

(19)



(11)

**EP 1 803 890 A2**

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:

**04.07.2007 Bulletin 2007/27**

(51) Int Cl.:

**E06C 5/04 (2006.01)**

(21) Application number: **06126600.3**

(22) Date of filing: **20.12.2006**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI  
SK TR**

Designated Extension States:

**AL BA HR MK YU**

(30) Priority: **28.12.2005 IT VR20050159**

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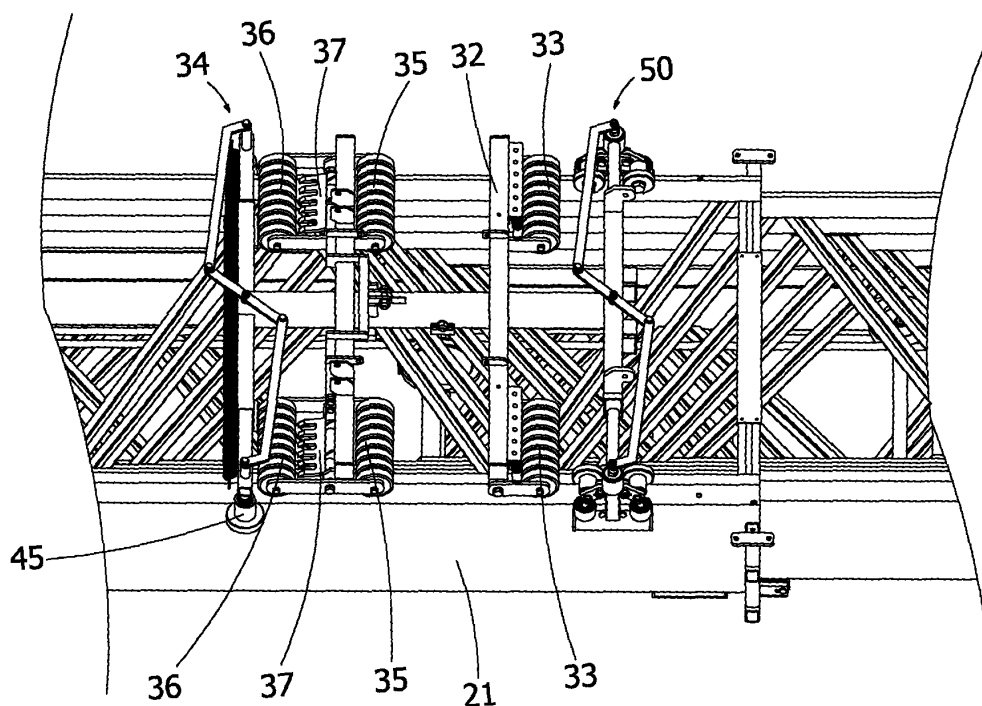
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### (54) PARTICULARLY SHAPED PACKAGE OF LADDERS AND CARRIAGE THEREOF

(57) A particular equipment includes ladders and a carriage thereof. This equipment is mounted on a motor-vehicle and is used to position things and/or persons at a wished height, in particular a considerable height, out-

side buildings. In general, the ladders package consists of a closed structure, which gives a greater solidity to the equipment. The carriage is provided with parallel wheels which are installed in suitable upper rails. The wheels are constrained to run laterally.



**Fig. 4**

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## Description

[0001] The present industrial invention refers to a package of ladders and a carriage thereof. This equipment is mounted on motor-vehicles and permits to reach considerable heights.

[0002] Said particular equipment includes ladders and carriage. This equipment is mounted on a motor-vehicle and is used to position things and/or persons at a wished height, in particular a considerable height, outside buildings, for instance for removals to building flats or in case of emergency interventions in buildings of considerable heights.

[0003] As is known, said operations are effected through particular carriages which are moved along ladders which are disposed on a motor-vehicle. In other terms, said ladders form structures which are extended by means of a telescopic mechanism. Their extension possibility depends on the number of sections of the ladder structure and the length of the ladder structure can be considerable.

[0004] The type of said structures is very important as well as the type of carriage running along the ladder structure.

[0005] As a rule, the ladder sections which are available on the market comprise two profiles which are connected to each other, only in the lower part, through rigid connections. This feature permits to produce ladders of a satisfying but not excellent lateral rigidity and therefore, the so-obtained structures have only a certain degree of flexibility, which is prejudicial to the safety.

[0006] The shape (in general a C-shape), of the profiles, which are utilized to produce the ladder sections, is not an optimal shape for the ladder sections because the run of the carriage wheels engages only the upper wings of the C-shaped profiles. Obviously, the upper wings of the C-shape profiles tend, under load, to locally deform and the two C-shapes tend to open wide apart since only the lower parts of the two C-shapes are connected to each other through said rigid connections, which involves a real risk for the carriage wheels to go out of the wings of the C-shapes.

[0007] The aim of the present invention is to remove all the above cited drawbacks and further ones by proposing a system inclusive of ladders and carriage offering a high standard of safety without increasing the weight but increasing the stability of the single profiles as well as the stability of the single ladder sections on the planes of working.

[0008] All the above aims and advantages are achieved according to the present invention by a ladders-carriage system, characterized by the fact of comprising ladders showing a closed, substantially squared profile and at least a translating carriage provided with running wheels positioned at the outer edges of said ladders.

[0009] The structure of the present invention is new and is very advantageous because it is very light thanks to the type of profile utilized and it is very static, as well.

[0010] In other words, if the weight remains unchanged in comparison with the systems of the known prior art, the new structure is very advantageous because it is very static.

