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

(11) **EP 4 506 296 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.02.2025 Bulletin 2025/07

(21) Application number: **24193634.3**

(22) Date of filing: **08.08.2024**

(51) International Patent Classification (IPC):
B66C 23/34 *(2006.01)* ***B66C 23/82*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B66C 23/342; B66C 23/82

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **11.08.2023 IT 202300017193**

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(54) A SELF-ERECTING CRANE WITH BOTTOM SLEWING

(57) A self-erecting crane (1) with bottom slewing comprising a support structure (10), a base (16) rotatable with respect to said support structure (10), a tower (20) arranged integrally on said base (16) and a loading arm (60) composed of one or more portions (61, 64, 66) articulated with each other and hinged to said tower (20) at a joint zone (22), said crane (1) being configurable between an operational working configuration and a non-operational transport configuration, wherein, in said working configuration, said tower (20) is arranged in an upright position and superiorly supports said loading arm (60) at said joint zone (22), and in said transport configuration, said tower (20) and said loading arm (60) are folded one above the other; said tower (20) comprises:
- a lower telescopic sector (24) comprising a first portion (26) extending longitudinally along a main axis (X) and a second portion (28) slidably associated with respect to said first portion (26), said first portion (26) comprising a first end (26a) hinged to said base (16) at a first fulcrum (F1);
- sliding means (30) adapted to position said second portion (28) in a retracted position with respect to said first portion (26) and at least one moved-away position with respect to said first portion (26) ;
and in that it comprises a boom (40) having a first end (42) hinged to said base (16) at a second fulcrum (F2) spaced apart from said first fulcrum (F1), and a second end (44) hinged to said second portion (28) of said lower telescopic sector (24) at a third fulcrum (F3) spaced apart from said first fulcrum (F1) and from said second fulcrum (F2).

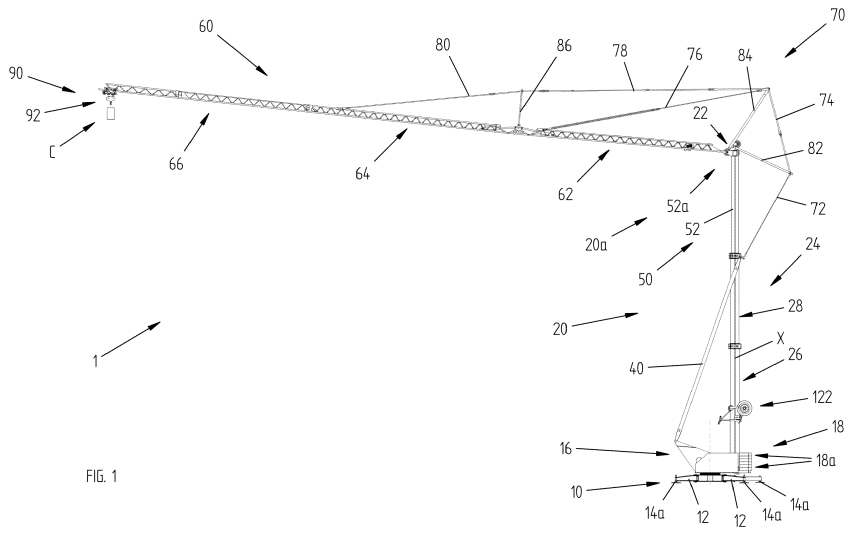


FIG. 1

EP 4 506 296 A1

Description

FIELD OF APPLICATION OF THE INVENTION

[0001] The present invention relates to the field of load lifting and moving systems, used, in particular, on construction sites. In particular, the present invention relates to a tower crane of the self-erecting type with bottom slewing.

STATE OF THE ART

[0002] The use of equipment to lift and move heavy loads, e.g. on construction sites, commonly known as cranes, is well known.

[0003] Among the cranes of the known type there are self-erecting tower cranes wherein a vertical element called tower, and a horizontal element superiorly supported by the tower and called loading arm are defined. A trolley, provided with appropriate load hooking systems, runs along the loading arm and by means of a rope system. The loading arm consists of one or more portions hinged to each other. The loading arm, and any portions thereof, is held in its working position by a tie-rod system.

[0004] The tower rises from a support structure and, in a particular type of crane known as a bottom slewing crane, the tower is rotated by a special slewing unit arranged at the support structure.

[0005] The support structure, and in particular the rotatable part of the structure supporting the tower, or turntable, is also associated with the counterweight that has the function of stabilising the equipment. The counterweight can be made of a variety of materials and typically consists of modular shaped concrete blocks that are arranged on site on the turntable.

[0006] Given the size of the crane, the latter can be configured to assume a first non-operational configuration suitable for the transport thereof and a working configuration wherein the tower is in its upright position to support the loading arm in a horizontal, or substantially horizontal, position.

[0007] In the transport configuration, on the other hand, the tower and the arm with its portions, if any, are folded and aligned on top of each other in a compact, substantially horizontal position.

[0008] The unfolding of the various parts allows switching from the transport configuration to the working configuration.

[0009] Setting up a crane on a construction site involves several steps. The crane arrives at the construction site specially loaded on a truck/trailer or towed by a road tractor, if equipped with its own axles, followed by another truck/lorry used only for transporting the modules that make up the counterweight and which will then be placed on the crane turntable.

[0010] Sometimes it is necessary to have another lifting means available on site in order to unload the counterweight modules from the truck and load them onto the crane turntable in a precise sequence.

[0011] A small portion of counterweight is preferably already installed on board the crane even before its transport, while the remaining part of counterweight will be positioned on site during the unfolding operations for switching the crane from the transport configuration to the working configuration.

[0012] According to the prior art, therefore, the preparation and logistics for the installation of a crane require the use of a significant number of means for transporting and/or handling the counterweight.

[0013] In addition, unfolding operations are delicate, also in terms of operator safety, and require great care in particular while unfolding, with a certain sequence, the various parts and the concomitant installation of counterweight modules to avoid displacements and/or tipping given the high weight forces involved.

[0014] Moreover, in the working configuration with the loading arm fully extended, it is also typically required to vary the tilt of the arm in order to raise it by a certain angle from the typical horizontal working position. The loading arm is then set up in a so-called climbing configuration. In order to configure the crane from a horizontal arm position to a climbing arm position, or vice versa, in known-type cranes, one typically acts on the tie-rod system supporting the arm by changing the length of at least one of the tie-rods used and/or adding/removing some of them. This operation requires folding the crane substantially into its initial transport configuration, changing the tie-rod concerned and unfolding the crane to return it to the working configuration.

[0015] It should be noted that folding the crane into the initial transport configuration requires the counterweight to be removed.

[0016] These operations are complex and require the operator to work in extremely safe conditions at all times and to carry out operations on mechanical parts that are essential for the correct use of the crane. A high amount of time is also required, resulting in undesired interruptions and the associated increase in costs.

EXPOSURE AND ADVANTAGES OF THE INVENTION

[0017] The main object of the present invention is thus to solve or at least partially overcome the drawbacks characterising the solutions known in the prior art.

[0018] A main object of the present invention is to propose a system that simplifies the operations for installing the crane compared to known-type techniques.

[0019] Another object of the present invention is to propose a system that allows to reduce the time and/or cost of installing a crane compared to known-type techniques.

[0020] A further object of the present invention is to propose a system that allows to simplify the reconfiguration operations of a crane in its already installed position.

[0021] Such and other objects are achieved thanks to the characteristics of the invention reported in indepen-

dent claim 1. The dependent claims outline preferred and/or particularly advantageous aspects of the invention.

[0022] In particular, the present invention, in a first aspect thereof, makes available a self-erecting crane with bottom slewing comprising a support structure, a base rotatable with respect to said support structure, a tower arranged integrally with said base, and a loading arm composed of one or more portions articulated to each other and hinged to said tower in a joint zone, said crane being configurable between an operational working configuration and a non-operational transport configuration, wherein, in said working configuration, said tower is arranged in an upright position and superiorly supports said loading arm at said joint zone, and in said transport configuration, said tower and said loading arm are folded one above the other;

wherein said tower comprises:

- a lower telescopic sector comprising a first portion extending longitudinally along a main axis and a second portion slidably associated with respect to said first portion, said first portion comprising a first end hinged to said base at a first fulcrum;
- sliding means adapted to position said second portion in a retracted position with respect to said first portion and at least one moved-away position with respect to said first portion;

and wherein said crane comprises a boom having a first end hinged to said base at a second fulcrum spaced apart from said first fulcrum, and a second end hinged to said second portion of said lower telescopic sector at a third fulcrum spaced apart from said first fulcrum and from said second fulcrum.

[0023] In a preferred embodiment, the joint zone is defined at one end of the tower opposite with respect to the base.

[0024] Preferably, the second fulcrum is arranged with respect to the first fulcrum in the same direction towards which the loading arm extends from the tower, considering the crane in the working configuration.

[0025] According to a preferred embodiment, the sliding means comprise at least one hydraulic actuator, preferably said hydraulic actuator being received within the first portion and within the second portion.

