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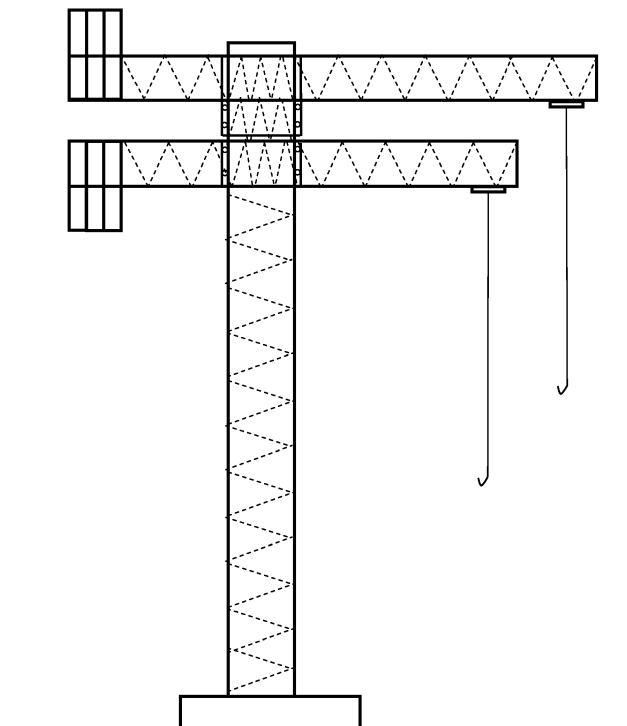
(54) **Device for lifting loads and method for erecting the same**

(57) The current invention is concerned with a device for lifting loads and a method for erecting the same.

The device at least comprises a cylindrical mast (1) with an axis and a jib which is attached to the mast (1), the mast (1) for standing vertically and the jib for extending horizontally. The device is characterized in that the jib is attached to the mast (1) such that it can be moved

along the axis of the cylindrical mast (1).

Making the jib movable along the axis of the mast allows for responding to strong winds by moving the jib down the mast thereby improving usability of the device. Similarly in case of ice built up on the jib, the jib can be moved down freed from ice and moved up again.



Figur 2

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Description

Field of the invention

[0001] The current invention is concerned with a device for lifting loads and a method for erecting the same.

Background

[0002] Devices for lifting loads are used intensively, for instance on almost every construction site.

[0003] One common form of load lifting devices is the so-called tower crane which comprises a cylindrical mast with an axis and a jib which is attached to the top of a mast, with the mast standing vertically and the jib extending horizontally.

[0004] Tower cranes are used extensively in construction and other industry to hoist and move materials. The main parts of tower cranes are the mast and the jib. The mast is a main supporting tower of the crane extending vertically. It can be made, e.g., of steel trussed sections that are connected together during installation. The jib, or operating arm, extends horizontally from the mast.

[0005] For enabling rotation of the jib, tower cranes may comprise a slewing unit. Top slewing tower cranes comprise the slewing unit at the top of the mast enabling the jib to rotate around the mast with the mast remaining fixed. Bottom slewing tower cranes have the jib fixed to the mast and a slewing ring located near the base such that both, the mast and the jib, rotate relative to the base. Compared to top slewing tower cranes, bottom slewing tower cranes can be erected and dismantled more quickly.

[0006] Often, several load lifting devices are used in parallel. Each requires its own space for installment of a base of the mast.

[0007] As construction sites are temporary, load lifting devices are erected and dismantled frequently.

[0008] Under adverse wind conditions putting strong forces on the jib, load lifting devices of the prior art cannot be used any more. As well ice building up at the jib increasing its weight can be detrimental to use of the prior art devices. Removing ice built up can be cumbersome and/or dangerous.

Invention

[0009] The current invention proposes a device according to claim 1 for lifting loads. The current invention further proposes a method according to claim 13 for erecting such device.

[0010] The device according to the invention comprises a cylindrical mast with an axis and a jib which is attached to the mast, the mast for standing vertically and the jib for extending horizontally. The device according to the invention is characterized in that the jib is attached to the mast such that it can be moved along the axis of the cylindrical mast.

[0011] Making the jib movable along the axis of the mast allows for responding to strong winds by moving the jib down the mast thereby improving usability of the device. Similarly in case of ice built up on the jib, the jib can be moved down freed from ice and moved up again. This as well improves usability. Furthermore, the jib can be mounted at a height as needed for current work reducing swing of the load as well as stress and movements of the mast. With work continuing and height needed increasing the jib can be moved higher. Movability of the jib further eases erecting the device since with the jib fixed the mast may be moved.

[0012] In an advantageous embodiment the jib further can be rotated around the axis.

[0013] This allows for more stable constructions of the mast.

[0014] The device may comprise an upper jib which at least can be rotated around the axis for alignment to the jib wherein the aligned jibs can be attached to each other.

[0015] When aligned, the jibs can be used together for lifting loads thereby enabling lift of higher loads. As well the jibs can be used independently enabling synchronous lifting of different loads.

[0016] In a part of the mast above the jib, the upper jib may be movable along the axis independent from the jib.

[0017] Then, making the upper jib movable provides the same advantages as the movability of the jib. In addition a lower of the two jibs may be used as further ballast for stabilizing the mast in adverse weather conditions such that usability of the higher jib is maintained.

[0018] The mast may have a regular polygonal base wherein pairs of toothed rags extend along the axis on each facet of the mast. The device may comprise a cylindrical climbing frame with a circular base to which the jib is attached, the climbing frame surrounding the mast and comprising, for each of the toothed rags, a pair of cogwheels engaging with the respective toothed rag wherein the jib can be moved by turning the cogwheels.

[0019] This is a way of realizing movability of the jib in a stable manner.

[0020] The climbing frame may comprise a circular double cogged rim and the jib may be attached to the climbing frame by means of at least one further pair of cogwheels engaging with the double cogged ring such that the jib can be rotated by turning the further cogwheels.

[0021] This is a way of realizing rotatability of the jib in a stable manner.

[0022] The double cogged rim may be a top rim of the climbing frame and the jib may comprise a load lifting jib section, a counterweight jib section and a cylindrical central jib section surrounding the mast, the load lifting jib section and the counterweight jib section extending in opposite directions from the central jib section. The further pair of cogwheels may be arranged at a bottom rim of the central jib section.

[0023] This is a way of realizing a counterbalance for the jib.

[0024] Or, the double cogged rim may be a bottom rim of the climbing frame and the jib may comprise a load lifting jib section and a counterweight jib section extending in opposite directions from the climbing frame wherein each of the load lifting jib section and the counterweight jib section is provided with the further pair of cogwheels arranged at a lower side of the load lifting jib section and the counterweight jib section, respectively. Anchoring rollers may be provided at upper sides of each of the load lifting jib section and the counterweight jib section, each of the load lifting jib section and the counterweight jib section then may be attached to the climbing frame by means of the respective anchoring rollers and the respective further pair of cogwheels.

[0025] This is an alternative way of realizing a counterbalance for the jib.

[0026] The device may comprise a further cylindrical climbing frame with a circular base to which the upper jib is attached, the further climbing frame surrounding the mast and comprising, for each of the toothed rags, a pair of yet further cogwheels engaging with the respective toothed rag wherein the upper jib can be moved by turning the yet further cogwheels.