[0011] In addition, the ladder sections are shaped like a closed polygon and achieve a high degree of rigidity and consequently, a high standard of safety.

[0012] Advantageously, a lateral running of the carriage (laterally to the profiles) provides a higher stability to the movement of the carriage.

[0013] Another feature of the present structure is the position of the windlass that moves the carriage: the windlass is positioned at the top of the ladder, which does reduce the load in comparison with the solutions of the known

prior art.

[0014] Further features and details of the present invention will be better understood from the following specification that is given as a non-limiting embodiment on the base of the accompanying drawings wherein:

Figures 1, 2 show the part of the structure according to the present invention comprising the carriage which is mounted on a section of the ladder package; Figure 3 is a lateral top view of the ladders-carriage system as a whole;

Figure 4 is a detail of Figure 3, namely, a three-dimensional lateral top view of the carriage mounted on the ladders;

Figures 5, 6 are lateral and top views, respectively, of the carriage mounted on the ladders;

Figure 7 is a sectional view of the carriage mounted on the ladders according to an orthogonal section to the direction of development of the ladders;

Figures 8, 9, 10 are bottom, lateral and three-dimensional views, respectively, of the carriage;

Figures 11, 12, 13 are lateral, three-dimensional and sectional views, respectively, of the ladders on which the carriage is mounted.

[0015] With reference to the accompanying drawings, number 1 denotes a structure according to the present invention.

[0016] The structure 1 comprises a carriage 2 and a package of ladders 3.

[0017] The package of ladders 3 includes at least two ladder sections. In the present embodiment, there are seven ladder sections.

[0018] Each ladder section comprises two lateral profiles which are connected to each other through a slanting or perpendicular cross-bar which is slanting or perpendicular to the profiles.

[0019] For instance, in Figure 2 the carriage 2 is disposed on a first ladder section 61 of the ladders package 3. The ladder section 61 comprises two lateral profiles 21 which are connected to each other through both slant-

ing cross-bars 24 and perpendicular cross-bars 25, which are slanting and perpendicular to the profiles 21, respectively.

**[0020]** The ladder sections are shaped in such a way as to be inserted in one another on forming a telescopic structure.

**[0021]** The upper end of each lateral profile is shaped in such a way as to permit the carriage 2 to slide. In particular, the upper part of the profile 21 has a projection or rail 4 which develops according to the direction of the ladders package 3, as it can be seen in Figures 1 and 13.

**[0022]** The rail 4 divides the upper part of the profile 21 in two surfaces 5, 6. The wheels of the carriage 2 run on the two surfaces 5, 6. In particular, the surface 6 is connected with the vertical surface of the profile 21 through a rectangular profile element having a lateral surface 17 as well as a lower surface 18, as it can be seen in Figure 13.

**[0023]** Similarly, the ladder sectors inside the first ladder section 61 have the same conformation. For instance, the second ladder section 62 also has a rail 14 and two surfaces 15, 16 on the upper part of the profile 22, as represented in Fig. 1.

**[0024]** The rails 4, 14 and the surfaces 5, 6, 15, 16 of the first two ladder sections 61, 62 as well as the rails and surfaces of the following ladder sections all are disposed on different planes. However, said parts, namely, the rails and the surfaces, have to form an only element on which the carriage 2 slides and therefore, the end parts of each ladder section comprise a connecting element 72 which is provided with a rail 8 which is connected with the rail 4 of the profile on which the connecting element 72 is mounted. The height of said rail 8 reduces in the direction of the opposite end to said connection.

**[0025]** Besides, the connecting element 72 has a surface 10 which is adjacent to the rail 8. The surface 10 is shaped like a right-angled triangle which has a side connected with the surface 6 of the ladder section.

**[0026]** In addition, each ladder section comprises a slip element 71 which is placed laterally to the ladder section itself near the connecting element 72. Said slip element 71 comprises both a support 73 and a curved element 74 which is connected with said support 73. The curved element 74 is to maintain the wheels of the carriage 2 adjacent to the lateral surfaces of the profiles 21, 22, 23 of the ladder sections.

**[0027]** A loading platform is placed on the carriage 2 for the operator or things to be lifted or lowered.

**[0028]** Besides, the carriage 2 is provided with wheels and rolls which are positioned adjacently to the surfaces 5, 6, 15, 16 and rails 4, 14 in such a way as not to wriggle out and to translate at the same time, independently of the width of the ladder section.

**[0029]** The carriage 2 is provided with a supporting cross-bar 31 on which a first element 50, a first bar 32, a second bar 34 and a second element 40 are mounted in succession.

**[0030]** The first element 50 has a variable width and

is provided with steering-wheels. The first bar 30 is provided with a pair of roller-guide units 33. The second bar 34 is provided with two pairs of roller-guide units 35, 37. The second element 40 has a variable width. The first element 50 provided with the steering-wheels comprises a bar 51 which is connected with the supporting cross-bar 51 transversely.

**[0031]** Each end of said bar 51 has a cavity in which a tubular element 52 moves. An end of the tubular element 52 is provided with a support 53 which is orthogonal to the tubular element 52.

**[0032]** On said support 53 there are two wheels 55, which are connected through a movable support, and a supporting bar 54 to which in turn, two lower wheels 56 and two lateral rollers 63 are coupled. The whole support 53 rotates according to its own axis of development and permits both the two wheels 55 and the lower wheels 56 and the two rollers 63 to steer.

**[0033]** The supports 53 are disposed symmetrically to the supporting cross-bar 31 and their movement is symmetrical thanks to a lever system. The lever system comprises a central bar 59 which rotates around an apex 60 which is connected with the supporting cross-bar 31 and bars 58 which are connected with their respective support 53 and end part of the central bar 59.

