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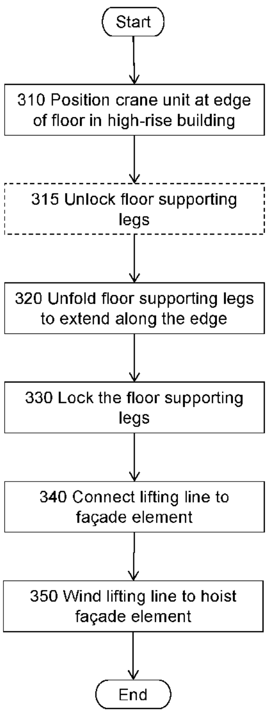

Fig. 6

(57) Abstract: A method and a crane unit (100) for vertical hoisting of a facade element (230) along a facade of a high-rise building (200) are disclosed. The crane unit (100) is positioned on a floor (210) of the high-rise building (200), adjacent to an edge (215) of the floor (210) and between two consecutive elongated mounting structures (240) of the high-rise building (200), whereby a beam arm (110) of the crane unit (100) extends beyond the edge (215). A lifting line (115) is connected (340) to the facade element (230). The wire (115) is winded by means of the crane unit (100) to hoist the facade element (230) along the facade of the high-rise building (200) while the two consecutive elongated mounting structures (240) guide the facade element (230). Before the step of winding (350) the wire (115), two floor supporting legs (120) are unfolded (320) from a respective transportation position (191) to a respective supporting position (192), wherein in the respective supporting position (192) each floor supporting leg (120) of said two floor supporting legs (120) extends along the edge (215) of the floor (210). Further, said each floor supporting leg (120) is locked (330) in the supporting position (192).

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METHOD AND CRANE UNIT FOR VERTICALLY HOISTING FACADE ELEMENTS FOR A HIGH-RISE BUILDING

TECHNICAL FIELD

Embodiments herein relate to construction of high-rise buildings, such as multi-storey buildings, skyscrapers, and the like. In particular, a method for vertically hoisting facade elements and a crane unit adapted for use in the method are disclosed.

BACKGROUND

Construction of high-rise buildings includes various transportation means and procedures, which usually differ from one manufacturer of a facade system to another. One such process for construction of a high-rise building is described in e.g. “A Novel Facade System to Improve the Whole High-Rise Building Process” by Henrik Falk et al, published in 2016. Within this process the facade elements are transported horizontally to a position at a ground level of the building and then hoisted vertically to a desired floor for installation.

A crane, such as the one disclosed in SE542667C2, may be used for vertically hoisting the facade elements. In order to vertically hoist the facade element, the crane is positioned between two wind posts, which are adapted to guide the facade element during vertical hoisting thereof. Then, a wire of the crane is lowered to the ground level, where the facade element is picked up by a jig fastened at the end of the wire. Next, the facade element is hoisted along the facade up to the desired floor level below the floor at which the crane is located. Subsequently, the facade element is mounted at the desired floor level and the crane is thus made available for the hoisting of an additional facade element. Thanks to the known crane and the related process for construction of high-rise buildings considerable time and cost savings are expected.

Even though the known crane is well-functioning for mounting of facades of high-rise buildings, there is room for improvement.

SUMMARY

An object is to provide an improved crane unit. A further object is to provide a method for construction of high-rise buildings having facades comprising facade elements, using said improved crane unit.

According to an aspect, the object is achieved by a method for vertical hoisting of a facade element along a facade of a high-rise building by means of a crane unit. With the method, the crane unit is positioned on a floor of the high-rise building, adjacent to an edge of the floor and between two consecutive elongated mounting structures of the high-rise building, whereby a beam arm of the crane unit extends beyond the edge. Further, a lifting line of the crane unit is connected to the facade element, and the wire is winded by means of the crane unit to hoist the facade element along the facade of the high-rise building, while the two consecutive elongated mounting structures guide the facade element.

Moreover, before the step of winding the wire, the method comprises unfolding two floor supporting legs of the crane unit from a respective transportation position to a respective supporting position, wherein in the respective supporting position each floor supporting leg of said two floor supporting legs extends along the edge of the floor. Next, said each floor supporting leg is locked in the supporting position.

Thanks to the foldable supporting legs, the weight of the crane unit, and any load carried by it, is distributed over the floor. As a result, the floor may be dimensioned for forces and/or stress that are less than when a crane without support legs is used.

Furthermore, an advantage with the foldable support legs is that they can be folded and unfolded quickly between the transportation and supporting positions. This is a considerable advantage since the crane unit needs to be moved many times during the construction of a facade comprising facade elements.

Preferably, the two floor supporting legs in the supporting positions and the crane unit extend over at least 50%, preferably at least 70%, and most preferably at least 90%, of a distance between the two consecutive elongated mounting structures. The greater portion of the distance that is overlapped, or covered, by the distal ends of the floor supporting legs, the more the force and/or strain on the floor is distributed. A greater percentage means that the floor can be made less strong and, thus, material and cost savings may be attained.

According to some embodiments, the unfolding comprises rotating the respective floor supporting leg about a hinge joint connecting a proximal end of the respective floor supporting leg to a lower portion of the crane unit.

In some embodiments, a distal support element of the respective floor supporting leg is adapted to abut against the floor in the respective supporting position.

Preferably, the method further comprises unlocking two floor supporting legs of the crane unit from the respective transportation position in which each floor supporting leg is positioned upright.