[0026] The hydraulic actuator preferably comprises a cylinder and a piston respectively integral to the first and second portions, or the hydraulic actuator preferably comprises a cylinder and a piston respectively integral to the second and first portions.

[0027] In a preferred embodiment, the tower further comprises a further telescopic sector slidably associated with respect to the second portion of the lower telescopic sector. The further telescopic sector comprises at least one extension portion.

[0028] Preferably, the crane comprises further sliding means adapted to position the extension portion in a retracted position with respect to the second portion of the lower telescopic sector and in a moved-away position with respect to the second portion of the lower telescopic sector.

[0029] According to a preferred embodiment, the further sliding means comprise at least one hydraulic actuator, preferably said hydraulic actuator being received within the extension portion and within the second portion of the lower telescopic sector.

[0030] The hydraulic actuator preferably comprises a cylinder and a piston respectively integral with the extension portion and the second portion of the lower telescopic sector, or the hydraulic actuator preferably comprises a cylinder and a piston respectively integral with the second portion of the lower telescopic sector and the extension portion.

[0031] In a preferred embodiment, the joint zone is defined at one end of said at least one extension portion.

[0032] Preferably, the crane should comprise a counterweight associated with the base.

[0033] According to a preferred embodiment, the counterweight and loading arm are on opposite sides of the tower, considering the crane in the working configuration.

[0034] In a preferred embodiment, the crane comprises movement means for moving the crane in the transport configuration.

[0035] Preferably, the movement means comprise at least one wheeled axle associated with the tower.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] Further features and advantages of the invention will be more apparent after reading the following description provided by way of a non-limiting example, with the aid of the figures illustrated in the accompanying tables, wherein:

- Figure 1: shows a side view of a crane in a first unfolded working configuration according to a preferred embodiment of the invention;
- Figure 2: shows the crane in Figure 1 in a folded configuration suitable for transport thereof;
- Figure 3: shows a plan view from above of the crane of Figure 2;
- Figure 4: shows the crane of Figure 2 with some elements removed for simplicity of explanation;
- Figures 5 and 6: show the crane of Figure 4 in two respective steps during the tower unfolding operations;
- Figures 7 to 10: show the crane of Figure 6 in three successive steps during the unfolding operations of the loading arm.

DESCRIPTION OF THE INVENTION

[0037] With reference to Figures 1 to 3, a crane in accordance with a first preferred embodiment of the invention is globally referred to as 1.

[0038] In Figure 1, the crane according to the invention is shown in a first typical working configuration while Figures 2 and 3 refer to the same crane 1 in a non-operational configuration and suitable for transport thereof.

[0039] The crane 1 shown and described hereinafter is of the so-called self-erecting type with bottom slewing, this type of crane being the subject of the present invention. The use of such cranes is particularly suitable to lift and move loads on construction sites.

[0040] The crane 1 comprises, substantially, a support structure 10, a base 16 rotatable with respect to the support structure 10, a tower 20 arranged on said base 16 and a loading arm 60. A trolley 90 provided with suitable hooking systems 92, e.g. a hook 92, can be moved along the loading arm 60 and allows to hook the load C to be moved.

[0041] The movement of the trolley 90 along the loading arm 60 preferably occurs by means of a rope system with electric or hydraulic motors provided with a drum on which the rope is wound.

[0042] In the following description, the system for moving the trolley 90 will not described in detail, as it can be made according to one of the known techniques. The same system also allows, as known, to raise or lower the hooking system 92 for raising or lowering the load C correspondingly.

[0043] The support structure 10 comprises, preferably, a series of beams 12, such as 5 beams in the embodiment shown, and a plurality of stabilisers 14 adapted to be interposed between the beams 12 and the support surface. Stabilisers 14 give the crane 1 ground stability and levelling and are preferably all adjustable in height. The stabilisers preferably comprise a shaped metal plate 14a which provides a greater area for distributing the crane weight.

[0044] In a preferred embodiment, not shown, the support structure could be of the translating type, preferably on rails, in which case the support structure is preferably provided with wheeled translation means.

[0045] The base 16 of the crane 1 supports the tower 20, which is fixed with respect to the base 16 itself. Appropriate rotation means, known in themselves and not described in detail below, allow for the rotation of the base 16, hereinafter also referred to as the turntable 16, with respect to the support structure 10.

[0046] The counterweight 18 is associated with the turntable 16 and has the function of stabilising the crane 1 by counterbalancing the weight of the loading arm 60 and of the load C when present. According to the preferred embodiment shown and described, the counterweight 18 comprises a series of modular blocks 18a, preferably positioned one above the other, and in a position such that the counterweight 18 and the loading arm 60 are on opposite sides with respect to the tower 20 in its upright position with the crane 1 in the working configuration. The counterweight 18 may be made of various materials and the blocks 18a preferably of steel or optionally of concrete.

[0047] It should be noted that the counterweight 18 according to an aspect of the present invention is preferably already installed on board the crane 1 even before it is transported to the construction site for installation.

[0048] The loading arm 60 is hinged to the tower 20 at a joint zone 22 which, in the working configuration, preferably corresponds to the upper end 20a of the tower 20.

[0049] According to the embodiment shown and described in the figures, the loading arm 60 preferably comprises three portions 62, 64, 66 articulated to each other, e.g. by means of joints, which allow a partial mutual rotation of the portions 62, 64, 66 themselves.

[0050] Advantageously, in the working configuration, the three portions 62, 64, 66 are unfolded and positioned substantially aligned with each other, as shown in Figure 1. In contrast, in the transport configuration, as shown for example in Figures 2 to 4, the three portions 62, 64, 66 are folded one above the other.

[0051] Maintaining and positioning the three portions 62, 64, 66 of the loading arm 60 in the working configuration of the crane 1 is achieved by means of an articulated system comprising tie-rods 72, 74, 76, 78, 80 and booms called, in the technical jargon, jibs 82, 84, 86.

[0052] The tie-rods 72, 74, 76, 78, 80 are typically made of wire ropes or metal profiles interconnected to each other and have the main function of supporting the loading arm 60, and the load C, if any, by transmitting the strains to the tower 20.

[0053] In the hereinafter description, this articulated system comprising tie rods 72, 74, 76, 78, 80 and jibs 82, 84, 86 will not be described in detail as it can be made according to one of the known techniques.

[0054] According to a first aspect of the present invention, the tower 20 is configured to have a lower sector 24 of the telescopic type.

[0055] The lower telescopic sector 24 preferably comprises a first portion 26 that extends longitudinally along a main axis X and a second portion 28 that is slidably associated with the first portion 26. The first portion 26 of the lower telescopic sector 24 comprises a first end 26a hinged to the turntable 16 at a first fulcrum F1.

[0056] In particular, the lower telescopic sector 24 may comprise, in addition to the first portion 26 and the second portion 28, further portions that slip out successively in a telescopic way. We will hereinafter always talk about a first portion 26 and second portion 28 according to the non-limiting embodiment represented in the figures.

[0057] As shown in Figure 1 with the crane 1 in a working configuration or Figure 6 with the crane 1 in an unfolded configuration, the second portion 28 is in a moved-away position with respect to the first portion 26, preferably in a first maximum moved-away position

with respect to the first portion 26; as shown in Figures 2 and 4 with the crane 1 in a transport configuration, the second portion 28 is in a retracted position with respect to the first portion 26, preferably in a totally retracted position with respect to the first portion 26; as shown in Figure 5 with the crane 1 in an intermediate operational configuration, better described hereinafter, the second portion 28 is in a partially moved-away position with respect to the first portion 26.

[0058] From the positions previously shown, it can be inferred that the second portion 28 is arranged in a maximum moved-away position with respect to the first portion 26 when the beam 20 is arranged in an upright position, in particular when the crane 1 is in a working configuration, and that the second portion 28 is arranged in a totally retracted position with respect to the first portion 26 when the beam 20 is arranged in a horizontal position, in particular when the crane 1 is in a transport configuration.

[0059] Preferably, the first and second portions 26, 28 are made from corresponding tubular elements, for example two steel tubular beams, adapted to slide into each other.

[0060] To enable the mutual positioning of the first and second portions 26, 28 in the desired positions, suitable sliding means 30 are provided.

[0061] In a preferred embodiment, the sliding means 30 comprise a hydraulic actuator, such as a cylinder and a piston respectively integral to the first and second portions 26, 28 or, vice versa, respectively integral to the second and first portions 28, 26. The hydraulic actuator is preferably received within the first and second portions 26, 28 and is therefore not visible in the figures.

[0062] In preferred embodiment variants, however, the sliding means can be different and fit-for-purpose, such as a system with rack-and-pinion, screw-nut, pulleys and ropes, etc.

[0063] According to an aspect of the present invention, the crane 1 comprises at least one boom 40 having a first end 42 hinged to the turntable 16 at a second fulcrum F2 spaced from the first fulcrum F1 and a second end 44 hinged to the second portion 28 of the lower telescopic sector 24 at a third fulcrum F3 spaced from the first fulcrum F1 and the second fulcrum F2.

[0064] Preferably, the second end 44 of the boom 40 is hinged at the upper end 28a of the second portion 28 of the lower telescopic sector 24.