**[0034]** Besides, the two supports 53 and the relative rollers 63 and wheels 55, 56 are pressed on the profile on which they are arranged. This is caused by the action of spring elements 57. An end of each spring element 57 is connected with the support 53 while the other end is connected with the bar 51.

**[0035]** The first bar 32 is provided with two units of rollers 33 which are arranged symmetrically to the supporting cross-bar 31. In the present embodiment, each roller unit is provided with eight rollers which have the same axis of rotation and are spaced from each other. The distance between two rollers corresponds to the width of the rail 4, 14.

**[0036]** The second bar 34 is provided with four units of rollers 35, 36, these roller units being disposed symmetrically. In particular, two roller units 35 are disposed symmetrically in front of the bar 34 while the remaining roller units 36 are disposed symmetrically behind the bar 34. In addition, the second bar 34 is provided with a comb element 37 which is placed between the bar 34 and the roller units 36.

**[0037]** The second element 40 having a variable length comprises a support 41 which comprises cavities in which two tubular elements 42 translate. The ends of each tubular element 42 are provided with supports 44 on which the wheels 45 are mounted.

**[0038]** Like the first element 50 equipped with steering wheels, also the second element 40 of a variable width is provided with a lever system which comprises a central bar 47 and two lateral bars 46 which press, together with the springs 43, the wheels 45 against the profile on which the carriage is mounted.

**[0039]** When the ladders package is completely ex-

tended, a sliding system is obtained. In the present embodiment, the sliding system comprises seven ladder sections. Each ladder section comprises a rail, two lateral surfaces which are disposed laterally to the rail, and a lateral surface which is perpendicular to said surfaces. The sliding system comprises seven parallel rails 4, 14, which are arranged on different planes, surfaces 5, 6, 15, 16, which are adjacent to said rails, and lateral surfaces 21, 22.

[0040] The sliding of the carriage is made stable and safe thanks to the sliding of the wheels and rollers on the ladders package on allowing the carriage 2 to move only parallelly to the direction of development of the ladders package 3.

[0041] Firstly, the rails 4, 14 are placed between the rollers of the roller units 33, 35, 36. In the element 40 having a variable width, the wheels 45 are positioned in such a way as to roll on the lateral surfaces 21 of the profiles and, at the same time, to press against the same surfaces.

[0042] The ends of the steering-wheel element 50 are provided with upper wheels 55 which beat and slide on the surface 5, 15 which is more internal than the rail 4, 14. The rollers 63 are arranged on the bar 54 which is connected with the support 53 and therefore, the rollers 63 beat on the upper part of the profile 21. In particular, the rollers 63 beat on the higher external surface 17. Besides, the rollers 63 are kept under pressure by means of a spring system 57.

[0043] Finally, the wheels 56 slide on the surface 18 opposite to the upper surface 6.

[0044] In this way, the steering-wheel element 50 is not able to shift in respect of the ladder section on which said element is disposed. The only movement the element 50 accomplishes is a movement of translation. The direction of this movement is parallel to the direction of extension of the ladders package.

[0045] In particular, the conformation of the carriage 2 permits the carriage to slide even in the passage from a ladder section to the following ladder section. In fact, the position of the chute element 71 and the position of the connecting elements 72 permits both the steering-wheel element 50 and the element 40 of variable width to press against the lateral surfaces.

[0046] In other words, the curved element 74 and the connecting element 72 guide the rollers 63 according to the width of the ladder section by means of a spring system 57. At the same time, the wheels 55 continue running from the surface 5 of the first ladder section to the surface 15 of the following ladder section, similarly to the lower wheels 56.

[0047] The width of the variable width element 40 is reduced on maintaining the wheels 45 against the surface 17.

[0048] In the passage from a ladder section to a following ladder section the rail 4 of a ladder section frees the seat between two rollers of the units 33, 35, 36 and the rail 14 of the following ladder section engages in a

seat between two rollers, this seat being adjacent to said seat. Anyhow, for safety reasons the system is equipped with suitable ratchet gears 37 which act in case of a breakage of the rope moving the carriage. Once the safety mechanism is freed from the tension of the drawing rope of the carriage, the safety mechanism enters into action automatically.

[0049] The windlass of movement of the carriage is placed on the top (last ladder section) of the ladders package to avoid a doubling of the load, should the windlass be placed on the bottom.

[0050] In addition, the extracting system for the extraction of the ladder sections of the ladders package consists of a windlass with four draughts of rope for the first ladder section and a windlass with double chains for the following ladder sections.

[0051] A technician of the sector can conceive some versions or changes that are to be considered as included in the scope of protection of the present invention.

## Claims

1. Ladders-carriage equipment, **characterized in that** it comprises ladders (3) with elements (61, 62) which have a telescopic movement and have a substantially closed quadrangular profile, and at least a carriage (2) which translates along said ladders (3) and comprises moving means (33, 35, 36, 45, 55, 56) which are positioned adjacent to said ladders (3).
2. Ladders-carriage equipment as claimed in the foregoing claim, **characterized in that** at least an element (61, 62) of said ladders (3) comprises two lateral profiles (21) which are connected with each other through at least a slanting cross-bar (24) and/or a perpendicular cross-bar (25) which are slanting and/or perpendicular to said profiles (21), respectively.
3. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** at least a profile (21, 22) comprises, on its upper part, a slide means (4, 14) which has a development parallel to said ladders (3) and divides the upper part of said profile (21) into a first surface (5) and a second surface (6); the moving means (33, 35, 36, 45, 55, 56) of said carriage (2) slide on said surfaces (5, 6); the second surface (6) is connected with the vertical surface of the profile (21) through a rectangular profile element having a lateral surface (17) and a lower surface (18).
4. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** said carriage (2) comprises wheels (45, 55, 56) and rollers (33, 35, 36) which are adjacent to the surfaces (5, 6, 15, 16, 17, 18) and slide means or rails (4, 14) so that the carriage (2) translates longitudinally without dis-

engaging.

5. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** the end part of each element (61) comprises at least a connecting element (72) which is provided with a second slide means (8) which is connected with said slide means (4) of the profile (21) on which said connecting element (72) is mounted; the height of the second slide means (8) reduces in the direction of the end; said connecting element (72) comprises a surface (10) adjacent to said second slide means (8) which is shaped like a right-angled triangle. 5
6. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** at least an element (61, 62) comprises a chute element (71) which is arranged laterally to said element (61, 62) near the connecting element (72); said chute element (71) comprises a support (73) and a curved element (74) which is connected with said support (73) and keeps the wheels of the carriage (2) adjacent to the lateral surfaces of the profiles (21, 22, 23) forming the elements (61, 62). 10
7. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** said carriage (2) is provided with a supporting cross-bar (31) on which a first element (50) having a variable width and steering-wheels (55, 56, 63), a first bar (32) with at least a pair of roller-guide units (33), a second bar (34) with at least a pair of roller-guide units (35, 37) and a second element (40) having a variable width are mounted in succession. 20
8. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** said first steering-wheel element (50) comprises a bar (51) which is provided, at least on one of their ends, with a cavity in which a tubular element (52) translates; an end of the tubular element (52) is coupled with a support (53) orthogonal to the tubular element (52) itself; said support (53) comprises at least two wheels (55), which are connected by means of a movable support, and a supporting bar (54) with which two lower wheels (56) and two lateral rollers (63) are coupled; said support (53) rotates according to its axis of development so that the two steering-wheels (55), the lower wheels (56) and the two rollers (63) are allowed to steer. 25
9. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** said bar (51) comprises two tubular elements (52) which are disposed symmetrically to each other; said tubular elements (52) translate according to a direction parallel to said bar (51); said translation is made symmetric by a levers system which comprises a central bar (59) which rotates in respect to an apex (60) which is connected with the supporting cross-bar (31), and bars (58); each bar (58) is connected with the respective support (53) and the respective end of the central bar (59). 30
10. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** the two supports (53) and the relative rollers (63) and wheels (55, 56) are pressed against the profile (21) on which they are positioned at least by means of a spring element (57). 35
11. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** said first bar (32) comprises two units of rollers (33) which are disposed symmetrically to the supporting cross-bar (31); each unit of rollers (33) comprises at least two rollers which have the same axis of rotation and are spaced from each other for an extent corresponding substantially to the width of the slide means (4, 14). 40
12. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** said second bar (34) comprises four units of rollers (35, 36), which are arranged symmetrically, and at least a comb element (37) which is placed between the bar (34) and the units of rollers (36). 45
13. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** said second element (40) having a variable width comprises a support (41) which has cavities in which two tubular elements (42) translate, the ends of which are coupled with supports (44) on which wheels (45) are mounted. 50
14. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** said second element (40) comprises a system of levers which consists of a central bar (47) and two lateral bars (46) which cooperate with springs (43) to press the wheels (45) against the profile (21) on which the carriage (2) is mounted.
15. Ladders-carriage equipment as claimed in the foregoing claims, **characterized in that** in the movement of the carriage (2) along the ladders (3):
  - the slide means (4, 14) come between the rollers of the units of rollers (33, 35, 36);
  - the wheels (45) of the element (40) having a variable width roll on the lateral surface (17) of the profiles (21) and, at the same time, press said surfaces;
  - the upper wheels (55) of the steering-wheel element (50) beat and slide on the surface (5,

15) which is more internal than the slide means (4, 14);

- the rollers (63) arranged on the bar (54) connected with the support (53) beat against the surface (17) which is higher and external of the profile (21), and are kept pressed through the spring system (57);

- the wheels (56) slide on the surface (18) opposite to the upper surface (6).

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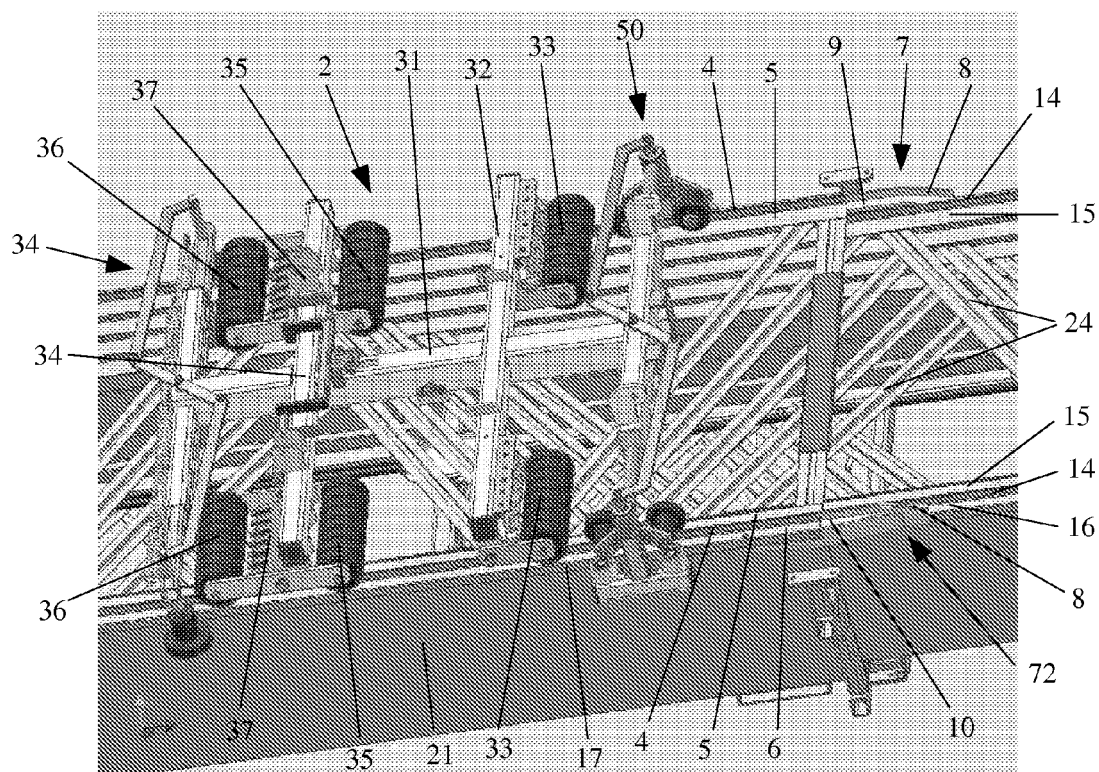