[0027] This is a way of realizing movability of the upper jib in a stable manner.

[0028] The further climbing frame may comprise a further circular double cogged rim and the upper jib may be attached to the further climbing frame by means of at least one even yet further pair of cogwheels engaging with the further double cogged ring such that the upper jib can be rotated by turning the even yet further cogwheels.

[0029] This is a way of realizing rotatability of the upper jib in a stable manner.

[0030] The further double cogged rim may be a top rim of further climbing frame and the upper jib may comprise a further load lifting jib section, a further counterweight jib section and a cylindrical central jib section surrounding the mast, the further load lifting jib section and the further counterweight jib section extending in opposite directions from the central jib section wherein the even yet further pair of cogwheels are arranged at a bottom rim of the central jib section.

[0031] This is a way of realizing a counterbalance for the upper jib.

[0032] The mast may be composed of mast sections of equal height which are attached to each other.

[0033] This eases erecting and dismantling the device.

[0034] A pair of middle mast sections may be attached to each other by means of absorbers for dissipating stresses and movements of a top part of the mast and for stabilizing a bottom part of the mast.

[0035] By means of the absorbers the working section of the load lifting device may be isolated from the lower section of the device. Then stresses and movements generated at the top of the mast during working times are dissipated. The device as a whole thus is more stable.

[0036] The method proposed according to the inven-

tion comprises placing the jib on a pair of supports of a further equal height at least as high the equal height and placing the upper jib on a further pair of supports of a yet further equal height at least as high the further equal height plus a height of the climbing frame wherein the upper jib is placed such that each of the yet further pairs of cogwheels is aligned with one of the pairs of cogwheels. The method proposed according to the invention further comprise positioning a mast section below the climbing frames and raising the mast section above until the pairs of cogwheels can engage with sections of the toothed rags, further raising the mast section by turning the pairs of cogwheels until the yet further pairs of cogwheels can engage with the sections of the toothed rags and yet further raising the mast section by turning the pairs of cogwheels and the yet further pairs of cogwheels.

[0037] In an advantageous embodiment the method may further comprise attaching a further mast section to a lower end of the mast section and moving the attached mast sections further above by turning the pairs of cogwheels and the yet further pairs of cogwheels.

[0038] Hence, because of the design of the device, the ability for self erection comes in to place. The sections of mast can be inserted and elevated on after the other through use of the climbing frames by engaging the cogwheels. When the required height is reached the base of the mast can be installed with designed anchoring and counterweights. The jibs can then elevate along the mast themselves in their normal manner. To dismantle the crane this process can be reversed. This makes the crane self erecting.

[0039] Further advantageous embodiments are specified in the dependent claims and/or can be deducted from the exemplary embodiments described in the following with reference to the figures. In the figures,

Figure 1 shows, schematically, a part of an exemplary embodiment of the load lifting device according to the invention with two jibs;

Figure 2 shows, schematically, the exemplary embodiment of the load lifting device according to the invention as a whole, with both jibs raised;

Figure 3 shows, schematically, the exemplary embodiment of the load lifting device according to the invention as a whole, with one jib raised and one jib lowered;

Figure 4 shows, schematically, the exemplary embodiment of the load lifting device according to the invention as a whole, with both jibs in the lowered position;

Figure 5 shows, schematically, an exemplary attachment device for attaching two jibs to each other to facilitate double load lift;

Figure 6 shows, schematically, a view of an exemplary circular climbing frame along an axis of the climbing frame;

Figure 7 shows, schematically, a view of another exemplary circular climbing frame along an axis of the other climbing frame;

Figure 8 shows, schematically, a view of an exemplary cylindrical mast with square base along an axis of the mast;

Figure 9 shows, schematically, an exemplary anchor roller for attaching an exemplary jib to the exemplary circular climbing frame shown in figure 7;

Figure 10 shows, schematically, an exemplary motorized cogged wheel as it may be attached to jibs; and

Figure 11 shows, schematically, an exemplary intermediate state of the exemplary embodiment of the load lifting device during erection according to an exemplary embodiment of the inventive method.

Exemplary embodiments

[0040] The inventive concept of a vertically movable jib may be applied to all load lifting device whether they are one or more jibbed. Therefore invention not only covers a single jibbed tower crane with a mast climbing jib but as well as a multiply jibbed tower crane with at least one of the jibs of the movable type, a multiply jibbed tower crane with all but one jib movable a multiply jibbed tower crane with all jibs movable.

[0041] Only for purpose of providing an example, figure 1 shows, schematically, a part of an exemplary embodiment of the load lifting device according to the invention with two movable jibs with different embodiments of climbing frames for exemplifying the different embodiments. The invention may be realized as well with same climbing frames for more the one of the movable jibs.

[0042] In Figure 1, it is shown a section of a cylindrical mast 1 having a square base and pairs of toothed rags (cogged runners) on each facet of the mast 1, the toothed rags extending along the vertical axis of the mast 1. The mast 1 is designed such that it can take loads and stresses placed on it by the jibs. In the depicted examples the toothed rags are arranged at edges of the facets. This is advantageous for requiring small cogged wheels but the invention is not limited thereto and the toothed rags can be arranged distant to the edges of the facets. Figure 8 shows, schematically, a view of the mast 1 along the axis of the mast 1.

[0043] An upper jib comprises an upper load lifting jib section 2, a cylindrical central jib section 4 and a counterweight jib section 3. The cylindrical central jib section 4 does not make any contact with the mast. The upper

load lifting jib section 2 is attached to the cylindrical central jib section 4 surrounding the mast. The upper load lifting jib section 2 is extending horizontally from the cylindrical central jib section 4. Extending horizontally opposite to upper load lifting jib section 2, there is the counterweight jib section 3 attached to the central jib section 4. As apparent from figures 2, 3 and 4 counterweights are comprised by the counterweight jib section 3 such that the counterweights extend upwardly to compensate for the weight of the loads attached to the upper load lifting jib section 2. The loads are attached by means of one or more hooks at one or more cables hanging from the load lifting jib section 2 at its far end. The loads can be lifted by coiling up the cables.

[0044] Beneath the central jib section 4 there is a circular climbing frame 5 surrounding the mast, too. The climbing frame 5 has pairs of cogwheels 10 attached to it. For each toothed rags of the mast 1, there is a pair of cogwheels 10 attached to the climbing frame 5 with horizontal rotational axes. Through engagement with the toothed rags of the mast, driving the pairs of cogwheels 10 of the climbing frame 5 facilitates upward and downward movement of the upper jib.

[0045] The central jib section 4 has further pairs of cogwheels 9 (cogged wheels) arranged at a lower circular edge of the central jib section 4 with horizontal rotational axes. The exemplary embodiment depicted has eight pairs of further cogged wheels 9 equally distanced to each other. This is exemplarily depicted in Figure 6.