In some embodiments, the locking is performed by locking a respective lockable hinge joint for said each floor supporting leg, wherein the respective lockable hinge joint connects a respective first folding arm and a respective second folding arm to each other, wherein the respective first folding arm is hingedly connected at the crane unit in the proximity below the beam arm, and the respective second folding arm is hingedly connected to a distal end of the respective floor supporting leg.

According to another aspect, the object is achieved by a crane unit adapted for vertical hoisting of a facade element along a facade of a high-rise building while standing on a floor of the high-rise building. The crane unit comprises a vertically extending support structure mounted at a first end of an elongated extension of the crane unit, wherein a beam arm is mounted at an upper end of the support structure, wherein the beam arm is fixedly arranged to extend beyond a front side at the first end of the crane unit and perpendicularly to the support structure, wherein the front side faces an edge of the floor during the hoisting of the facade element.

Furthermore, the crane unit comprises, at the front side and for each of long side of the crane unit that is longer than the front side:

- a respective floor supporting leg hingedly connected for movement in a plane, parallel with the front side, at a lower portion of the crane unit by means of a hinge joint,
- a respective first folding arm hingedly connected for movement in the plane to the support structure above the hinge joint,
- a respective second folding arm hingedly connected to the respective floor supporting leg, and
- a respective lockable hinge joint that connects the respective first and second folding arms.

Moreover, the respective floor supporting leg is foldable between a supporting position, in which the respective floor supporting leg is lockable towards the floor by means of the respective lockable hinge joint, and a transportation position, in which the floor supporting leg is lockable along the support structure by means of the respective lockable joint.

Thanks to the folding arms, and the floor supporting legs, the crane unit is adapted for fast folding/unfolding between the transportation position and the supporting position. In some examples, the unfolding takes advantage of gravity in order to further facilitate the unfolding of the support legs.

An advantage is that time and/or cost for the construction of a facade comprising facade elements is reduced.

Preferably, the respective lockable joint is adapted to lock the respective floor supporting leg when the supporting position is reached. An advantage is that operation of unfolding is simplified, e.g. since the supporting legs automatically, i.e. without manual intervention, lock when the supporting position is reached.

BRIEF DESCRIPTION OF THE DRAWINGS

The various aspects and embodiments disclosed herein, including particular features and advantages thereof, will be readily understood from the following detailed description and the accompanying drawings, which are briefly described in the following.

Figure 1 is a schematic overview of a high-rise building in connection with which the embodiments herein may be applied.

Figure 2 is a perspective view illustrating embodiments of the crane unit.

Figure 3 is another perspective view illustrating embodiments of the crane unit.

Figure 4 is a front view illustrating embodiments of the crane unit.

Figure 5 is another front view illustrating embodiments of the crane unit.

Figure 6 is a flowchart illustrating embodiments of the method.

DETAILED DESCRIPTION

When seeking to improve the facade system mentioned in the background section, the present inventor realized that there is a gain in terms of cost and consumption of material for the floor construction if the building could be constructed with a less sturdy floor.

Several options have been explored. For example, it has been investigated whether removable temporary enforcements of the floor could be used such that the reinforcements could be removed and reused after the facade elements have been installed.

Further, it has been suggested to use a well-known ground-based and stand-alone crane for the hoisting of e.g. facade elements. Such cranes would not expose the floors of the building to excessive loads or weight, since they are standing on the ground surrounding the building. However, stand-alone cranes are associated with disadvantages such as being sensitive to strong winds and cumbersome installation at the construction site. This is also one of the disadvantages that the initially mentioned novel facade system is designed to overcome.

When seeking to reduce weight on the floor, or more evenly distribute the weight over the floor, the present inventor has investigated known spider cranes. One such spider crane is provided with extendable spider legs that are capable of supporting the crane against surrounding ground. The spider legs are motorized and extend slowly when an operator pushes a button. When the legs are extended the weight of the crane and any load carried by the crane will be distributed over the ground between the extended legs. Since time is a crucial factor of the initially mentioned novel facade system, it would appear as an obvious solution to simply improve speed of the extension and retraction of the spider crane's motorized legs. A further disadvantage of the spider cranes is their typical lifting range, i.e. the spider cranes can normally only lift e.g. a facade element 10-20 meters vertically, which is not sufficient when building high-rise buildings with the initially mentioned novel facade system. However, the present inventions have chosen a different path by providing the method and the related crane unit according to the various embodiments as described herein.

Throughout the following description, similar reference numerals have been used to denote similar features, such as legs, arms, parts, items, elements, units, steps or the like, as applicable.

Figure 1 is a schematic overview illustrating a high-rise building 200 in connection with which the embodiments herein may be applied. The high-rise building 200 has a plurality of floors 210, such as levels, floor levels, or the like. As shown in the Figure, a facade 220 of the high-rise building 200 is at least partly covered with facade elements 230. A crane unit 100 for the installation of facade elements 230 is positioned on a floor 210 between two elongated mounting structures 240, such as wind posts or the like.

Installation of the facade elements 230 can be summarized as follows.