Fig. 1

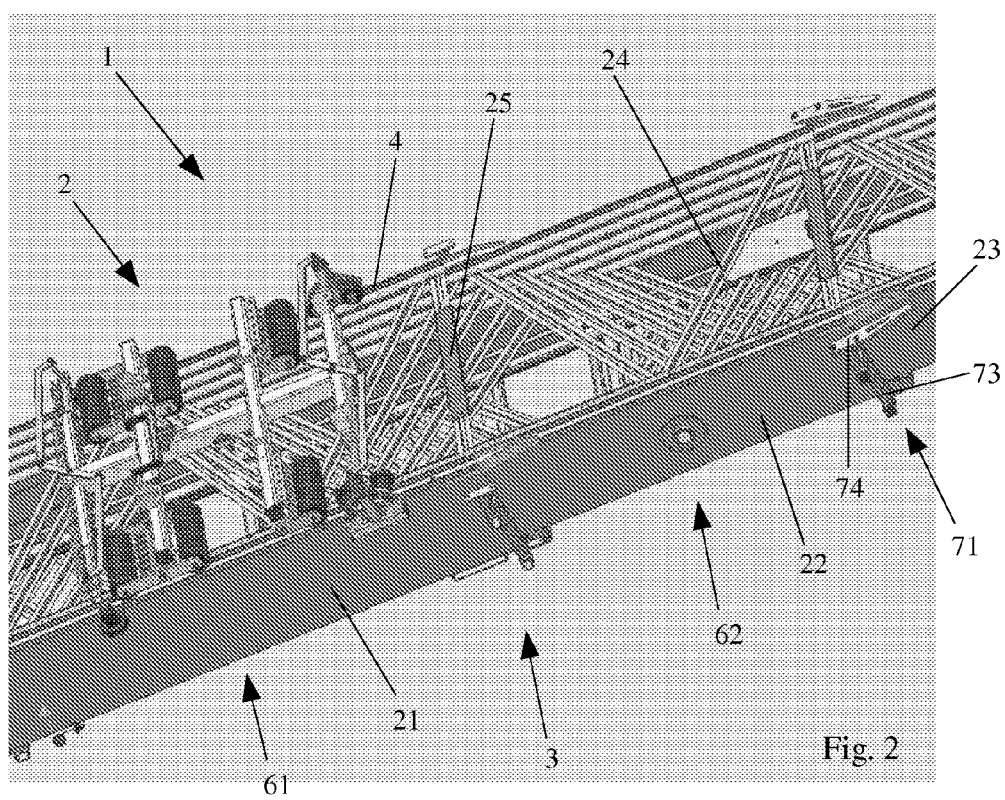


Fig. 2

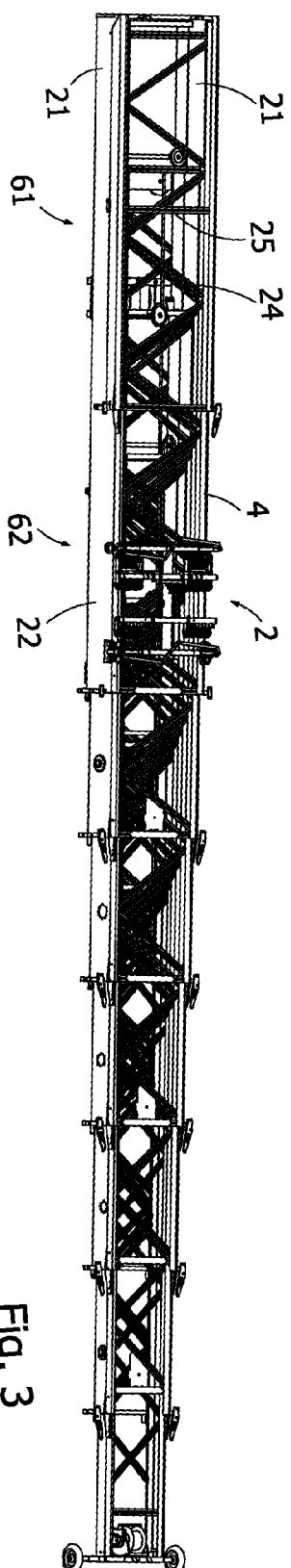


Fig. 3