[0046] At its upper edge, the circular climbing frame 5 is provided with a double cogged ring 12 (cogged running tracks) having its teeth extending vertically upwards and downwards. The further pairs of cogged wheels 9 of the central jib section 4 are engaged with the double cogged ring 12 such that the upper jib can travel on them. Hence by driving the cogged wheels 9 the upper jib can rotate 360 degrees, i.e. in the full circle, around the mast 1. Thereby slewing of the upper jib of the example is enabled. For driving, the further pairs of cogged wheels 9 may be motorized.

[0047] By means of the pairs of cogged wheels 10 the circular climbing frame 5 transfers to the mast 1 loads and stress transferred from the load lifting section 2 via the central jib section 4.

[0048] A lower jib comprises a lower load lifting jib section 6, a further circular climbing frame 7 and a further counterweight jib section 8. The lower load lifting jib section 6 is attached to the further circular climbing frame 7 surrounding the mast. The lower load lifting jib section 6 is extending horizontally from the further circular climbing frame 7. Extending horizontally opposite to lower load lifting jib section 6, there is the further counterweight jib section 8 attached to the further circular climbing frame 7. As apparent from figures 2, 3 and 4 counterweights are comprised by the further counterweight jib section 7 such that the counterweights extend downwardly to compensate for the weight of the loads attached to the lower load lifting jib section 6. The loads are attached by means

of one or more hooks at one or more cables hanging from the lower load lifting jib section 6 at its far end. The loads can be lifted by coiling up the cables.

[0049] The further climbing frame 7 has yet further pairs of cogwheels 10 attached to it with horizontal axes. For each toothed rags of the mast 1, there is a yet further pair of cogwheels 10 attached to the further climbing frame 7. Through engagement with the toothed rags of the mast, driving the yet further pairs of cogwheels 10 of the further climbing frame 7 facilitates upward and downward movement of the lower jib.

[0050] The lower load lifting jib section 6 and the further counterweight jib section 8, each, have even yet further pairs of cogwheels 9 (cogged wheels) with horizontal axes arranged at a lower edge of the end facing the mast. The exemplary embodiment depicted has two yet further pairs of further cogged wheels 9 at ends at the lower edge of the lower load lifting jib section 6 and two yet further pairs of further cogged wheels 9 at ends at the lower edge of the further counterweight jib section 8. This is exemplarily depicted in Figure 7.

[0051] At ends at an upper edge of the end facing the mast, the lower load lifting jib section 6 and the further counterweight jib section 8, each, have anchor rollers 11 with vertical rotational axes. The anchor rollers 11 attach the upper edges of the lower load lifting jib section 6 and the further counterweight jib section 8 to the further climbing frame 7 which is provided with a single cogged ring having its teeth extending horizontally inwards to which the anchor rollers 11 engage. The anchor rollers 11 are exemplarily depicted in Figure 9.

[0052] At its lower edge, the further circular climbing frame 7 is provided with a further double cogged ring 12 (cogged running tracks) having its teeth extending vertically upwards and downwards. The even yet further pairs of cogged wheels 9 of the lower load lifting jib section 6 and of the further counterweight jib section 8 are engaged with the further double cogged ring 12 such that the lower jib can travel on them. Hence by driving the further cogged wheels 9 the lower jib can rotate 360 degrees, i.e. in the full circle, around the mast 1. Thereby slewing of the lower jib of the example is enabled. For driving, the even yet further pairs of cogged wheels 9 and/or the anchor rollers 11 may be motorized. But at least one of the even yet further pairs of cogged wheels 9 and/or the anchor rollers 11 may be free rolling.

[0053] By means of the yet further pairs of cogwheels 10 the circular climbing frame 5 transfers to the mast 1 loads and stress transferred from the load lifting section 2 via the central jib section 4.

[0054] The embodiments of the lower and the upper jibs are exemplary. A single jibbed tower crane with a mast climbing jib may comprise any one of the exemplary jibs. In a tower crane with multiple mast climbing jibs, each climbing jib may be designed as any one of the lower and the upper jibs described above.

[0055] Further, rotatability of the jibs with respect to the climbing frames is optional. The invention also covers

a bottom slewing tower crane with a movable jib where the jib is fixed to the climbing frame.

[0056] The mast of the exemplary embodiment is composed of mast sections of equal height attached to each other. In the exemplary embodiment, a pair of middle mast sections is attached to each other by means of absorbers for dissipating stresses and movements of a top part of the mast and for stabilizing a bottom part of the mast. The absorbers may be spring loaded. They provide further advantages to the invention independent from those provided by the movable jib. Thus, the absorbers are optional. In the exemplary embodiment they are inserted between a top working mast section where the jibs operate loaded is suspended from a lower section of the mast. The stresses and movements generated at the top of the mast during working times are dissipated and make the lower section of mast more stable.

[0057] In a load lifting device with two or more climbing jibs, each jib can be operated independently. They can be slewed independent of each other as well as raised or lowered independent of each other. The only restriction is that they cannot change vertical positions. They do not climb or descend on the mast as a single unit although they could be synchronised to do this if it were necessary. Each jib may be designed and built separately. Each jib is balanced by its own counterweights. However in certain cases i.e. for the lifting of heavier loads jibs can be linked together for their combined lifting capacity. Or, one jib is loaded with weight in an opposite direction to the other for improving load lifting capacities of the other by providing additional counterweight. As well, one jib may be used for as a wind anchor extending against the wind and hooked to the ground anchor.

[0058] For avoiding entanglement, the load lifting sections of the upper jib may be longer than that of the lower jib. More generally speaking the jibs haven a vertical order wherein of each two jibs, the one higher in the order may extend longer than the one lower in the order.

[0059] The jibs may be operated remotely or from operation cabins attached to the load lifting jib sections, e.g. below thereto. Each operating cabin may contain the operating controls at least of the respective jib.

[0060] In normal operation both jibs would be placed at the top of the mast. Each would revolve around a 360 degree axis carrying out its requirements. Entanglements of the cables during these operations may then be prevented by the skills of the operators. Optionally a warning device is provided.

[0061] The warning device comprises means for determining at least angular positions of the jibs. It may further take into account, heights of the jobs and/or height of the loads. In case of imminent collision the device may issue warning signals to one or all operators of the respective jibs.

[0062] In adverse weather conditions one or both jibs may be lowered to keep operations going on, or to ensure the stability of the whole crane. As wind speeds increase the lower jib may be lowered to base level. This prevents

the crane from becoming top heavy. It also allows the lower jib to act as ballast at the base of the crane and enable the higher jib to remain in operation for a longer period. In excessive high winds both jibs can be lowered. This manoeuvre takes the wind resistance from the top of the mast to the lower regions allowing the jibs to act as ballast weights at the base of the mast leaving the mast more secure with wind pressure minimized.

[0063] Another benefit of this crane in adverse weather conditions is in sub arctic conditions. In areas where ice storms occur and ice build up becomes a problem the movable jib can be lowered during said storms to ensure stability of the crane. De-icing of the jib can also be carried out much easier in a less hostile environment to men and machine at low level. General maintenance of the jib would also be carried out at a safer lower level even during hostile weather when such work would be prevented.