[0065] In preferred embodiment variants, the second end of the boom 40 may be hinged at an intermediate zone of the second portion of the lower telescopic sector.

[0066] Still preferably, considering the crane 1 in a working configuration, the second fulcrum F2 is arranged with respect to the first fulcrum F1 in the same direction towards which the loading arm 60 extends from the tower 20.

[0067] According to the preferred embodiment shown, a pair of struts 40 is preferably arranged laterally with respect to the tower 20 and more preferably arranged laterally with respect to the second portion 28 of the lower telescopic sector 24, as visible in Figure 3. This advantageously gives the crane 1 a symmetrical and more stable structure. In a preferred embodiment variant, however, only one of these booms may be provided.

[0068] In the hereinafter description, for the sake of simplicity, reference will be made to only one of these booms 40, it being clear, however, that what is described for one boom 40 can also be extended to the other boom. Also in the figures, except for Figure 3, only one boom will be visible.

[0069] The elements of the crane 1 described above actually define a triangle whose vertices are defined by said fulcrums F1, F2, F3. It should be noted that two sides of this triangle, the first side defined between the first fulcrum F1 and the second fulcrum F2 and the second side defined between the first fulcrum F1 and the third fulcrum F3, maintain their length in any configuration of the crane 1, while the third side of this triangle defined between the first fulcrum F1 and the third fulcrum F3 has an adjustable length that is defined by the amount of displacement that is imposed between the second portion 28 and the first portion 26, as will be better described hereinafter. In other words, by changing the distance between the second portion 28 and the first portion 26 of the lower telescopic sector 24, by means of said sliding means 30, it is possible to change the length of the third side of the triangle and thus the shape of the triangle itself.

[0070] As shown in Figures 2 and 4 with the crane 1 in a transport configuration, the length of the third side is minimum with the second portion 28 in a totally retracted position with respect to the first portion 26 and the triangle has minimum dimensions; as shown in Figure 5 with the crane 1 in an intermediate working configuration, the length of the third side is intermediate with the second portion 28 partially moved away from the first portion 26 and the triangle shows a corresponding intermediate dimension; as shown in Figure 1 with the crane 1 in a working configuration or in Figure 6 with the crane 1 in a particular unfolding step, the length of the third side is maximum with the second portion 28 in a maximum moved-away position from the first portion 26 and the triangle assumes a maximum dimension.

[0071] Therefore, as shown above, it will be possible to bring/rotate the tower 20 of the crane 1 from the transport configuration (Figure 4) to the upright configuration (Figure 6) by acting on the sliding means 30 moving the second portion 28 away from the first portion 26 and simultaneously changing the shape of the triangle until it reaches its maximum dimension and the tower 20 reaches the desired upright position 20.

[0072] Vice versa, it will be possible to return/rotate the tower 20 of the crane 1 from the configuration with upright tower 20 (Figure 6) to the transport configuration (Figure 4), which is essentially horizontal, by acting on the sliding means 30 to retract the second portion 28 into the first portion 26 and simultaneously change the shape of the triangle until it reaches its minimum size and the tower 20

reaches the desired horizontal position 20.

[0073] Therefore, from the foregoing, the use of the lower telescopic sector 24 and the implementation of the respective sliding means 30 take place during the steps of switching the configuration of the crane 1 to change the position of the tower 20 from horizontal to vertical and vice versa. The other steps of unfolding or folding the loading arm 60 and its possible portions 62, 64, 66 will be described hereinafter.

[0074] Advantageously, the operations of moving the tower 20 of the crane 1 are simpler, faster and safer than the known-type techniques.

[0075] It should be noted that the particular spatial arrangement of the elements of the crane 1, in particular the arrangement of the second fulcrum F2 with respect to the first fulcrum F1 in the same direction towards which the loading arm 60 extends from the tower 20 and the consequent positioning of the boom 40 on the same side, makes it possible for the tower 20 to be, during the rotations described above, on the same side where the counterweight 18 is positioned and therefore on the opposite side with respect to the folded loading arm 60. Therefore, the weight force of the tower 20 acts favourably against the weight force of the loading arm 60 and adds to the weight force provided by the counterweight 18. In other words, the weight force of the tower 20 acts as an additional counterweight when moving the tower 20 between the horizontal and upright positions, or vice versa.

[0076] In other words, the weight force of the tower 20 generates a stabilising moment with respect to the rotation axis formed by the stabiliser 14 of the beam 12, which extends from the side of the loading arm 60 and opposes the tilting moment generated by the weight force of the loading arm 60.

[0077] Advantageously, therefore, the crane 1 of the invention does not require additional counterweight modules to be used when installing or removing the crane 1, and the counterweight 18 already installed on board the crane 1 is sufficient.

[0078] Still advantageously, therefore, no vehicles/trucks intended to transport the counterweight modules alone are required, as is the case with known-type cranes, with considerable advantages in terms of logistics and consequent advantages in terms of time and/or installation costs.

[0079] In a preferred embodiment, not shown, the tower could consist only of the lower telescopic sector, as described above, and in that case the joint zone wherein the loading arm is hinged to the tower is substantially located at the upper end of the second portion of the lower telescopic sector itself.

[0080] According to the preferred embodiment shown and described, however, the tower 20 comprises an additional telescopic sector 50 slidably associated with the second portion 28 of the lower telescopic sector 24. The further telescopic sector 50, hereinafter also referred to as the upper telescopic sector 50, comprises at least one extension portion 52 and, preferably, the joint zone 22 wherein the loading arm 60 is hinged to the tower 20 is substantially defined at the upper end 52a of the extension portion 52. The extension portion 52 develops longitudinally along said main axis X.

[0081] In particular, the upper telescopic sector 50 may comprise, in addition to the extension portion 52, further extension portions that slip out successively in a telescopic way. We will hereinafter always talk about the extension portion 52 following the non-limiting embodiment shown in the figures.

[0082] Preferably, the extension portion 52 consists of a tubular element, for example a tubular steel beam, adapted to slide within the second portion 28 of the lower telescopic sector 24.

[0083] In order to allow the extension portion 52 to be moved with respect to the second portion 28 of the lower telescopic sector 24 in the desired positions, further sliding means 100 are provided.

[0084] In a preferred embodiment, the further sliding means 100 comprise a hydraulic actuator, such as a cylinder and a piston respectively integral to the extension portion 52 and to the second portion 28 of the lower telescopic sector 24 or, vice versa respectively integral to the second portion 28 of the lower telescopic sector 24 and to the extension portion 52. The hydraulic actuator is preferably received within the extension portion 52 and the second portion 28 and therefore not visible in the figures.

[0085] In preferred embodiment variants, however, the sliding means can be different and fit-for-purpose, such as a system with rack-and-pinion, screw-nut, pulleys and ropes, etc.

[0086] The extension portion 52 can be positioned in a retracted position with respect to the first portion 26, preferably in a totally retracted position with respect to the second portion 28 of the lower telescopic sector 24, for example as shown in Figures 2 to 6, and in moved-away positions with respect to the second portion 28 itself, for example as shown in Figures 7 to 10.

[0087] In particular, the extension portion 52 is arranged in a totally retracted position with respect to the second portion 28 when the loading arm 60 with its portions 62, 64, 66 are fully folded together; the extension portion 52 is gradually moved away from the second portion 28 when the first portion 62 of the loading arm 60 is brought into a horizontal working position. These steps are shown with reference to the sequence in Figures 6 to 10.

[0088] In Figure 6 the extension portion 52 is in a totally retracted position with respect to the second portion 28 and the loading arm 60, with its portions 62, 64, 66, is fully retracted.

[0089] In Figures 7 and 8 and 9 the extension portion 52 is shown as partially moved away with respect to the second portion 28 and in Figures 8 and 9 the first portion 62 of the loading arm 60 is shown as partially rotated with respect to the joint zone 22: this slewing action of the first

portion 62 of the loading arm 60 is achieved by the combined action of the telescopic movement of the extension portion 52, the tie-rods 72, 74, 76 and the jibs 82, 84, 86.

[0090] In Figure 10, the extension portion 52 is brought to a first maximum moved-away position with respect to the second portion 28 and the first portion 62 of the loading arm 60 is arranged in its desired standard horizontal, or substantially horizontal, working position.

[0091] The subsequent steps for the final positioning of the loading arm 60 with the other two portions 64, 66 totally unfolded and aligned to the first portion 62 are not described and fall within the prior art with the use, preferably, of additional rope mechanisms and/or motors and/or auxiliary hydraulic actuators mounted, for example, at the articulation zones between the portions 62, 64, 66 of the loading arm 60.

[0092] Similarly, and by means of operations substantially opposite to the above ones, the extension portion 52 may be gradually returned to the retracted position with respect to the second portion 28 when the first portion 62 of the loading arm 60 is to be returned to the folded position, for example when the crane 1 is being moved from the working configuration to the transport position.

[0093] Furthermore, according to another aspect of the present invention, the upper telescopic sector 50 allows to change the tilt of the loading arm 60 in the working configuration, for example, to raise it by a certain angle from the standard horizontal working position to a so-called climbing configuration.