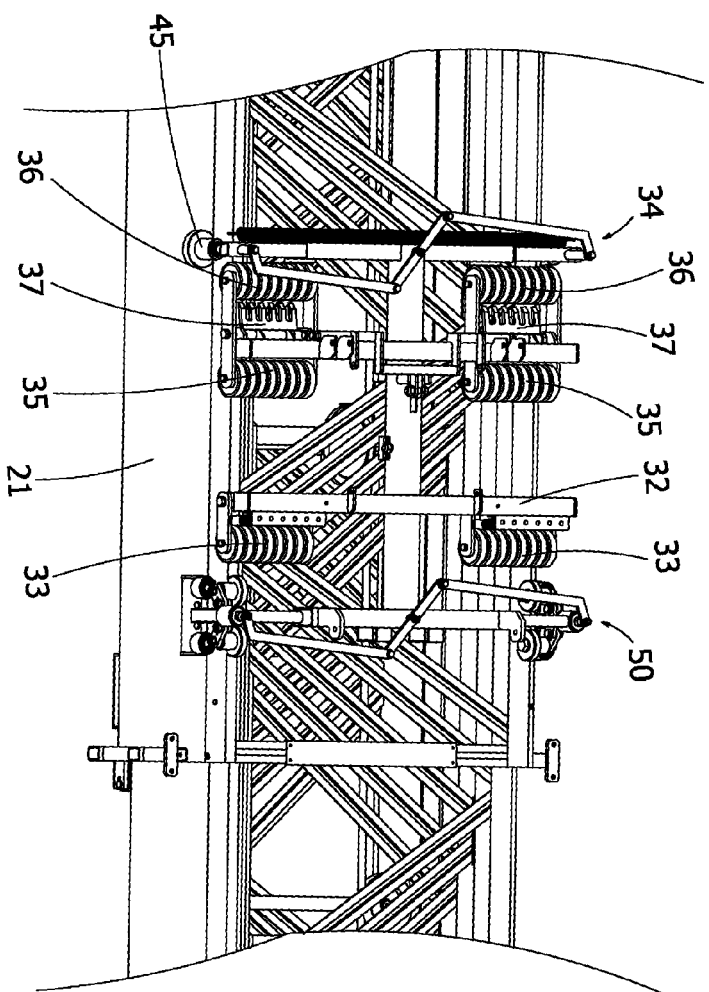
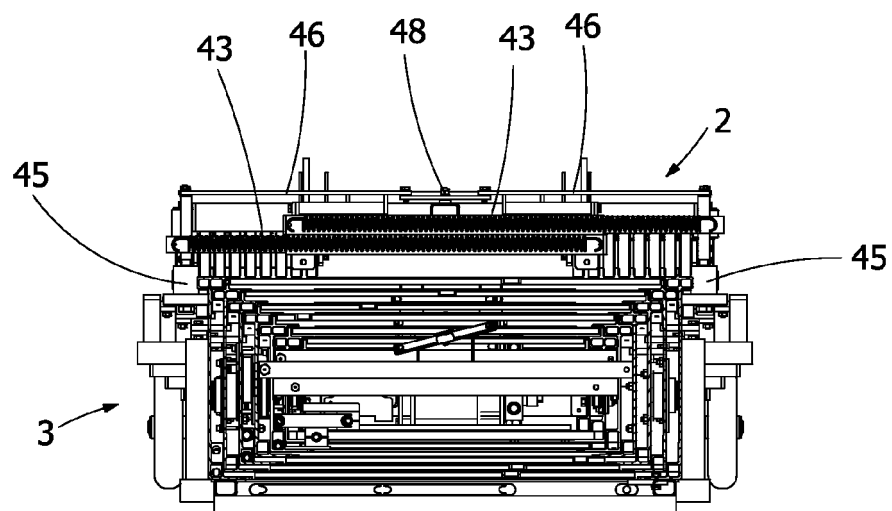
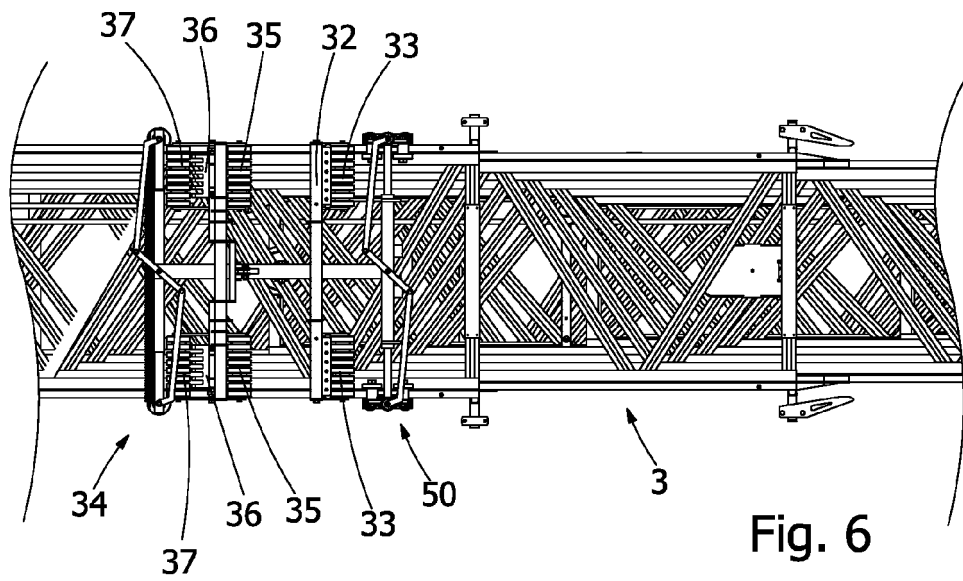