1. A truck (not shown) arrives at the construction site with a plurality of facade elements 230.
2. The facade elements 230 are vertically off-loaded from the truck. The facade elements 230 are vertically connected to a rail.
3. The facade elements 230 are put in a queue on the rail, ready to be horizontally transported before installation.
4. A facade element 230 is transported to a position under the crane unit 100 positioned between two elongated mounting structures 240, as mentioned above.
5. A wire (not shown) of the crane 100 is connected, such as indirectly connected via a lifting jig (not shown), to the facade element 230.
6. The crane unit 100 hoists the facade element 230 to the desired floor 210, while the facade element is guided by the elongated mounting structures 240.
7. Next, the facade element is secured at its desired position at the facade 220 of the high-rise building 200.

Now turning to Figure 2, in which an exemplifying crane unit 100 is shown. The crane unit 100 is adapted for use in the embodiments of the method disclosed herein.

Accordingly, in one example, the crane unit 100 is adapted for vertical hoisting of a facade element 230 along a facade of a high-rise building 200 while standing on a floor 210 of the high-rise building 200. As an example, this means that the crane unit 100 is capable of extending a beam arm thereof beyond and/or over an edge 215 of the floor 210. It may be noted that e.g. so-called portal cranes are not capable of extending a beam arm beyond and/or over an edge 215 of the floor 210.

The crane unit 100 comprises a vertically extending support structure 160 mounted at a first end 101 of an elongated extension of the crane unit 100. With respect to the elongated extension of the crane unit 100, the crane unit 100 may have two parallel long sides 107, a front side 105 and a back side (not shown). A beam arm 110 is mounted at an upper, or distal, end 165 of the support structure 160. The beam arm 110 is fixedly arranged to extend beyond the front side 105 at the first end 101 of the crane unit 100 and perpendicularly to the support structure 160. The front side 105 faces, such as adapted to face or the like, an edge 215 of the floor 210 during the hoisting of the facade element 230.

The crane unit 100 comprises, at the front side 105 and for each long side 107 of the crane unit 100 that is longer than the front side 105:

- a respective floor supporting leg 120 hingedly connected for movement in a plane P1, parallel with the front side 105, at a lower portion 106 of the crane unit 100 by means of a hinge joint 122.
- a respective first folding arm 130 hingedly connected for movement in the plane P1 to the support structure 160 above the hinge joint 122. In more detail, the respective first folding arm 130 may be hingedly connected in the proximity below the beam arm 110, such as within 50 cm, more preferably within 40 cm, and most preferably within 30 cm. The respective first folding arm 130 may be connected by means of an articulated joint 132, such as a hinge joint or the like.
- a respective second folding arm 140 hingedly connected to the respective floor supporting leg 120, and
- a respective lockable hinge joint 150 that connects the respective first and second folding arms 130, 140.

The respective first and second folding arms 130, 140 and the floor supporting leg 120 may typically be located within a cross section of the crane 100 when the transporting position is assumed. The cross section is parallel to the front side 105. In this manner, the crane may easily be transported in narrow environments, such as through doorways or the like.

The respective floor supporting leg 120 is foldable between a supporting position 192, in which the respective floor supporting leg 120 is lockable towards the floor 210 by means of the respective lockable hinge joint 150, and a transportation position 191, in which the floor supporting leg 120 is lockable along the support structure 160 by means of the respective lockable joint 150. The supporting position 192 may be a predefined supporting position 192, which may be defined by the lengths of the arms and/or legs and the locking of the joint between the folding arms 130, 140.

In this example, the crane unit 100 takes advantage of the flat floor, i.e. the floor supporting legs 120 do not need to be adapted to a height-varying ground, sloping ground, that cranes are normally adapted to stand on.

The supporting legs 120 are in the supporting position 192, extending along a straight line. A force during lifting is directed mainly in the longitudinal direction of the folding arms, in which they can withstand greater forces than when positioned at an angle relative to each other. This means that the folding arms 130, 140 may be made relatively thin and slender, whereby cost is expected to be lower than if made thick and sturdy.

Furthermore, in some examples, one or more of the supporting legs, the folding arms, preferably all of them, are manufactured from U-beams, which when located in the transportation position takes advantage of the U-shaped cross-section to at least partly overlap with each other. In this manner, the transportation position 191 is made compact, whereby less space is required.

As an example, in the transportation position the supporting legs are typically folded not to extend beyond a base plate of the crane unit 100. Further, the transportation position is typically upright, e.g. one or more of the floor supporting legs, and foldable arms, are locked in upright positions, such as vertical positions, when the crane unit 100 is standing on the floor.

The respective lockable joint 150 is adapted to lock the respective floor supporting leg 120 when the supporting position 192 is reached. In this manner, no additional action is required to lock the supporting leg(s) 120 in the supporting position 192.

In more detail, however not shown in the Figures, the crane unit 100 may comprise a motorized winch unit for the hoisting of the facade element 230 using the lifting line 115 whose path runs at least partly along or within the beam arm 110. The motorized winch unit comprises a winch wire storage reeler (not shown), such as a drum, a cylinder, or the like, for winding of the winch wire during the hoisting. The motorized winch unit is arranged at a second end of the crane unit 100. The second end is oppositely located with respect to a first end at the front side of the crane unit 100.

Figure 3 illustrates a perspective view of the exemplifying crane unit 100 when the floor supporting legs 120 are in the transportation position 191.

Figure 4 illustrates a front view of the exemplifying crane unit 100 when the floor supporting legs 120 are in the supporting positions 192.

As shown in the Figure, the exemplifying crane unit 100 has a locking mechanism for locking the first and second folding arms 130, 140.