[0094] This will be easily accomplished by bringing the extension portion 52 into a second maximum moved-away position from the second portion 28, which will result in a corresponding further rotation of the first portion 62 of the loading arm 60, which will be arranged in the new climbing-like working position.

[0095] Advantageously, the new climbing working configuration is achieved simply by acting on the further sliding means 100 to move the extension portion 52 away by the desired amount. This allows to avoid the laborious reconfiguration operations required in known-type systems.

[0096] In an embodiment of the invention, the crane 1 is also preferably equipped with an aid system for moving the crane 1.

[0097] Preferably, the crane 1 comprises movement means 122, 124 for moving said crane 1 to said transport configuration.

[0098] As shown for example in Figure 2, preferably the movement means 122, 124 comprise a plurality of wheels. According to the preferred embodiment shown and described, the aid system preferably comprises two axles 122, 124 each provided with wheels, for example each axle 122, 124 provided with respective twin wheels. At least one of the two axles 122, 124 is also preferably of the steering type to facilitate the crane 1 handling.

[0099] Preferably said movement means 122, 124 comprise at least one axle 122 provided with wheels associated with said tower 20.

[0100] The first 122 of these axles is preferably connected to the tower 20, more preferably it is connected to the first portion 26 of the lower telescopic sector 24 of the tower 20. The second 124 of these axles is preferably connected to the rotatable base 16 or optionally to the support structure 10.

[0101] Once the crane 1 is positioned on the ground and stabilised by means of the stabilisers 14, the second axle 124 is preferably removed while, according to an aspect of the present invention, the first axle 122 is intentionally left connected to the tower 20. In addition to eliminating the time required to remove the axle and any risks to the operator during this operation, as is the case with known-type cranes where both axles are removed, the first axle 112 that remains associated with the tower 20 performs an advantageous counterbalancing action on the weights of the crane 1 as it is unfolded. As shown, for example, in Figure 5, the weight force of the first axle 112 generates a stabilising moment with respect to the rotation axis formed by the stabiliser 14 of the beam 12 that extends from the side of the loading arm 60 and opposes the tilting moment generated by the weight force of the loading arm 60 and of its folded portions 62, 64, 66. This allows to avoid dangerous displacements as the crane 1 is unfolded.

[0102] As a result of the above, it can be noted that the operations for installing and/or removing a crane according to the invention are simplified compared to known-type techniques.

[0103] It has therefore been demonstrated by means of the present description that the apparatus according to the present invention allows to achieve the intended objects.

[0104] It must be understood however that what described above has an exemplary and non-limiting purpose; therefore, possible variants of detail that may be necessary for technical and/or functional reasons, are considered from now falling within the same protective scope defined by the hereinafter reported claims.

Claims

1. A self-erecting crane (1) with bottom slewing comprising a support structure (10), a base (16) rotatable with respect to said support structure (10), a tower (20) arranged integrally on said base (16), and a loading arm (60) composed of one or more portions (61, 64, 66) articulated together and hinged to said tower (20) at a joint zone (22), said crane (1) being configurable between an operational working configuration and a non-operational transport configuration, wherein, in said working configuration, said tower (20) is arranged in an upright position and superiorly supports said loading arm (60) at said joint zone (22), and in said transport configuration, said tower (20) and said loading arm (60) are folded

one above the other;

characterized in that said tower (20) comprises:

- a lower telescopic sector (24) comprising a first portion (26) extending longitudinally along a main axis (X) and a second portion (28) slidably associated with respect to said first portion (26), said first portion (26) comprising a first end (26a) hinged to said base (16) at a first fulcrum (F1);
- sliding means (30) adapted to position said second portion (28) in a retracted portion with respect to said first portion (26) and at least one moved-away position with respect to said first portion (26);

and in that it comprises a boom (40) having a first end (42) hinged to said base (16) at a second fulcrum (F2) spaced apart from said first fulcrum (F1), and a second end (44) hinged to said second portion (28) of said lower telescopic sector (24) at a third fulcrum (F3) spaced apart from said first fulcrum (F1) and from said second fulcrum (F2).

2. The crane (1) according to claim 1, **characterized in that** said joint zone (22) is defined at an end (20a) of said tower (20) that is opposite with respect to said base (16).

3. The crane (1) according to any one of the preceding claims,
characterized in that said second fulcrum (F2) is arranged with respect to said first fulcrum (F1) in the same direction towards which said loading arm (60) extends from said tower (20), assuming said crane (1) in said working configuration.

4. The crane (1) according to any one of the preceding claims,
characterized in that said sliding means (30) comprise at least one hydraulic actuator, preferably said hydraulic actuator being received inside said first portion (26) and inside said second portion (28).

5. The crane (1) according to any one of the preceding claims,
characterized in that said tower (20) additionally comprises a further telescopic sector (50) slidably associated with respect to said second portion (28) of said lower telescopic sector (24), said further telescopic sector (50) comprising at least one extension portion (52).

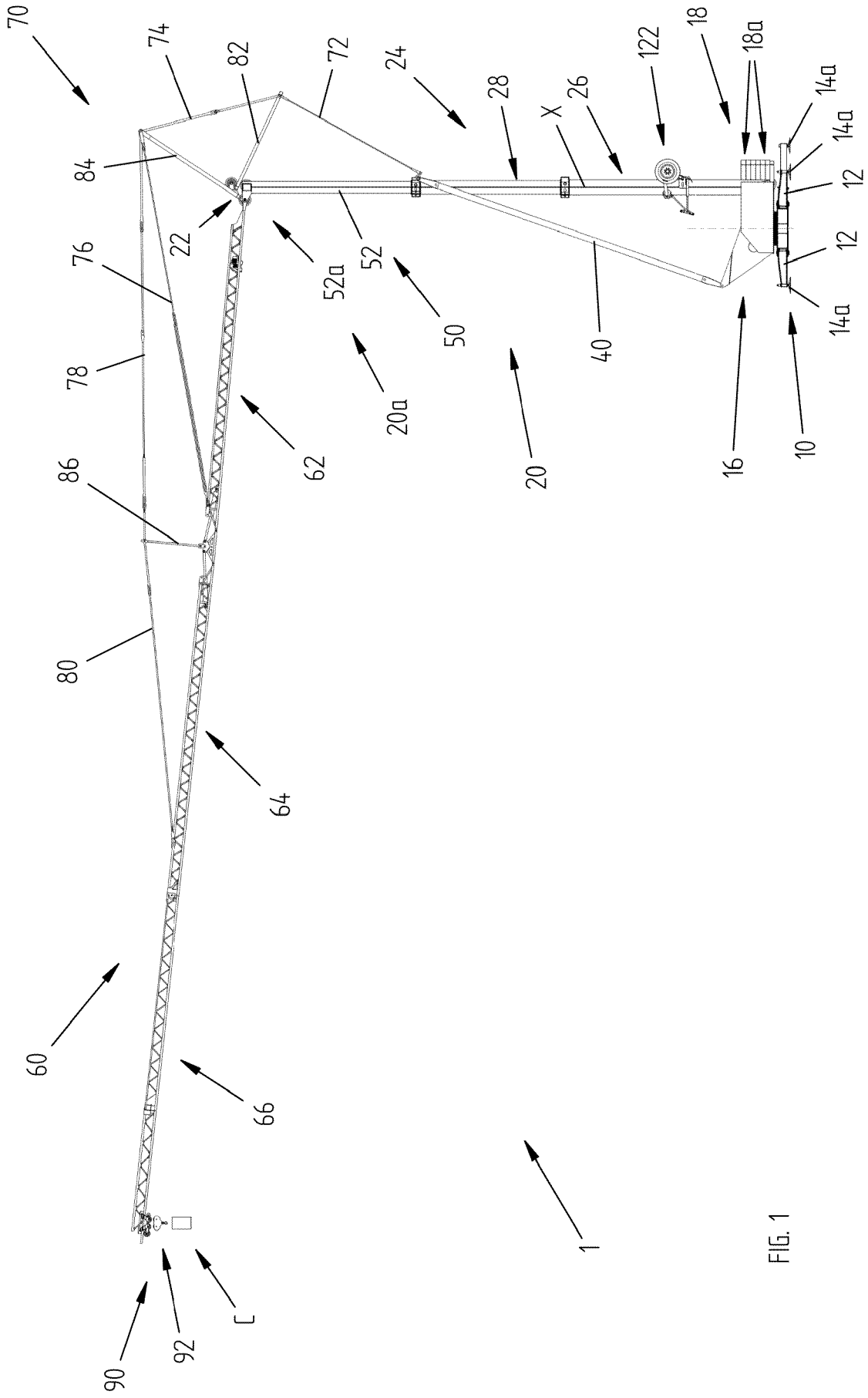
6. The crane (1) according to claim 5, **characterized in that** it comprises further sliding means (100) adapted to position said extension portion (52) in a retracted portion with respect to said second portion (28) of said lower telescopic sector (24), and in a moved-away position with respect to said second portion (28) of said lower telescopic sector (24).

