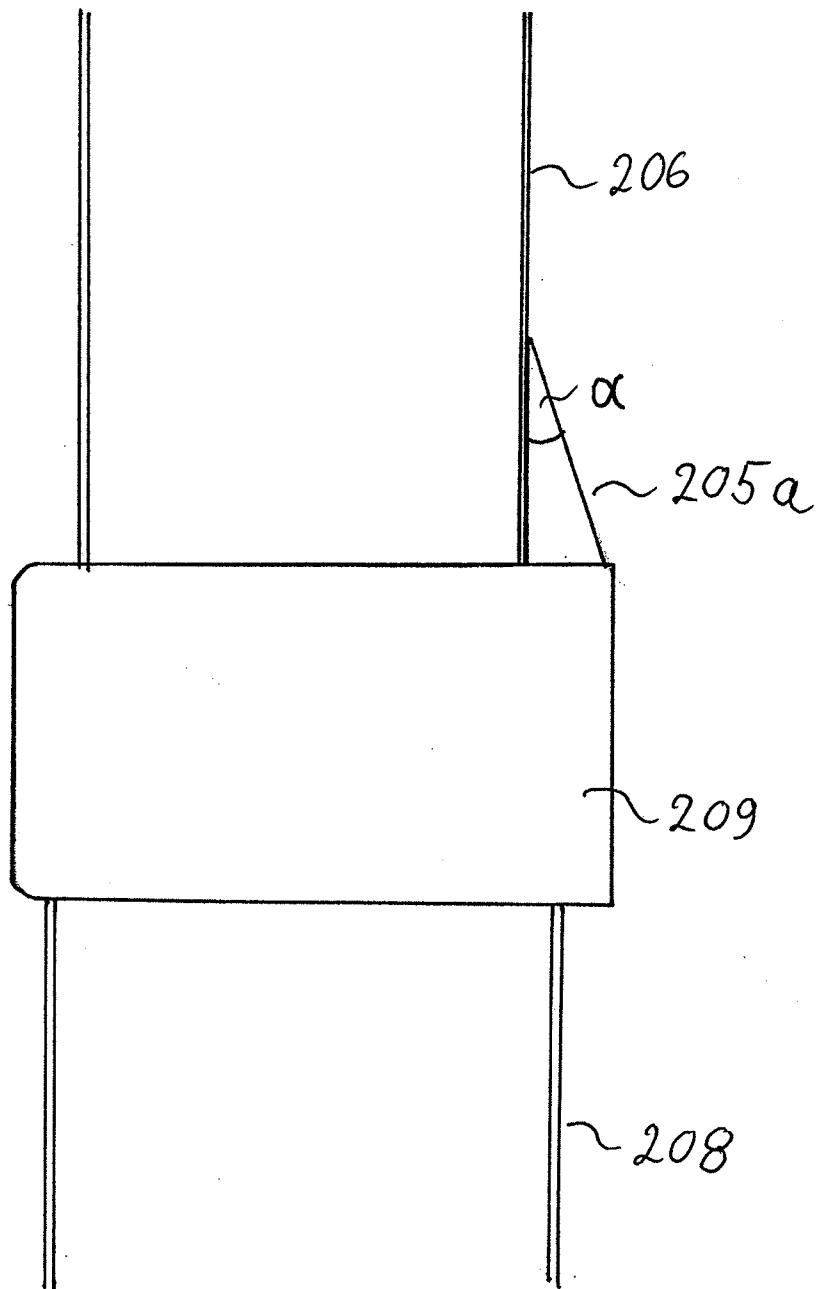


Fig. 4a

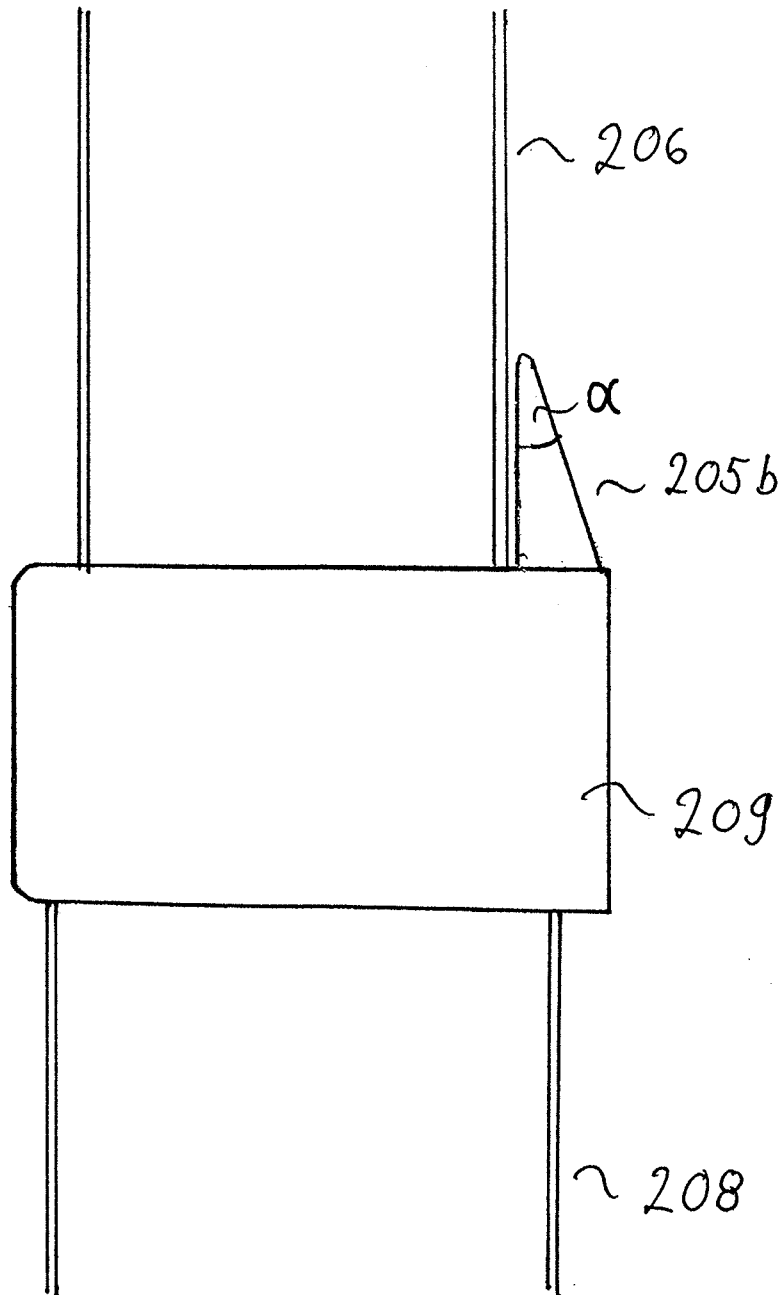


Fig. 4b

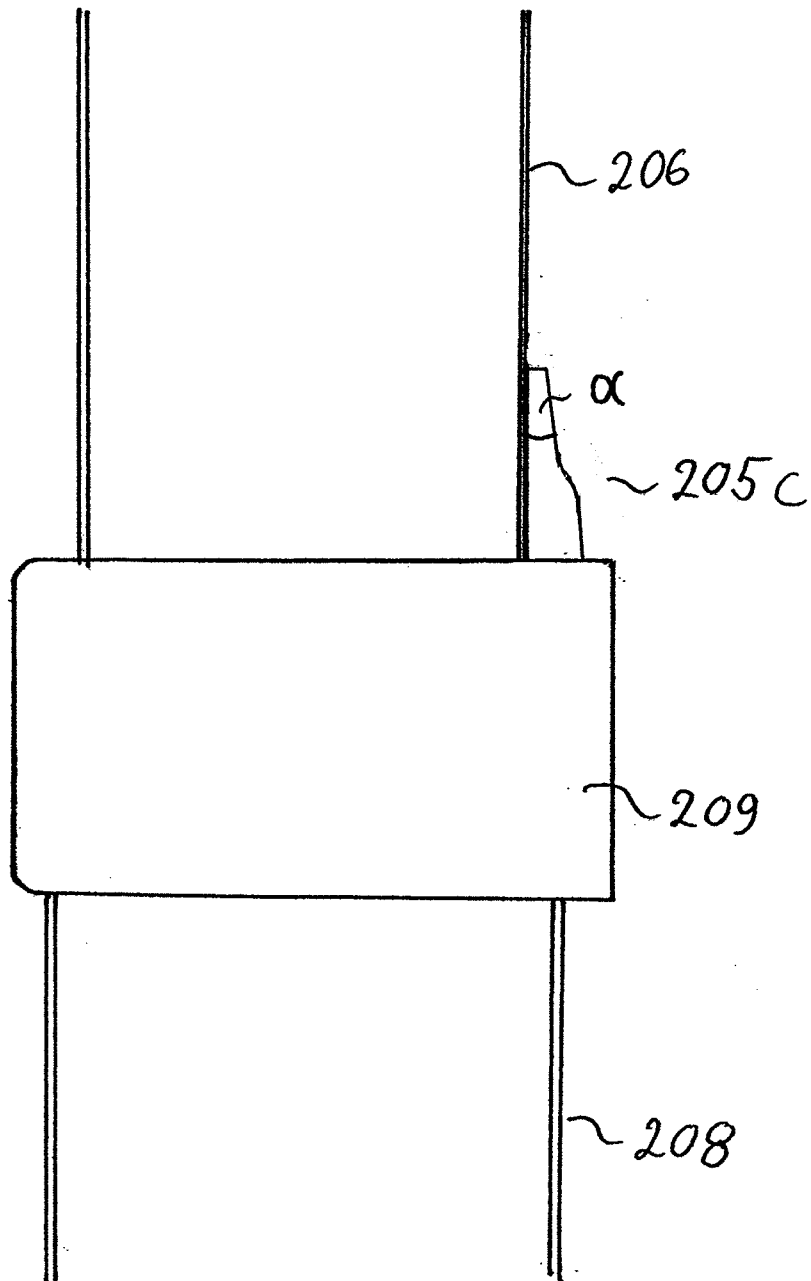


Fig. 4.c

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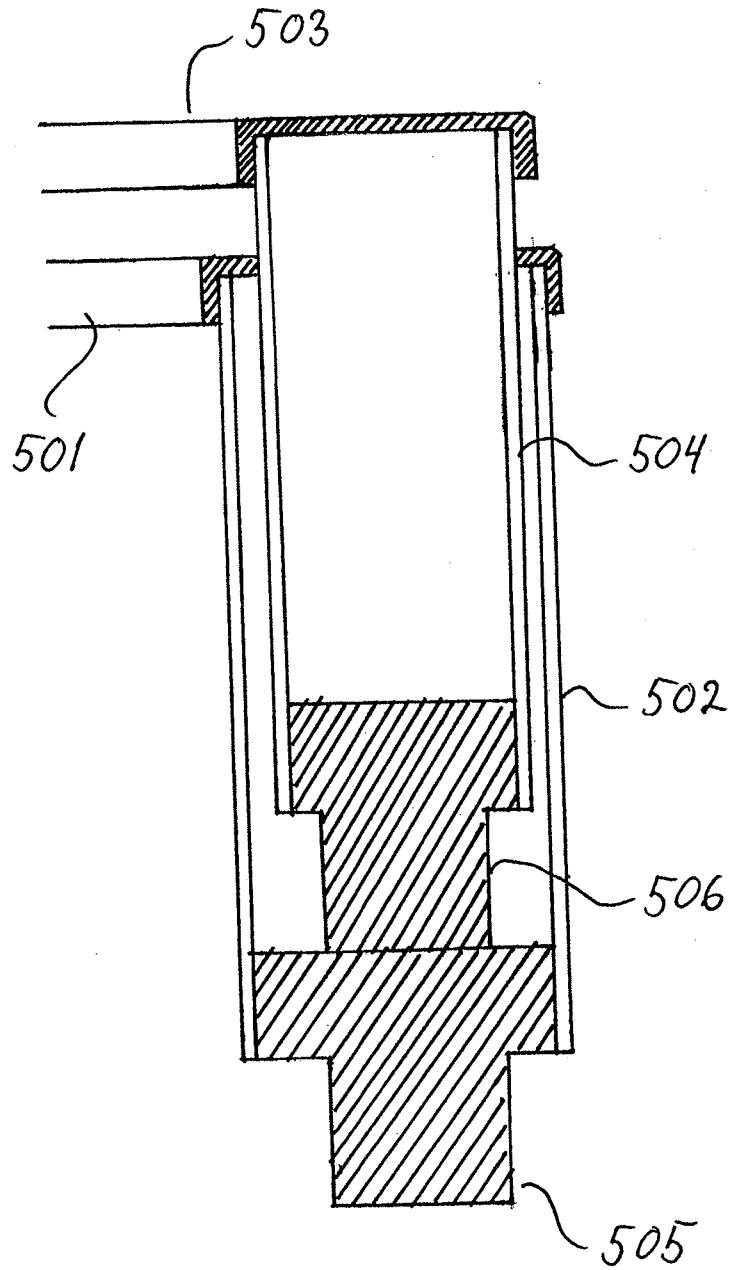


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/066026

A. CLASSIFICATION OF SUBJECT MATTER
INV. E06C1/12
ADD.
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)
E06C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102 278 059 B (WANG WANXING) 5 June 2013 (2013-06-05) figures 1, 2, 4, 6-8	1-7, 10-15
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Further documents are listed in the continuation of Box C.

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Date of the actual completion of the international search 14 October 2014	Date of mailing of the international search report 21/10/2014
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Bauer, Josef
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INTERNATIONAL SEARCH REPORT

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PCT/EP2014/066026

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