In the supporting position 192, the first and second folding arms 130, 140 are locked, such as secured or the like, such that the hinge joint 150 is folded whereby the first and second folding arm 130, 140 has a major overlap and are substantially parallel with each other. In the supporting position 192, for example a mechanically biased pin 135 is received by a hole 145 of the second folding arm 140. The pin 135 may be lockable in an extracted position and/or in a retracted position in order to cooperate with the holes 145, 146.

In the transportation position 191, the first and second folding arms 130, 140 may be locked such that the hinge joint 150 is straight, whereby the first and second folding arms 130, 140 only overlap in the vicinity of the hinge joint 150. The floor supporting leg 120 may abut against the floor 210. In the transporting position 191, the pin 135 may be received by a hole 146 of the second folding arm 140.

The floor supporting leg 120 may comprise a distal support element 127 that is adapted to abut against the floor 210, when the floor supporting leg 120 is in the supporting position. An advantage is that floor supporting leg(s) can be unfolded also when smaller items, such as cables, debris, building material, or the like, are obscuring the floor close to the edge of the floor.

Figure 5 illustrates a front view of the exemplifying crane unit 100 when the floor supporting legs 120 are in the transportation positions 191.

In some examples of the crane disclosed herein, a platform 103 in the lower portion 106 of the crane 100 may be provided with a material having high friction. The material may be rubber or the like. As an example, a bottom surface (not shown) of the platform 103 may be provided with one or more strips of the high friction material. For example, more than one third of the area of the bottom surface closest to the front side 105 may be provided with the high friction material, such as one or more layers of vulcanized rubber applied thereon.

There is a risk that the crane slides on the edge of the floor, in case the front edge has tipped over the edge, e.g. when the crane is moved with a pallet lift. Thanks to the high friction material such risk is reduced.

Figure 6 is a flow chart illustrating an example of the method disclosed herein. In view of the method illustrated briefly with reference to Figure 1, the method of Figure 6 comprises further steps associated with the operation of the crane unit 100 described herein. In one example, Figure 6 illustrates a method for vertical hoisting of a facade element 230 along a facade 220 of a high-rise building 200 by means of a crane unit 100.

One or more of the following steps may be performed.

In a step 310, the crane unit 100 is positioned on a floor 210 of the high-rise building 200, adjacent to an edge 215 of the floor 210, whereby a beam arm 110 of the crane unit 100 extends beyond the edge 215. The crane unit 100 may be positioned, e.g. in the middle, between two consecutive elongated mounting structures 240. The edge 215 may be a floor slab edge or the like. The two consecutive elongated mounting structures 240, such as wind post or the like, are consecutive in terms of their position along the edge 215 and/or along the facade 220 of the high-rise building 200.

Typically, the floor 210 is supported by a floor supporting structure, which often is different from the elongated mounting structures 240. However, with a view to mount and install the facade element 230 and the hoisting thereof, it is an advantage to place, or position, the crane unit 100 in the middle between two such consecutive elongated mounting structures 240, such as wind posts, beams, or the like. Pulling the facade element 230 upwards may thus proceed at the middle of a hoisting jig (not shown), which is then kept balanced.

In a step 315, the two floor supporting legs 120 of the crane unit 100 may be unlocked from a respective transportation position 191. In the respective transportation position 191, each floor supporting leg 120 may be positioned upright, such as vertically or substantially vertically.

Preferably before the step 350, a step 320 is performed. In the step 320, two floor supporting legs 120 of the crane unit 100 are unfolded from a respective transportation position 191 to a respective supporting position 192. In the respective supporting position

192, each floor supporting leg 120 of said two floor supporting legs 120 extends along the edge 215 of the floor 210, such as parallelly with, and preferably in proximity to the edge 215 of the floor 210, such as in close proximity to the edge 215 of the floor 210, such as 0.0-0.5, preferably 0.0-0.3, and most preferably 0.0-0.1 times the length of each floor supporting leg 120.

The two floor supporting legs 120 in the supporting position 192 and the crane unit 100 may preferably extend over at least 50% of a distance between the two consecutive elongated mounting structures 240, when positioned in the respective supporting position.

In this step, the unfolding may comprise rotating the respective floor supporting leg 120 about a hinge joint 122 connecting a proximal end 126 of the respective floor supporting leg 120 to a lower portion 106 of the crane unit 100.

An advantage with the folding of the supporting legs 120 is that the supporting legs 120 can be moved, e.g. by a construction worker or the like, from the transportation positions 191 to the supporting positions 192. This can be done quickly, since in a transition between the transporting position and the supporting position, the floor supporting legs 120 are freely movable, e.g. uncapable of being locked such as to support the crane. The invention as herein described, in its context of use, is optimised for use on flat surfaces, such as a floor in a high-rise building. As mentioned, the supporting legs 120 can be moved quickly between the transporting and supporting positions.

In some examples, the preceding step of positioning the crane 100 may comprise a sub-step of lowering the crane 100, e.g. from a pallet lift, whereafter the crane stands on the floor. In these examples, the step 320 of unfolding the arms may be performed before the crane 100 is lowered to the floor.

In a step 330, also typically before the step 350 below, said each floor supporting leg 120 is locked in the supporting position 192.

In this manner, a weight of the facade element 230 and the crane unit 100 is distributed over the floor 210 by means of the two floor supporting legs 120 that can be quickly unfolded to the supporting position and folded to the transportation position.