7. The crane (1) according to claim 6, **characterized in that** said further sliding means (100) comprise at least one hydraulic actuator, preferably said hydraulic actuator being received inside said extension portion and inside said second portion (28) of said lower telescopic sector (24).

8. The crane (1) according to any one of the claims 5 to 7,
characterized in that said joint zone (22) is defined at an end (52a) of said at least one extension portion (52).

9. The crane (1) according to any one of the preceding claims,
characterized in that it comprises a counterweight (18) associated with said base (16).

10. The crane (1) according to claim 6, **characterized in that** said counterweight (18) and said loading arm (60) are located on opposite parts with respect to said tower (20), assuming said crane (1) in said working configuration.


70
74
82
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24
28
X
26
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18a
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22
52a
52
50
40
76
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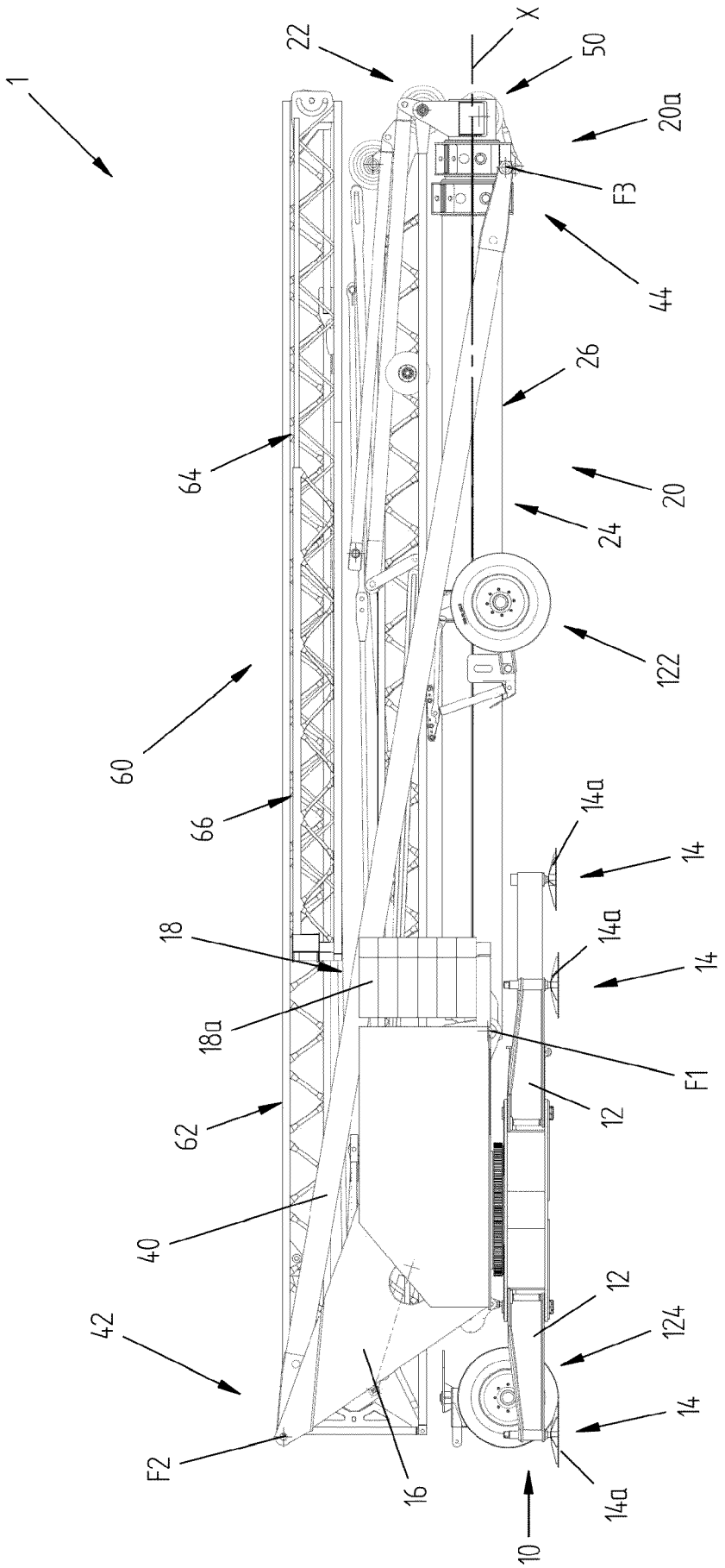
20a
20
16
10
86
62
80
64
60
66
1
90
92
C

FIG. 1


1
22
X
50
20a
F3
44
26
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14a
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F1
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62
40
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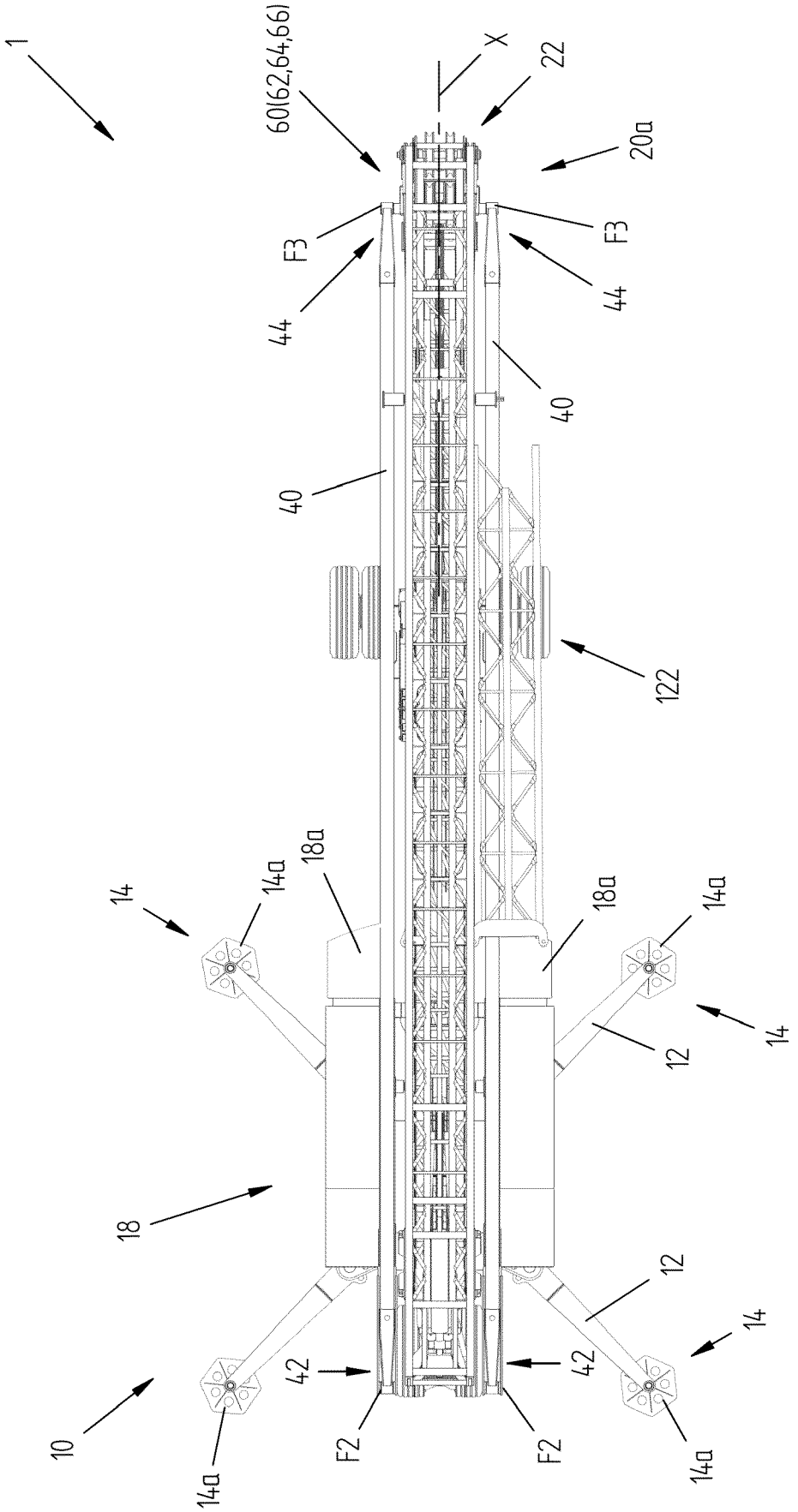
42
124
14
F2
16
14a
10