[0064] This design also allows the crane to combine the lifting capacities of several jibs for lifting together one load. To do so, a device can be attached to jibs when they are aligned vertically under each other, with jib control of all but one of the aligned jibs disengaged allows the crane to operate as one unit. Advantageously driving of cables to which hooks are attached is then synchronized. This combines the lifting capacity of jibs brought together as a single unit. Alignment of the jibs also provides as many hooks displaced distant from each other thereby reducing rotation of loads. Figure 5 shows, schematically, an exemplary attachment device for attaching two jibs to each other to facilitate double load lift.

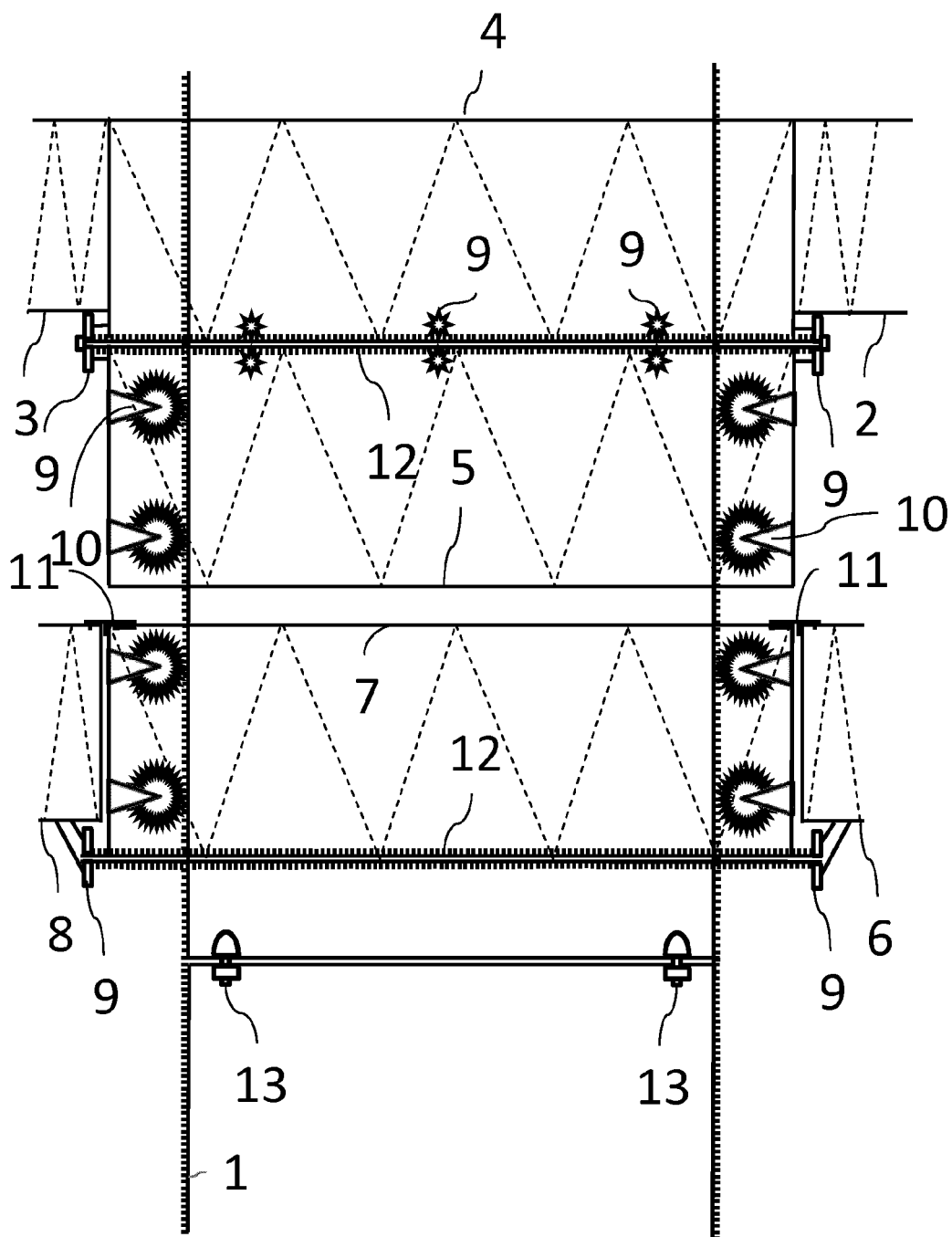
[0065] Because of the design of this crane with these types of jibs, the ability for self erection comes in to place. If the lower jib is first placed on a pair of supports with the upper jib aligned transverse at 90 degrees above it on another support system, the top section of mast can then be inserted and elevated upwards through both climbing frames by engaging the climbing wheels. Subsequent sections of the mast can then be attached thereafter allowing the mast to be raised to its required height. When the required height is reached the base of the mast can be installed with designed anchoring and counterweights. The jibs can then elevate themselves in their normal manner. To dismantle the crane this process is reversed. This makes the crane self erecting. Figure 11 is an example of this procedure.

Claims

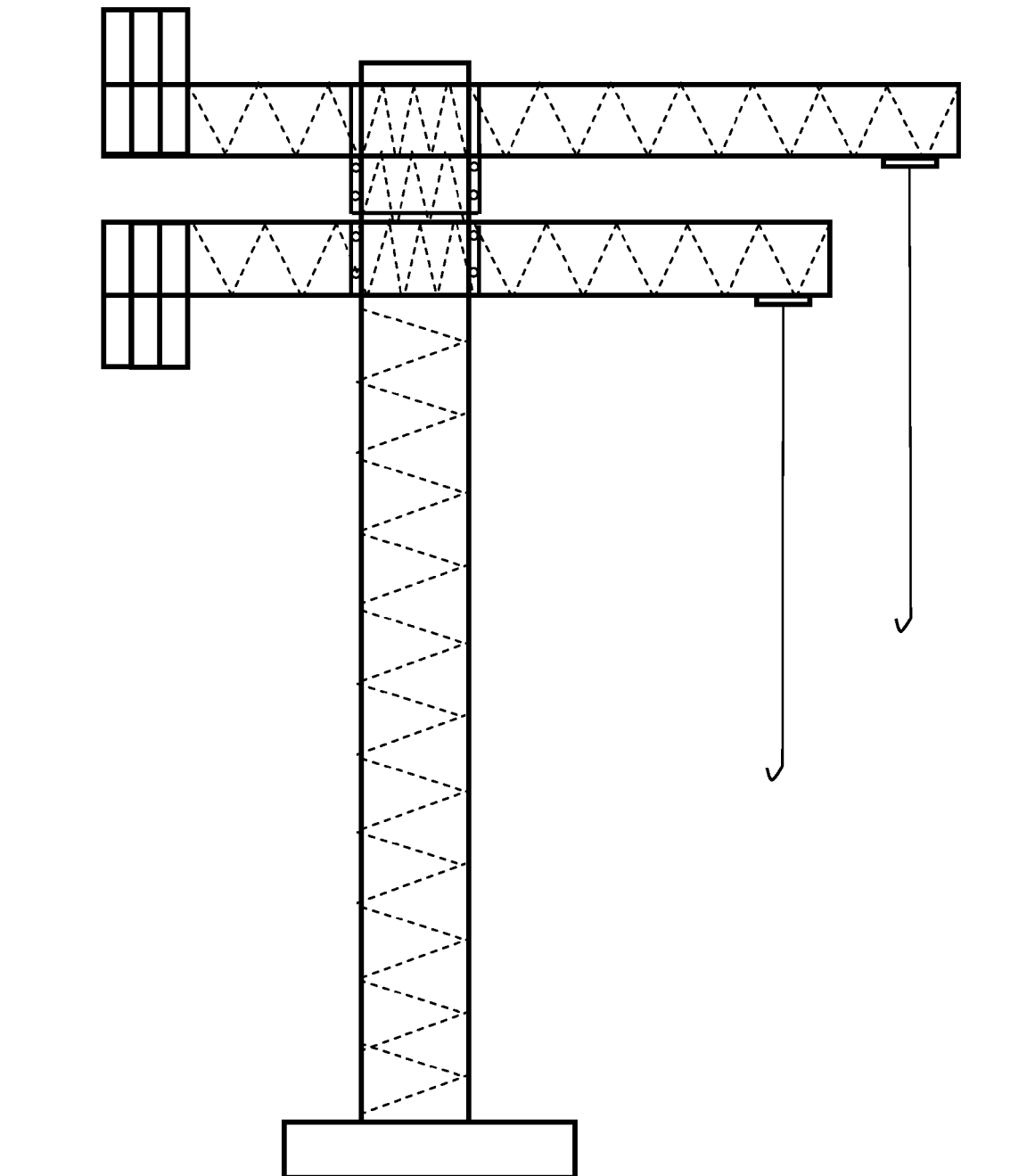
1. Device for lifting loads, comprising a cylindrical mast (1) with an axis and a jib which is attached to the mast (1), the mast (1) for standing vertically and the jib for extending horizontally, **characterized in that** the jib is attached to the mast (1) such that it can be moved along the axis of the cylindrical mast (1).
2. Device of claim 1 wherein the jib further can be rotated around the axis.