In one example, the locking of the two floor supporting legs 120 is performed by locking a respective lockable hinge joint 150. The respective lockable hinge joint 150 may connect a respective first folding arm 130 and a respective second folding arm 140 to each other. The respective first folding arm 130 is hingedly connected at the crane unit 100 in the proximity below the beam arm 110, and the respective second folding arm 140 is hingedly connected to a distal end 125 of the respective floor supporting leg 120. In more detail, the respective second folding arm 140 may be connected to the distal end 125 of the floor supporting leg 120 via an articulated joint 142.

In a step 340, a lifting line 115, such as a wire, a rope or the like, of the crane unit 100 is connected to the facade element 230.

In a step 350, the wire 115 is winded, e.g. onto a reeler (not shown) of the crane unit 100, by means of the crane unit 100 to hoist the facade element 230 along the facade of the high-rise building 200 while the two consecutive elongated mounting structures 240 guide the facade element 230.

Even though embodiments of the various aspects have been described, many different alterations or modifications thereof will become apparent for those skilled in the art. The described embodiments are therefore not intended to limit the scope of the present disclosure whatsoever.

CLAIMS

1. A method for vertical hoisting of a facade element (230) along a facade of a high-rise building (200) by means of a crane unit (100), wherein the method comprises:

   positioning (310) the crane unit (100) on a floor (210) of the high-rise building (200), adjacent to an edge (215) of the floor (210) and between two consecutive elongated mounting structures (240) of the high-rise building (200), whereby a beam arm (110) of the crane unit (100) extends beyond the edge (215),

   connecting (340) a wire (115) of the crane unit (100) to the facade element (230), and

   winding (350) the wire (115) by means of the crane unit (100) to hoist the facade element (230) along the facade of the high-rise building (200) while the two consecutive elongated mounting structures (240) guide the facade element (230), wherein the method is **characterized by**, before the step of winding (350) the wire (115):

   unfolding (320) two floor supporting legs (120) of the crane unit (100) from a respective transportation position (191) to a respective supporting position (192), wherein in the respective supporting position (192) each floor supporting leg (120) of said two floor supporting legs (120) extends along the edge (215) of the floor (210), and

   locking (330) said each floor supporting leg (120) in the supporting position (192).

2. The method according to claim 1, wherein the two floor supporting legs (120) in the supporting positions (192) and the crane unit (100) extend over at least 50% of a distance between the two consecutive elongated mounting structures (240).

3. The method according to any one of the preceding claims, wherein the unfolding comprises rotating the respective floor supporting leg (120) about a hinge joint (122) connecting a proximal end (126) of the respective floor supporting leg (120) to a lower portion (106) of the crane unit (100).

4. The method according to any one of the preceding claims, wherein a distal support element (127) of the respective floor supporting leg (120) is adapted to abut against the floor (210) in the respective supporting position (192).

5. The method according to any one of the preceding claims, wherein the method further comprises:

unlocking (315) two floor supporting legs (120) of the crane unit (100) from the respective transportation position (191) in which each floor supporting leg (120) is positioned upright.

6. The method according to any one of the preceding claims, wherein the locking (330) is performed by locking a respective lockable hinge joint (150) for said each floor supporting leg (120), wherein the respective lockable hinge joint (150) connects a respective first folding arm (130) and a respective second folding arm (140) to each other, wherein the respective first folding arm (130) is hingedly connected at the crane unit (100) in the proximity below the beam arm (110), and the respective second folding arm (140) is hingedly connected to a distal end (125) of the respective floor supporting leg (120).

7. A crane unit (100) adapted for vertical hoisting of a facade element (230) along a facade of a high-rise building (200) while standing on a floor (210) of the high-rise building (200), wherein the crane unit (100) comprises:

a vertically extending support structure (160) mounted at a first end (101) of an elongated extension of the crane unit (100), wherein a beam arm (110) is mounted at an upper end (165) of the support structure (160), wherein the beam arm (110) is fixedly arranged to extend beyond a front side (105) at the first end (101) of the crane unit (100) and perpendicularly to the support structure (160), wherein the front side (105) faces an edge (215) of the floor (210) during the hoisting of the facade element (230), **characterized in that** the crane unit (100) comprises, at the front side (105) and for each of long side (107) of the crane unit (100) that is longer than the front side (105):

- a respective floor supporting leg (120) hingedly connected for movement in a plane (P1), parallel with the front side (105), at a lower portion (106) of the crane unit (100) by means of a hinge joint (122),
- a respective first folding arm (130) hingedly connected for movement in the plane (P1) to the support structure (160) above the hinge joint (122),
- a respective second folding arm (140) hingedly connected to the respective floor supporting leg (120),
- a respective lockable hinge joint (150) that connects the respective first and second folding arms (130, 140),

wherein the respective floor supporting leg (120) is foldable between a supporting position (192), in which the respective floor supporting leg (120) is lockable towards the floor (210) by means of the respective lockable hinge joint (150), and a transportation position (191), in which the floor supporting leg (120) is lockable along the support structure (160) by means of the respective lockable hinge joint (150).

8. The crane unit (100) according to the preceding claim, wherein the respective lockable hinge joint (150) is adapted to lock the respective floor supporting leg (120) when the supporting position (192) is reached.