FIG. 2


1
60(62,64,66)
X
22
20a
F3
F3
44
44
40
40
122
14
14a
18a
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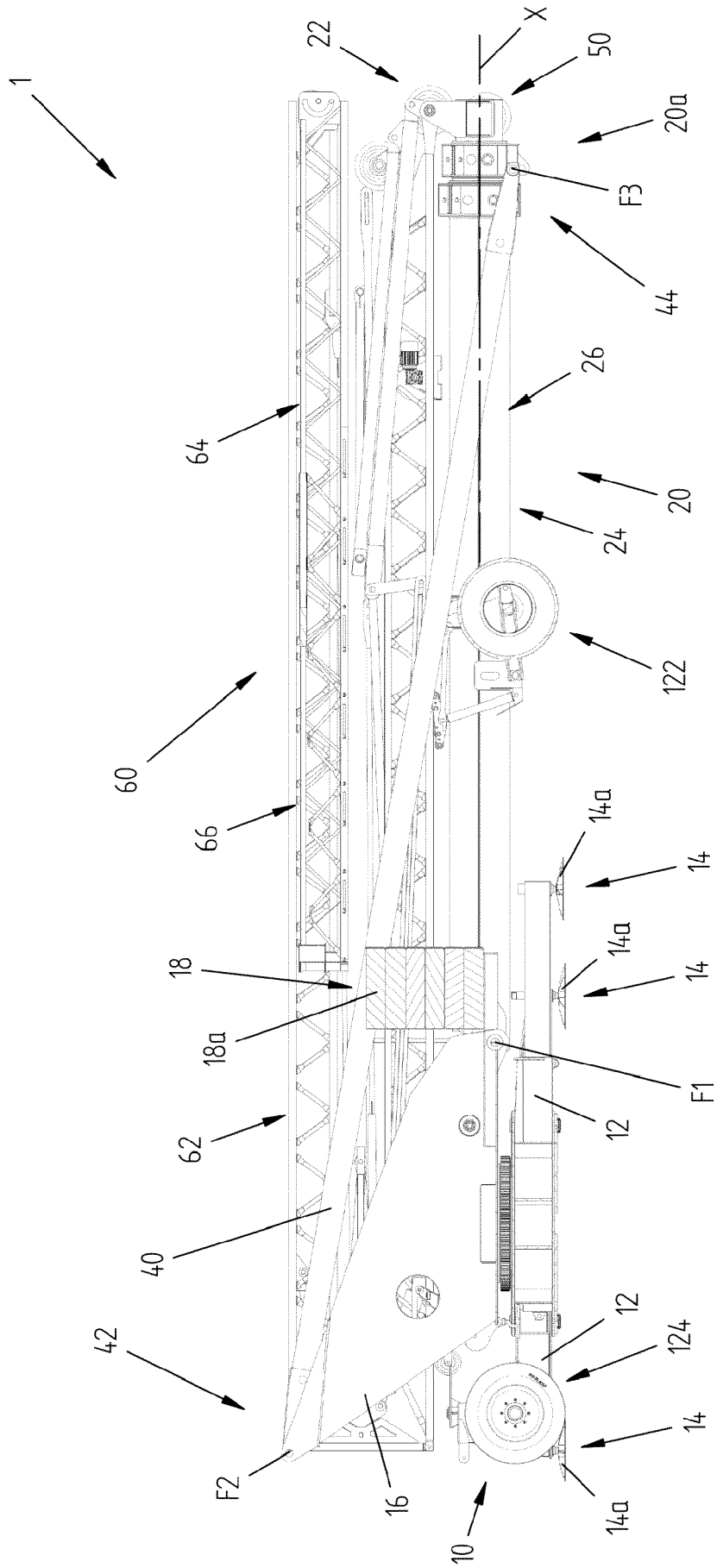
14
12
18
12
42
42
14
10
F2
F2
14a
14a

FIG. 3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22
X
50
20a
F3
44
26
64
20
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60
66
14a
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F1
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62
40
42
12
124
14
F2
16
14a
10