3. Device of claim 2 wherein the device comprises an upper jib above the jib wherein the upper jib at least can be rotated around the axis for alignment to the jib wherein the aligned jibs can be attached to each other.
4. Device of claim 3 wherein, in a part of the mast above the jib, the upper jib can be moved along the axis independent from the jib.
5. Device of one of the preceding claims wherein the mast (1) has a regular polygonal base wherein pairs of toothed rags extend along the axis on each facet of the mast and wherein the device comprises a cylindrical climbing frame (5, 7) with a circular base to which the jib is attached, the climbing frame (5, 7) surrounding the mast (1) and comprising, for each of the toothed rags, a pair of cogwheels (10) engaging with the respective toothed rag wherein the jib can be moved by turning the cogwheels (10).
6. Device of claim 2 and of claim 5 wherein climbing frame (5, 7) comprises a circular double cogged rim (12) and the jib is attached to the climbing frame (5, 7) by means of at least one further pair of cogwheels (9) engaging with the double cogged ring (12) such that the jib can be rotated by turning the further cogwheels.
7. Device of claim 6 wherein the double cogged rim (12) is a top rim of the climbing frame (5) and wherein the jib comprises a load lifting jib section (2), a counterweight jib section (3) and a cylindrical central jib section (4) surrounding the mast (1), the load lifting jib section (2) and the counterweight jib section (3) extending in opposite directions from the central jib section (4) wherein the further pair of cogwheels (9) are arranged at a bottom rim of the central jib section (5).
8. Device of claim 6 wherein the double cogged rim (12) is a bottom rim of the climbing frame (7) and wherein the jib comprises a load lifting jib section (6) and a counterweight jib section (8) extending in opposite directions from the climbing frame (7) wherein each of the load lifting jib section (6) and the counterweight jib section (8) is provided with the further pair of cogwheels (9) arranged at a lower side of the load lifting jib section (6) and the counterweight jib section (8), respectively, wherein anchoring rollers (11) are provided at upper sides of each of the load lifting jib section (6) and the counterweight jib section (8), each of the load lifting jib section (6) and the counterweight jib section (8) being attached to the climbing frame (7) by means of the respective anchoring rollers (11) and the respective further pair of cogwheels (9).