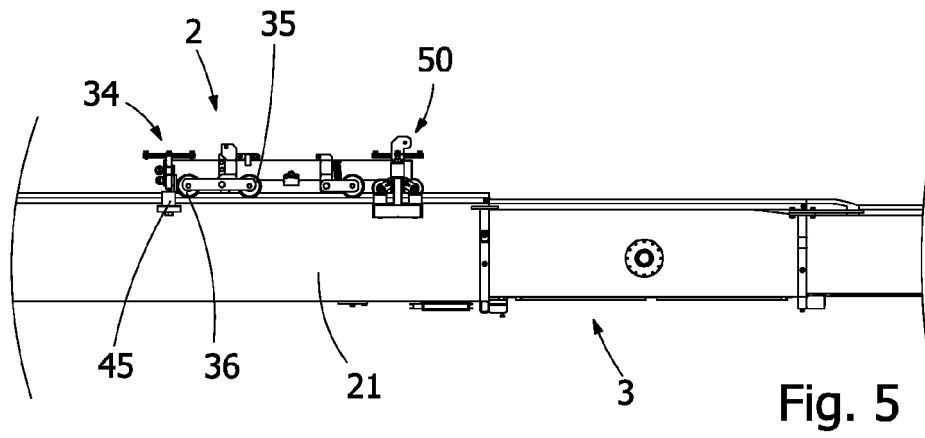
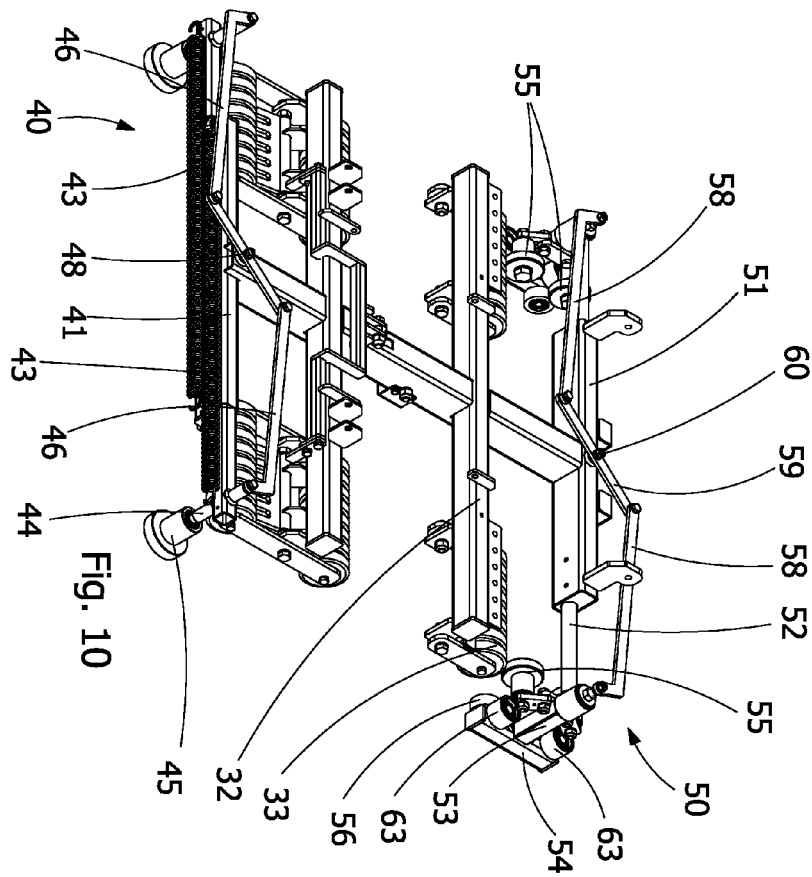
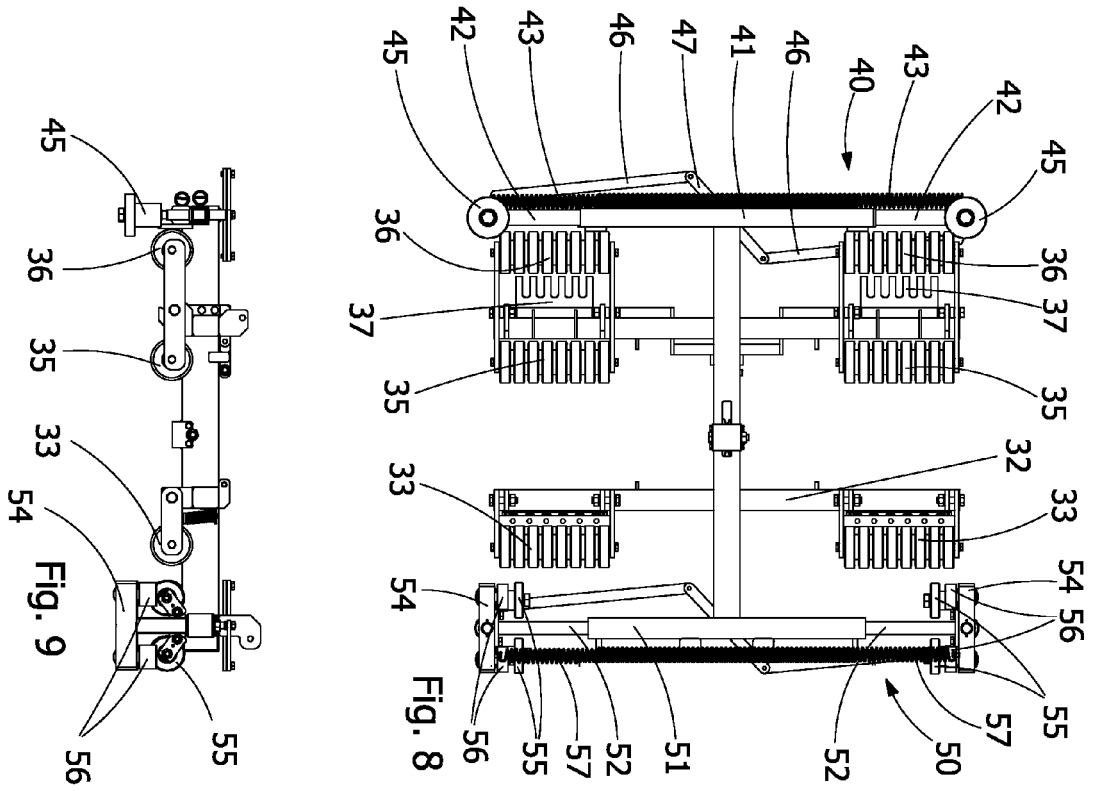