FIG. 4

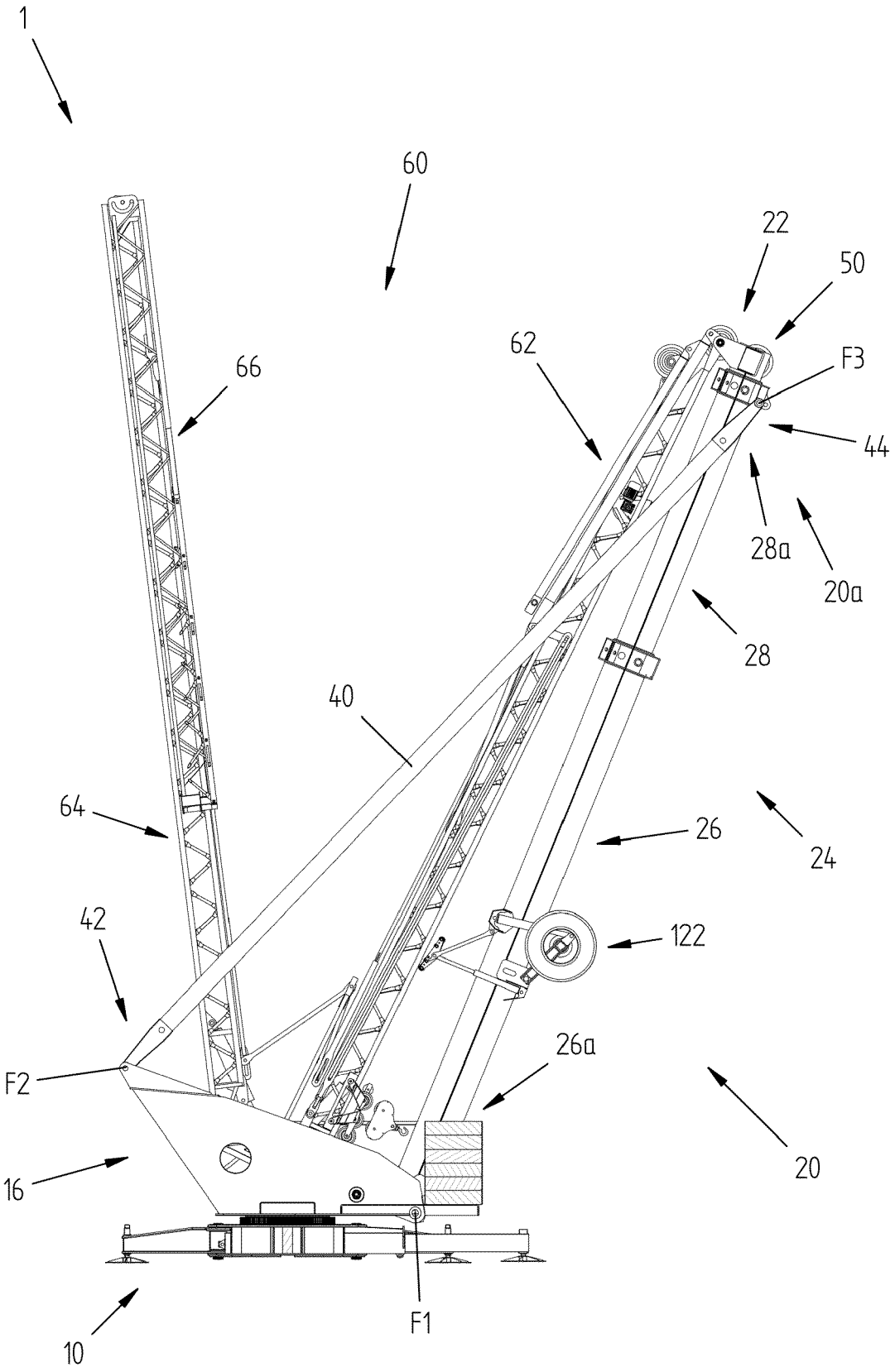


FIG. 5

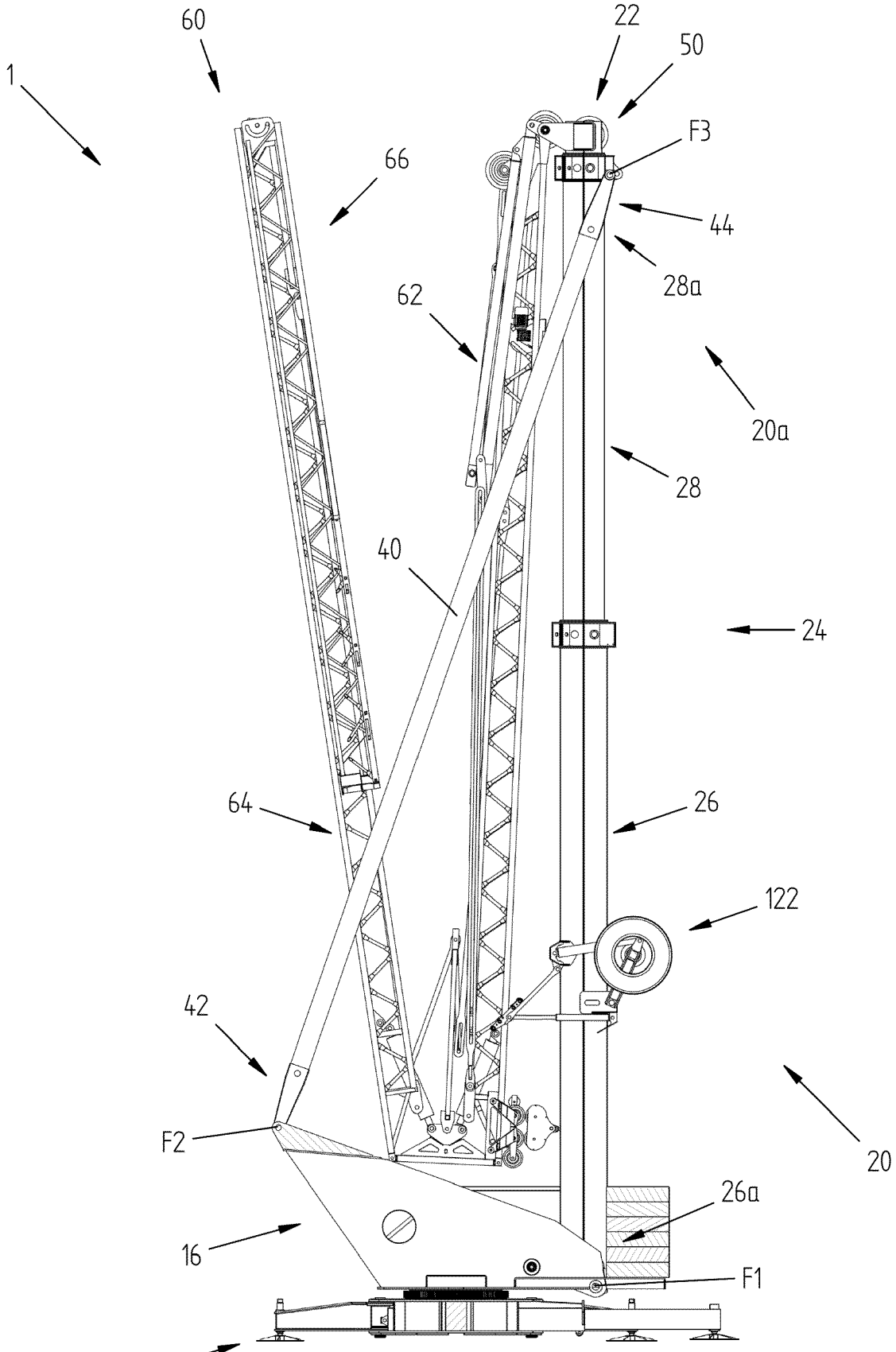
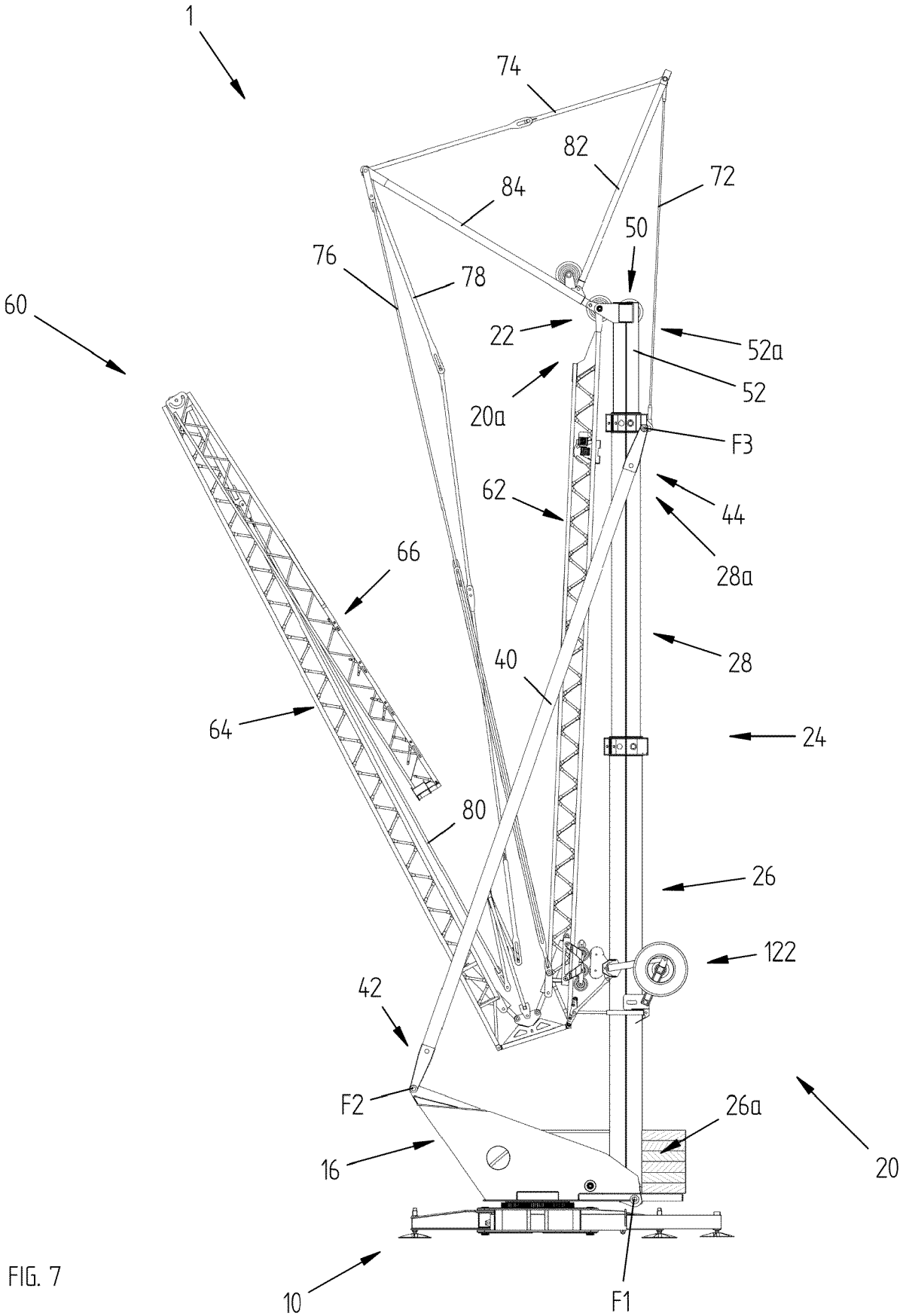


FIG. 6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82
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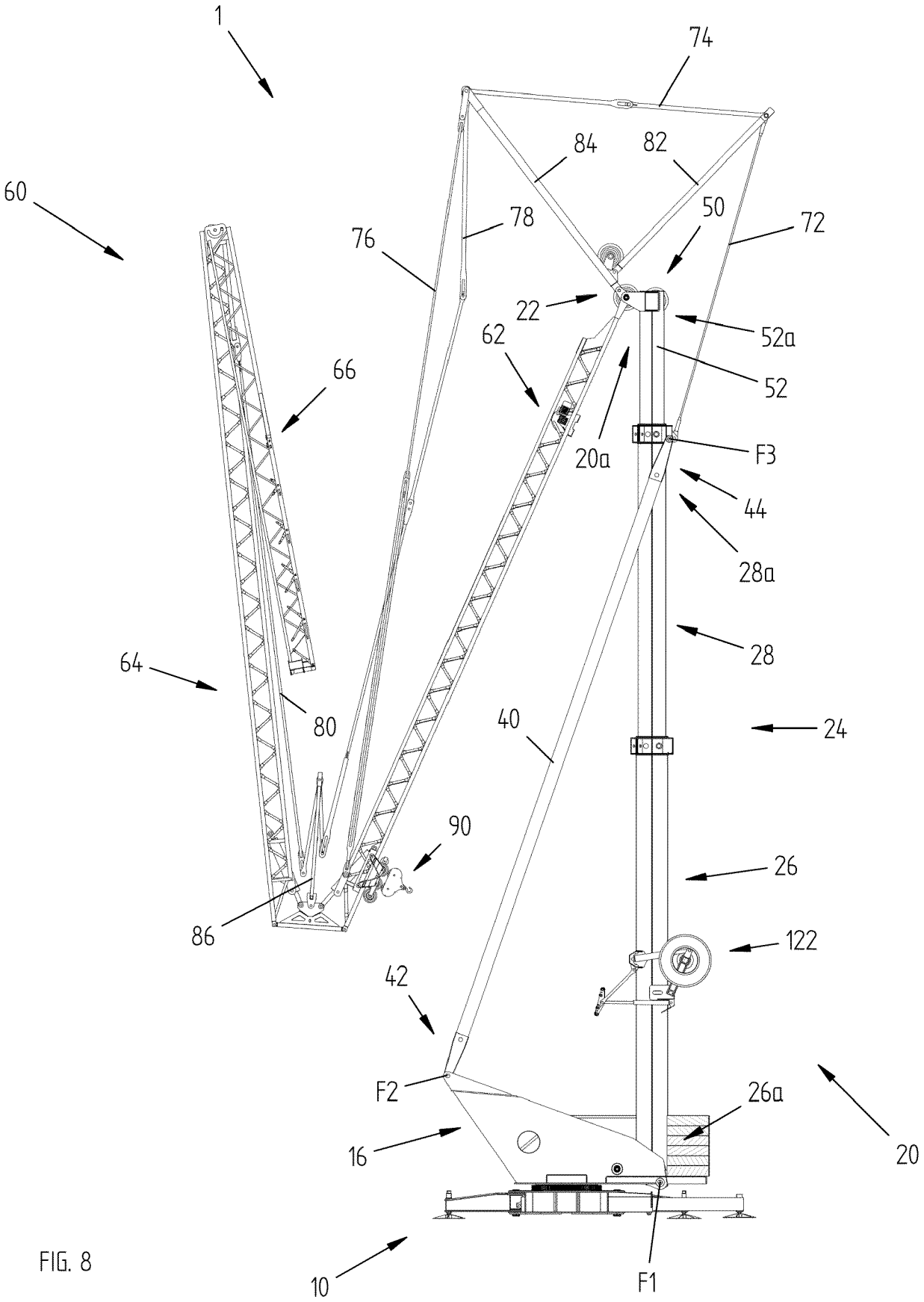
50
76
78
60
22
52a
52
20a
F3
62
44
28a
66
28
40
64
24
80
26
122
42
F2
26a
16
20
10
F1