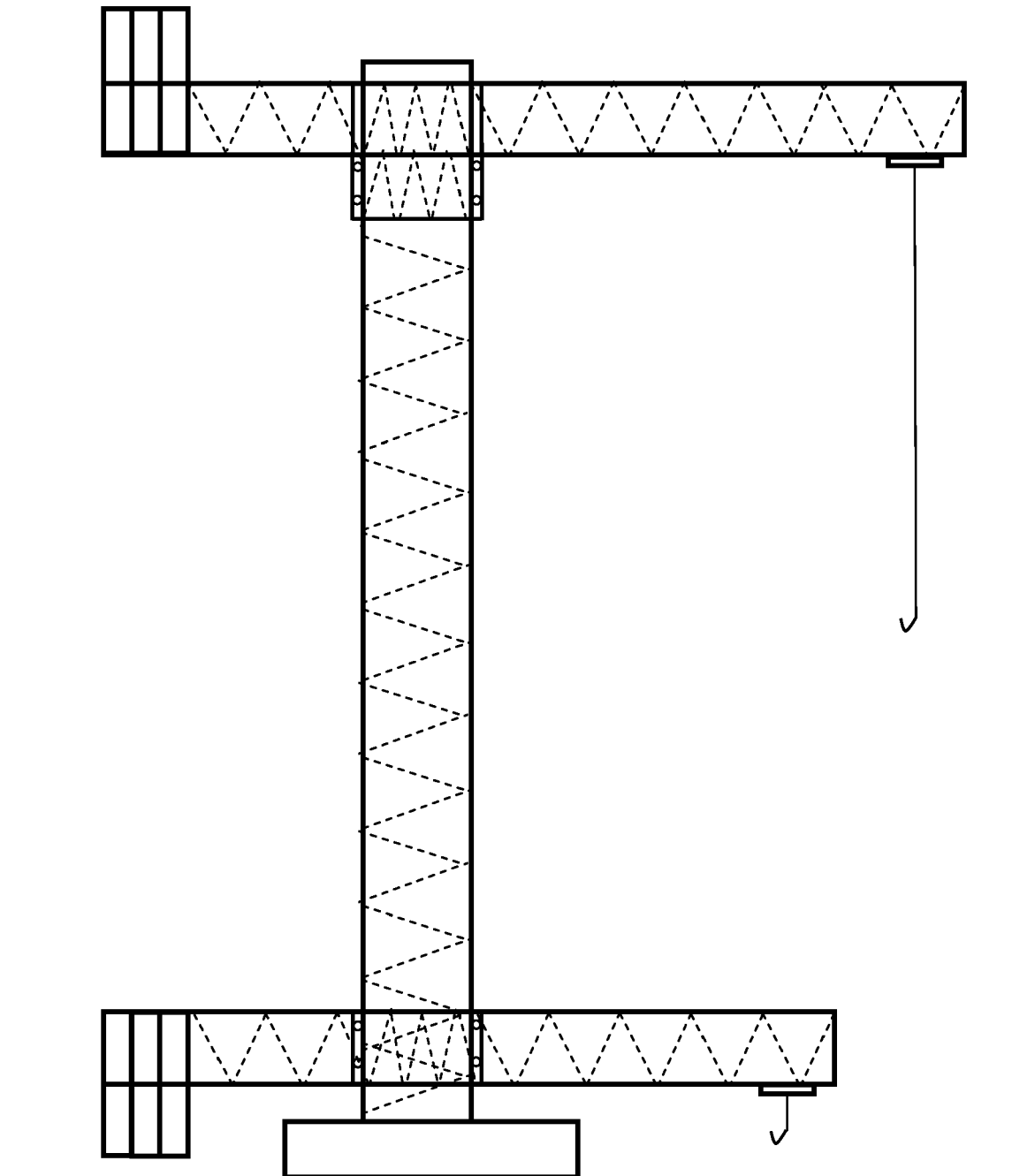
9. Device of claim 4 and of claim 8 wherein the device comprises a further cylindrical climbing frame (5) with a circular base to which the upper jib is attached, the further climbing frame (5) surrounding the mast (1) and comprising, for each of the toothed rags, a pair of yet further cogwheels (10) engaging with the respective toothed rag wherein the upper jib can be moved by turning the yet further cogwheels (10). 5
10. Device of claim 9 wherein the further climbing frame (5) comprises a further circular double cogged rim (12) and the upper jib is attached to the further climbing frame (5) by means of at least one even yet further pair of cogwheels (9) engaging with the further double cogged ring (12) such that the upper jib can be rotated by turning the even yet further cogwheels (9). 10 15
11. Device of claim 10 wherein the further double cogged rim (12) is a top rim of further climbing frame (5) and wherein the upper jib comprises a further load lifting jib section (2), a further counterweight jib section (3) and a cylindrical central jib section (4) surrounding the mast (1), the further load lifting jib section (3) and the further counterweight jib section (3) extending in opposite directions from the central jib section (4) wherein the even yet further pair of cogwheels (9) are arranged at a bottom rim of the central jib section (4). 20 25
12. Device of claim 11 wherein the mast (1) is composed of mast sections of equal height which are attached to each other. 30
13. Device of claim 12 wherein a pair of middle mast sections is attached to each other by means of absorbers for dissipating stresses and movements of a top part of the mast (1) and for stabilizing a bottom part of the mast (1). 35
14. Method for erecting the device of claim 12 or 13, the method comprising placing the jib on a pair of supports of a further equal height at least as high the equal height, placing the upper jib on a further pair of supports of a yet further equal height at least as high the further equal height plus a height of the climbing frame (7) wherein the upper jib is placed such that each of the yet further pairs of cogwheels (10) is aligned with one of the pairs of cogwheels (10), positioning a mast section below the climbing frames (5, 7) and moving the mast section above such that the pairs of cogwheels (10) can engage with sections of the toothed rags, further moving the mast section above by turning the pairs of cogwheels such that the yet further pairs of cogwheels (10) can engage with the sections of the toothed rags and yet further moving the mast section above by turning the pairs of cogwheels (10) and the yet further pairs of cogwheels (10). 40 45 50 55
15. Method of claim 14 further comprising attaching a further mast section to a lower end of the mast section and moving the attached mast sections further above by turning the pairs of cogwheels (10) and the yet further pairs of cogwheels (10).