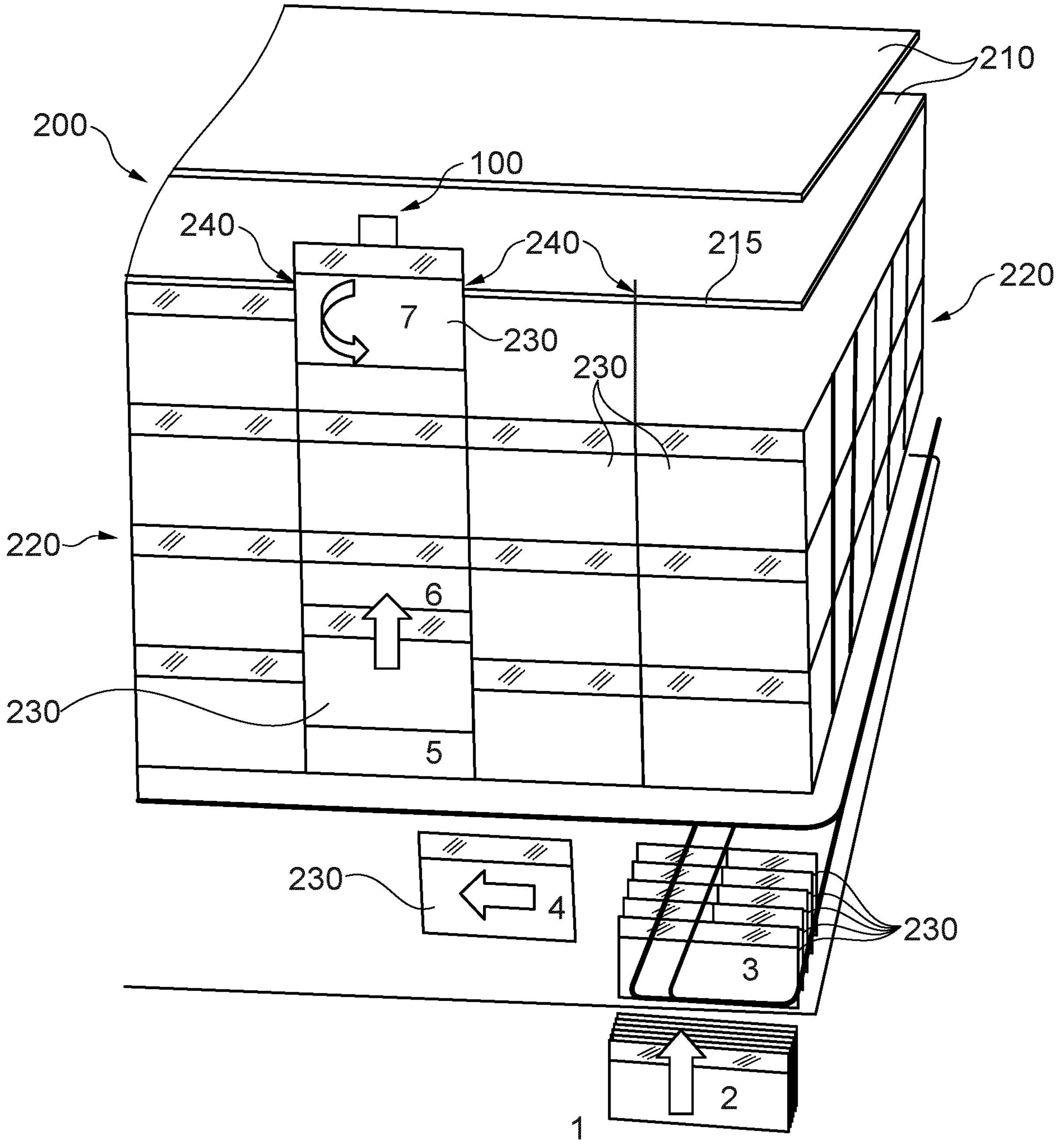

Fig. 1

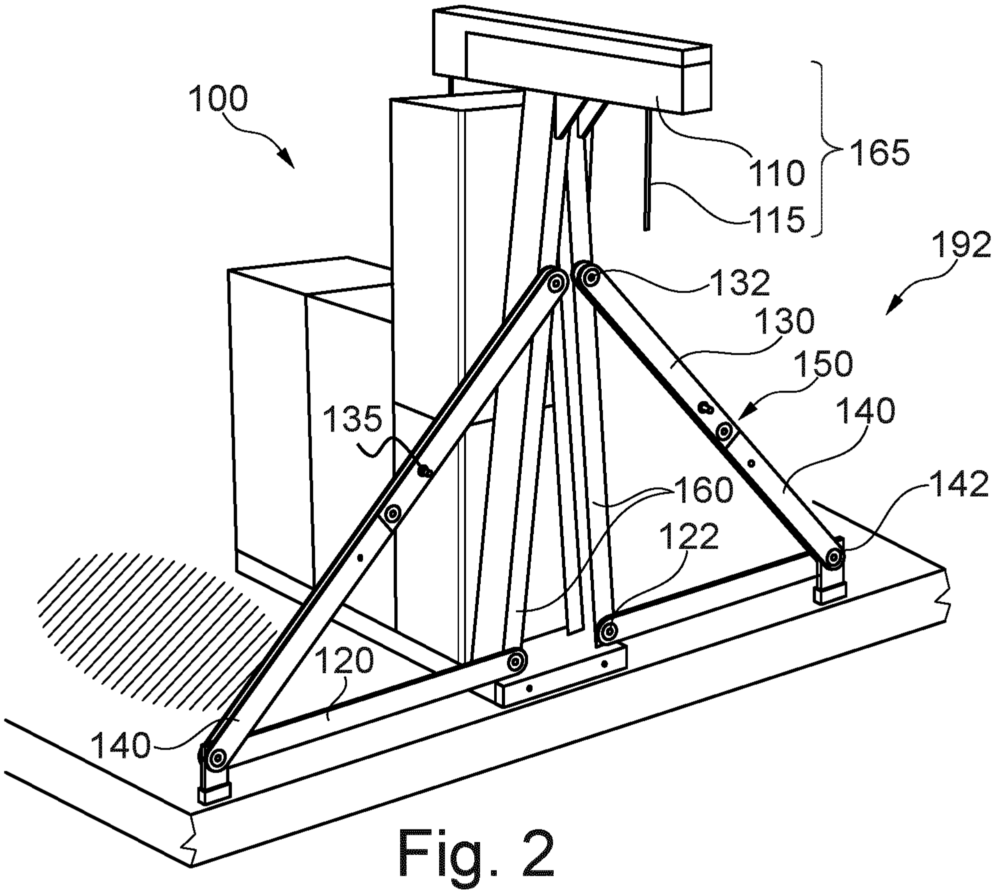
100
165
110
115
192
132
130
150
140
135
160
142
122
120
140