FIG. 7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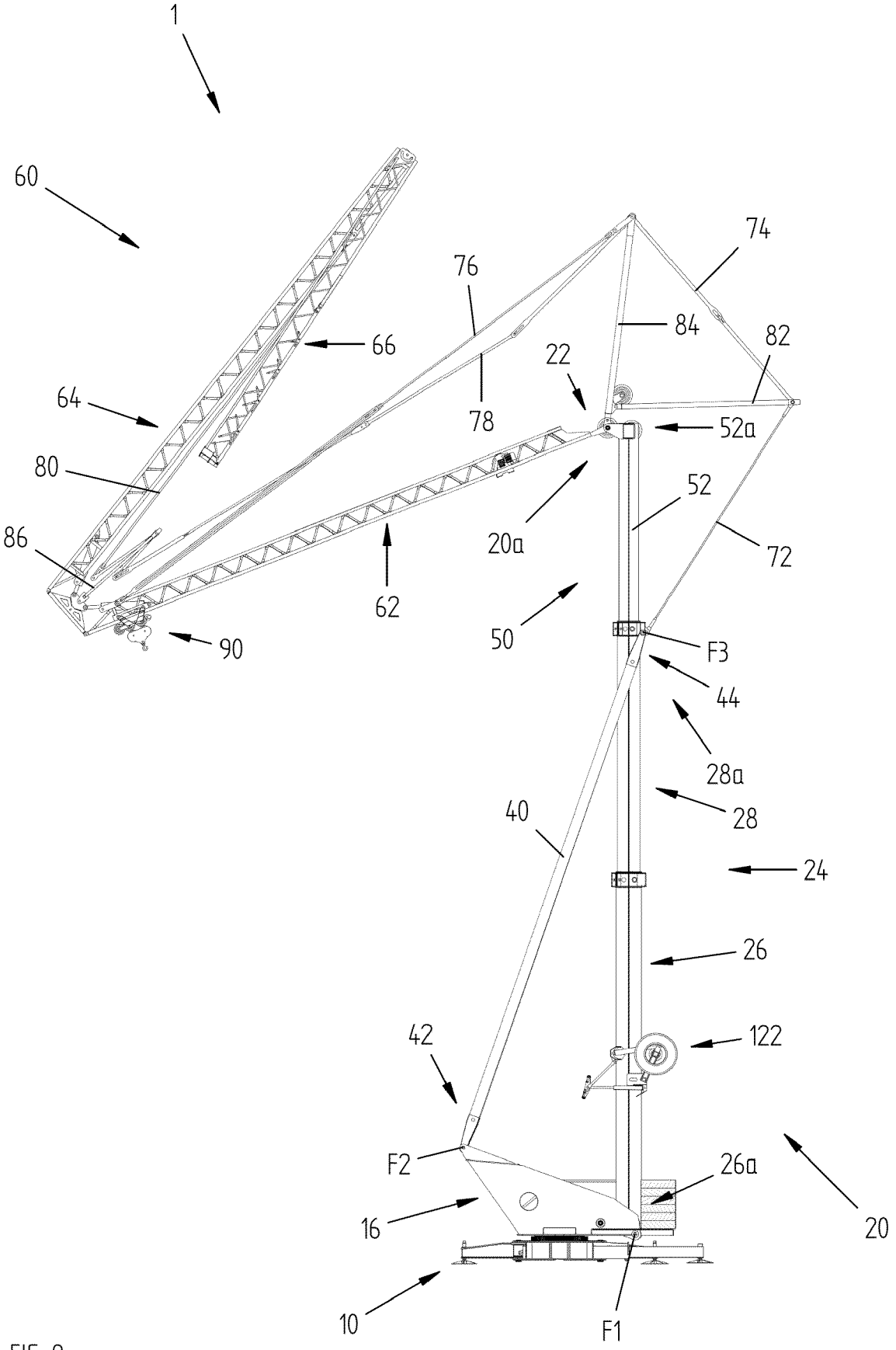
72
76
22
52a
62
52
66
20a
F3
44
28a
64
28
80
40
24
90
26
86
122
42
F2
26a
16
20
10
F1

FIG. 8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52
20a
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F3
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122
F2
26a
16
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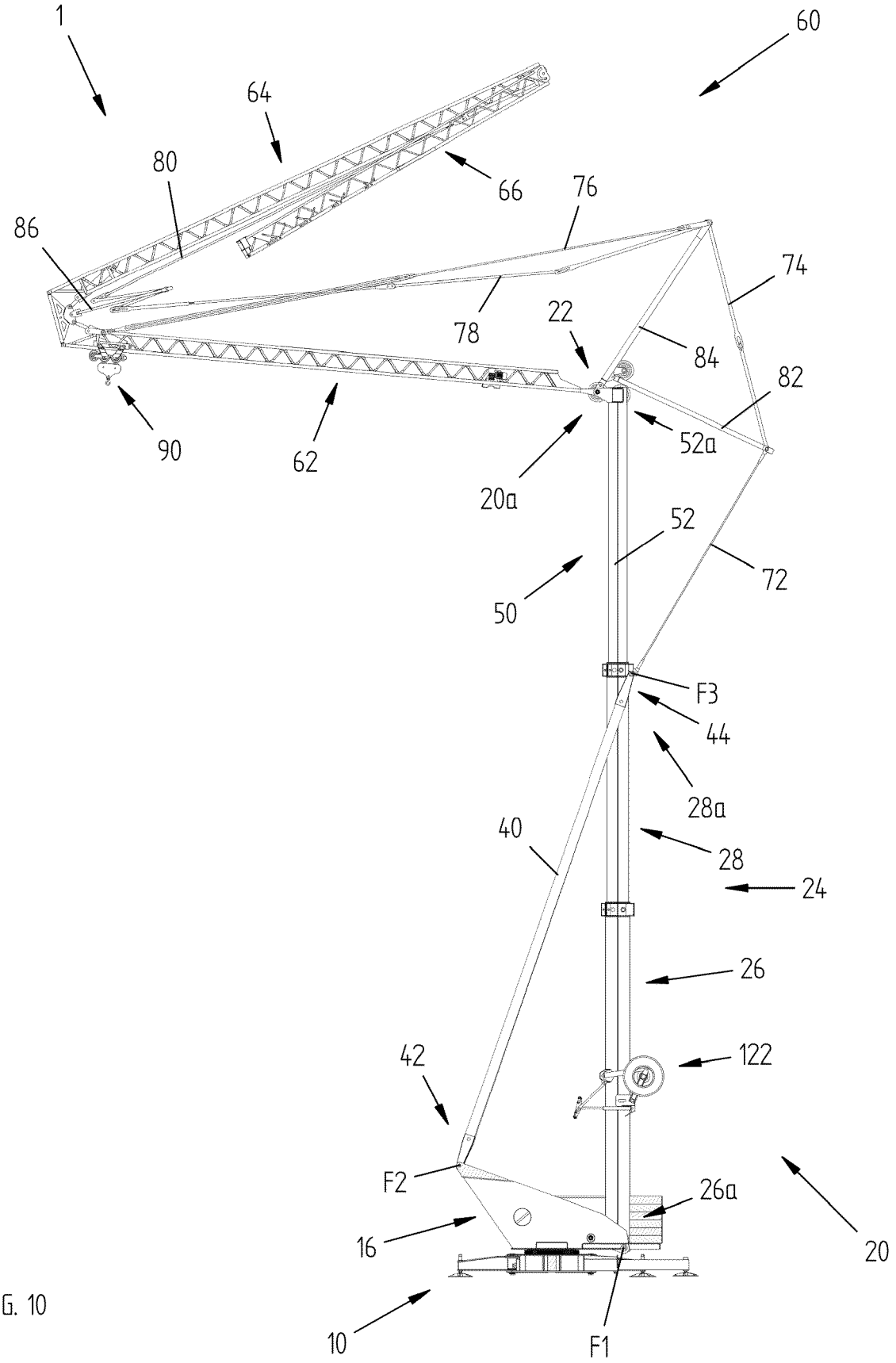
10
F1

FIG. 9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122
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F1

FIG. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 3634

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B66C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 December 2024	Özsoy, Sevda

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06-12-2024

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