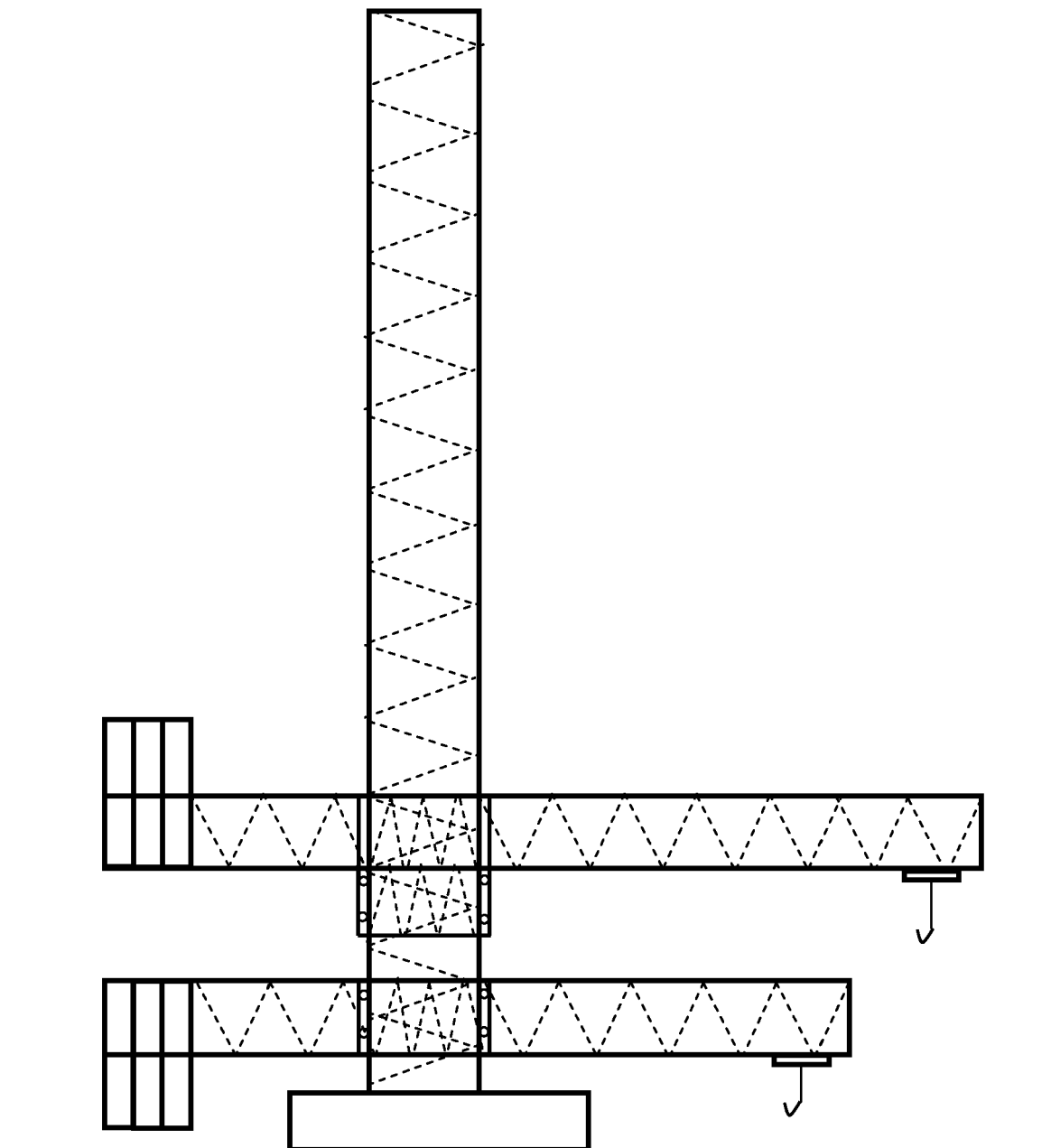
Figur 1



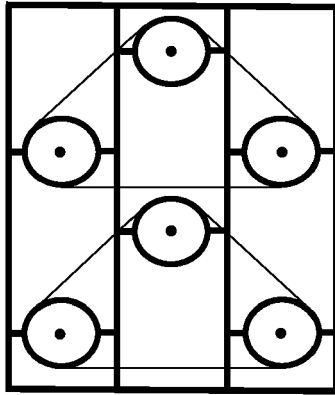
Figur 2



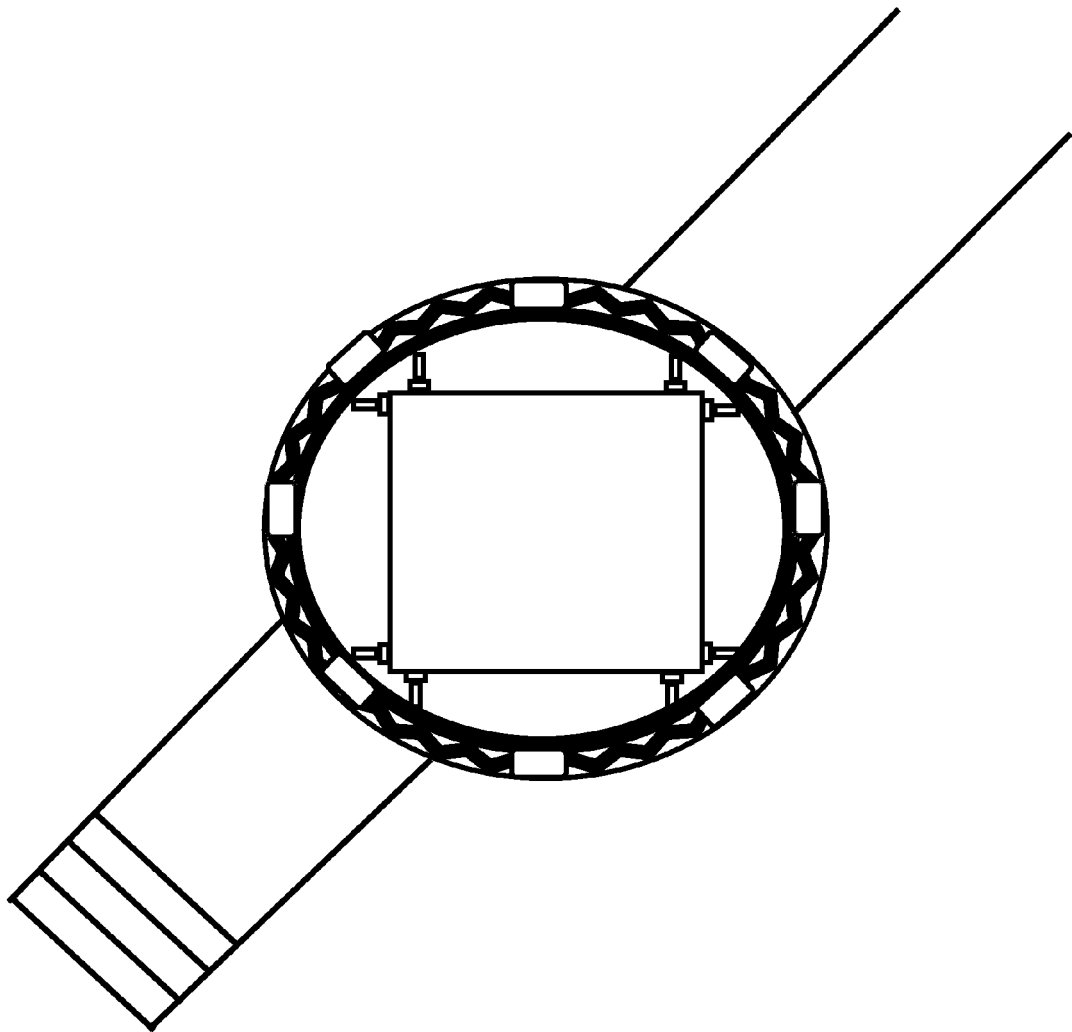
Figur 3



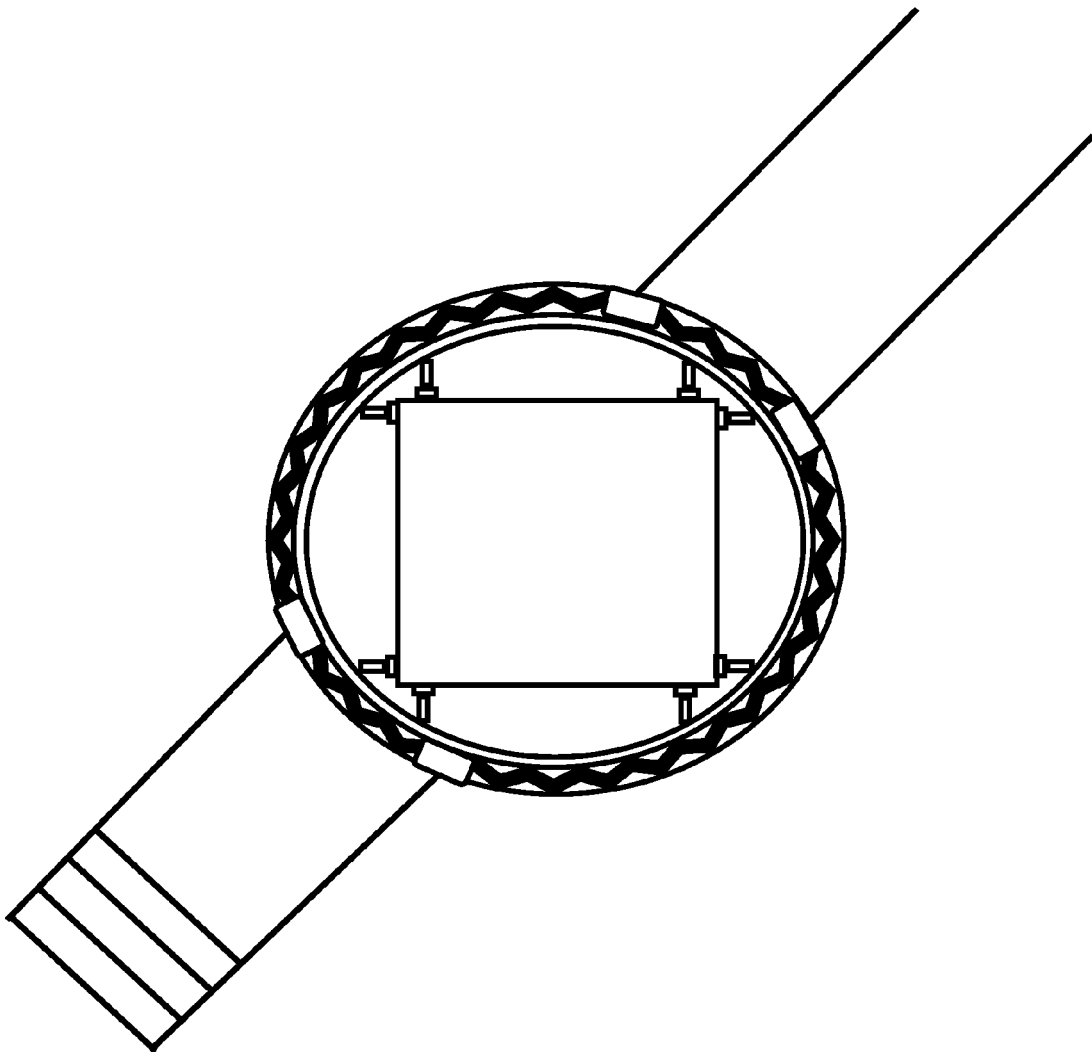
Figur 4



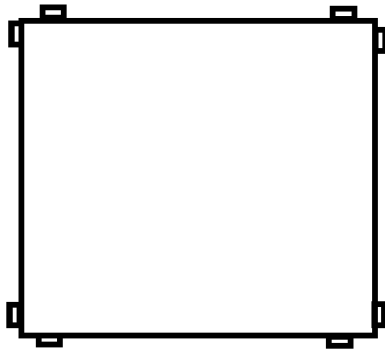
Figur 5



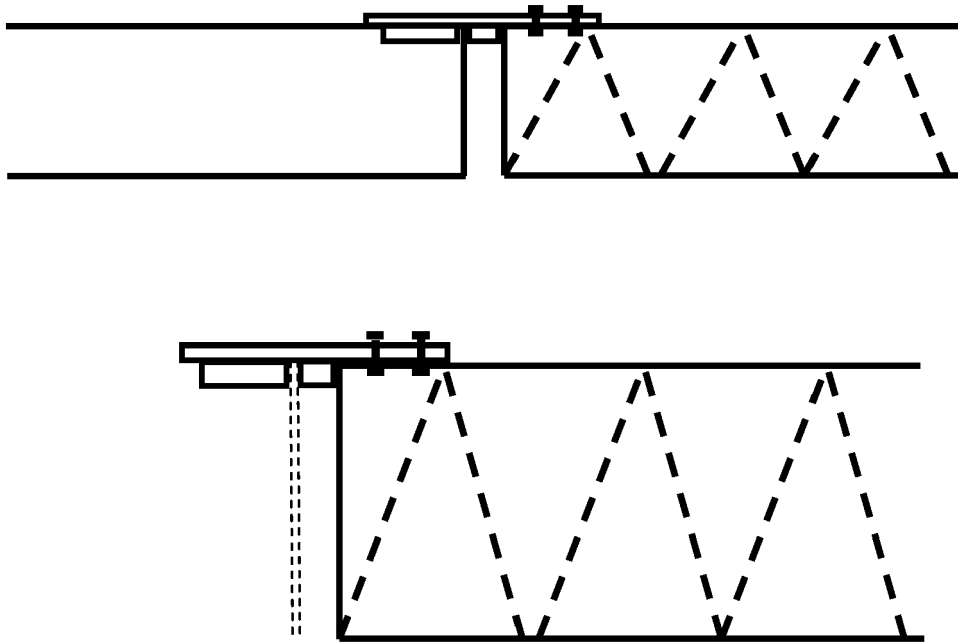
Figur 6



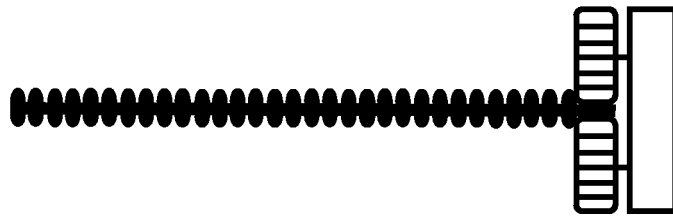