Fig. 2

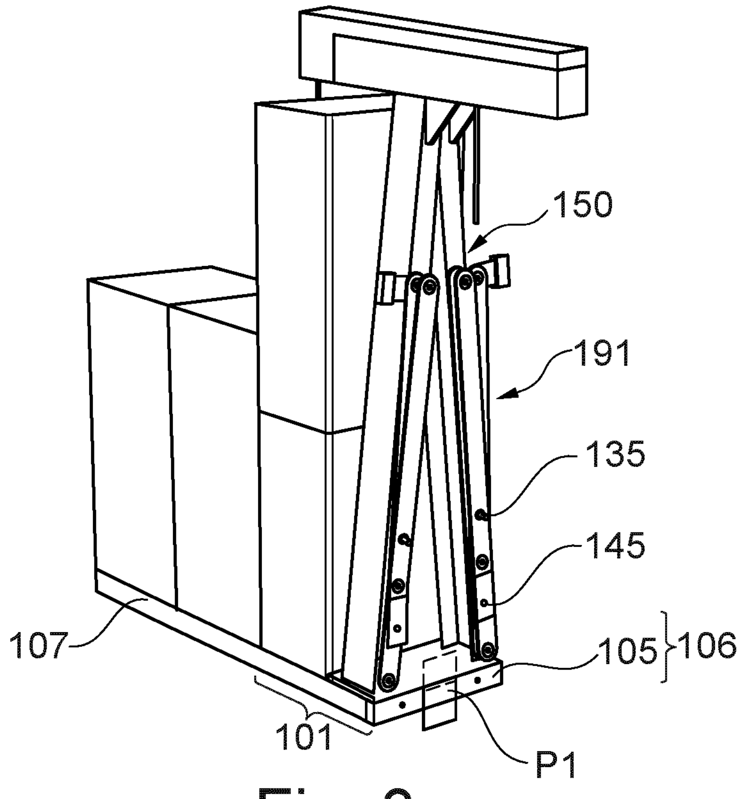
150
191
135
145
107
105
106
101
P1

Fig. 3

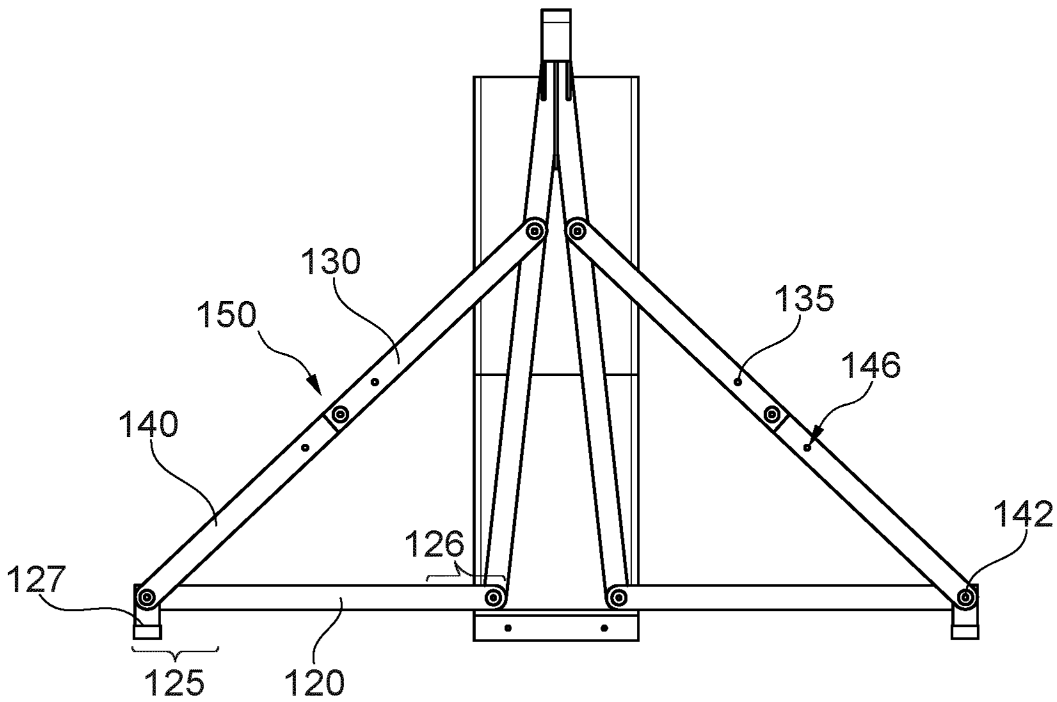
130
150
135
146
140
142
126
127
125
120

Fig. 4

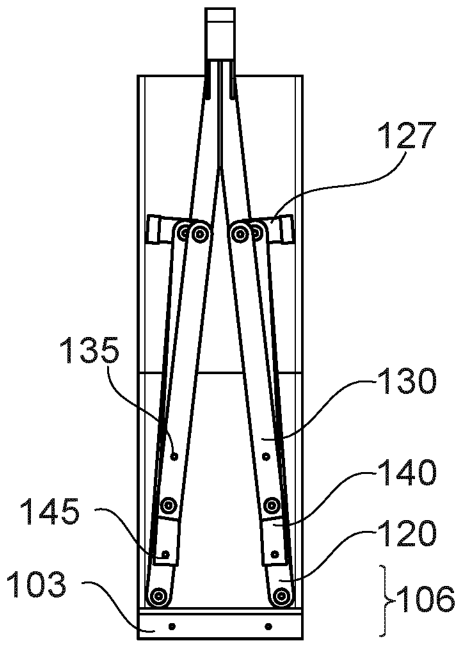
127
135
130
140
145
120
103
106

Fig. 5

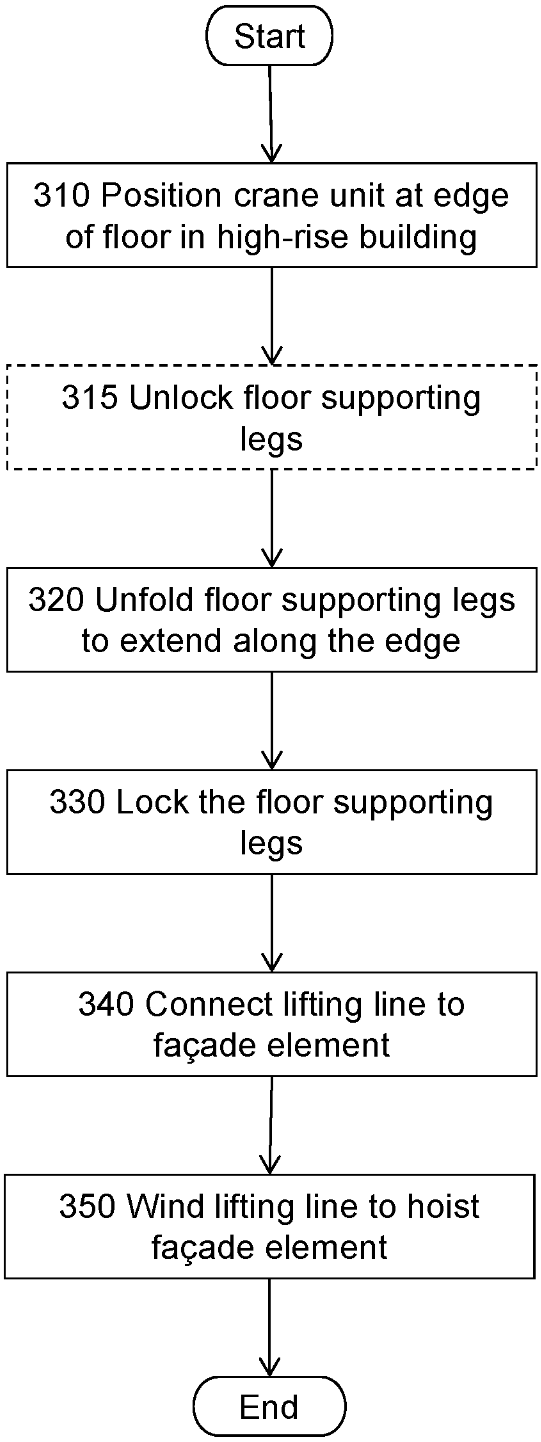
Start
310 Position crane unit at edge of floor in high-rise building
315 Unlock floor supporting legs
320 Unfold floor supporting legs to extend along the edge
330 Lock the floor supporting legs
340 Connect lifting line to façade element
350 Wind lifting line to hoist façade element
End

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/064410

A. CLASSIFICATION OF SUBJECT MATTER
INV. B66C23/26 B66C23/20
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)
B66C

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 Y	US 3 978 989 A (AVILA JR FRED) 7 September 1976 (1976-09-07) column 1, line 37 - column 3, line 40; figures 1,2	1-3,5-8 4
Y	US 5 622 237 A (MOLDOW STEFFEN [US]) 22 April 1997 (1997-04-22) figure 3	4
A	US 3 910 379 A (MILLER ROBERT E ET AL) 7 October 1975 (1975-10-07) the whole document	1-8

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 September 2023	18/09/2023

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Delval, Stéphane

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2023/064410

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 3978989	A	07-09-1976	NONE		
US 5622237	A	22-04-1997	NONE		
US 3910379	A	07-10-1975	CA	1038643 A	19-09-1978
			US	3910379 A	07-10-1975