Fig. 4





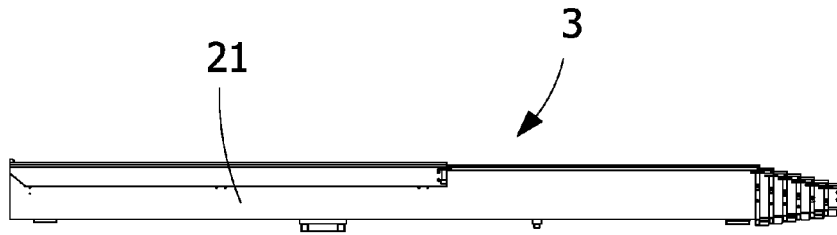


Fig. 11

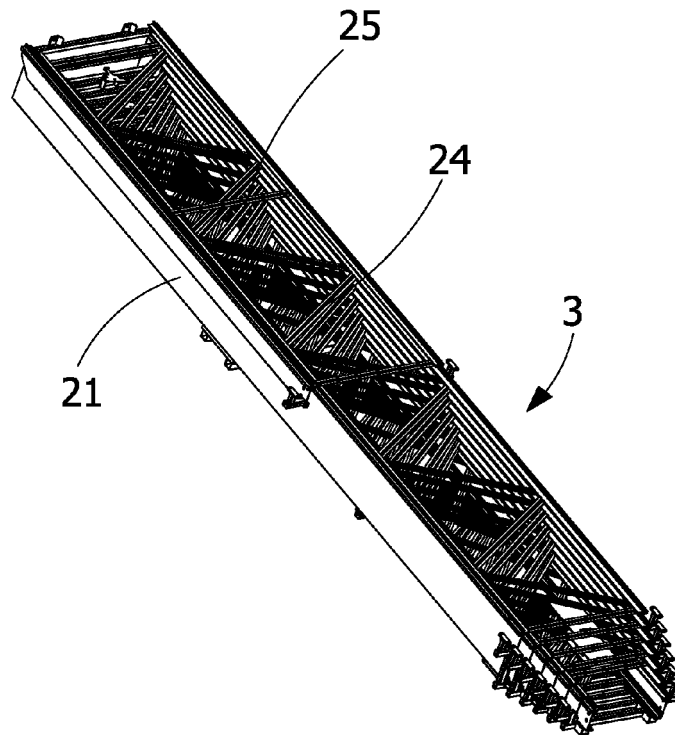


Fig. 12

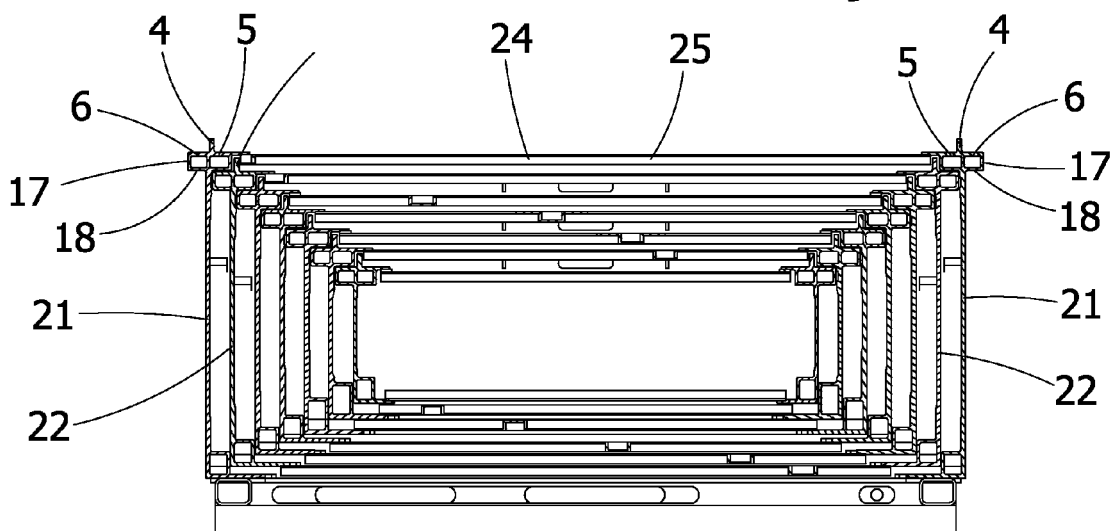


Fig. 13