Figur 7



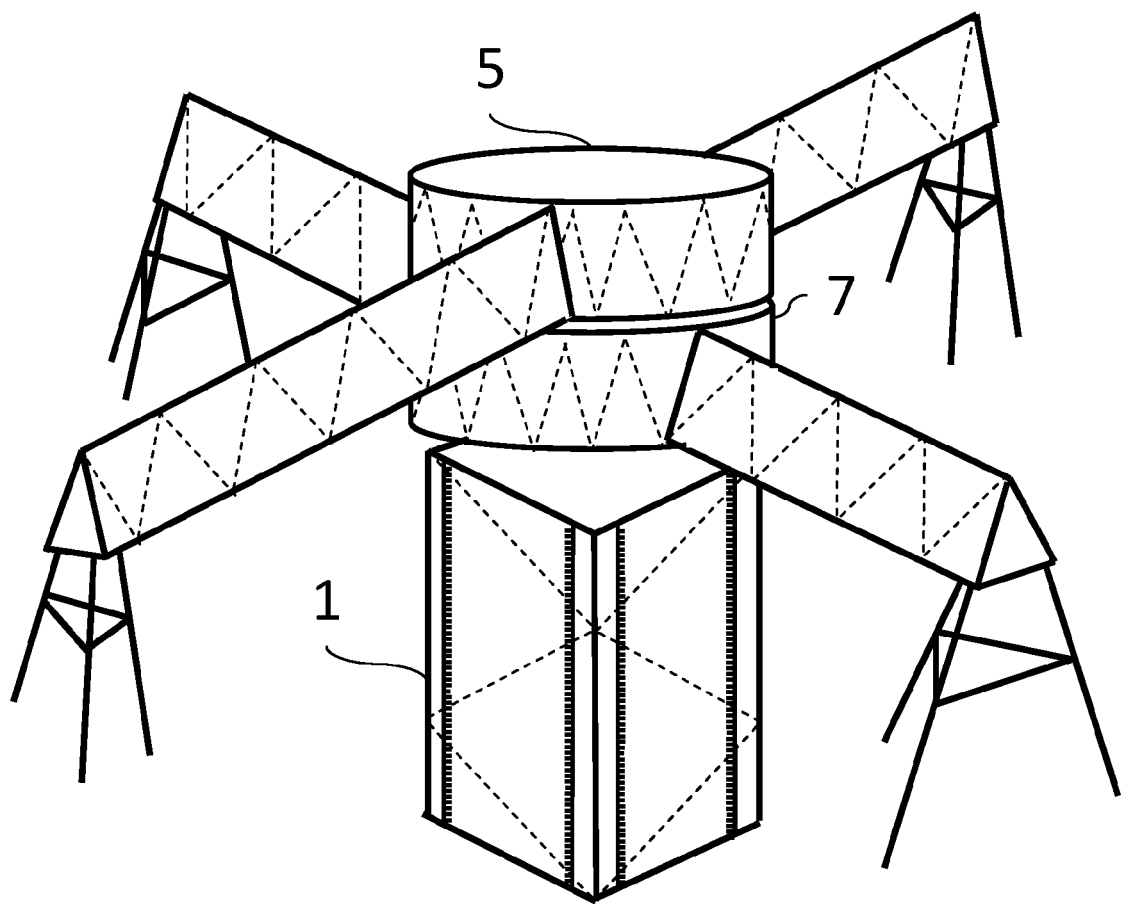
Figur 8



Figur 9



Figur 10



Figur 11



EUROPEAN SEARCH REPORT

Application Number
EP 14 17 5003

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Place of search The Hague		Date of completion of the search 3 December 2014	Examiner Rupic, Zoran
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