

(19) **DANMARK**

(10) **DK/EP 2953882 T3**



Patent- og
Varemærkestyrelsen

(12) Oversættelse af
europæisk patentskrift

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- (51) Int.Cl.: **B 66 C 1/42 (2006.01)** **B 66 C 1/58 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2018-01-15**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2017-12-20**
- (86) Europæisk ansøgning nr.: **13807911.6**
- (86) Europæisk indleveringsdag: **2013-11-14**
- (87) Den europæiske ansøgnings publiceringsdag: **2015-12-16**
- (86) International ansøgning nr.: **DK2013050381**
- (87) Internationalt publikationsnr.: **WO2014079454**
- (30) Prioritet: **2012-11-25 DK 201200747**
- (84) Designerede stater: **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 MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **GRIBEVÆRKTØJ TIL FIKSERING AF EN AFLANG GENSTAND**
- (56) Fremdragne publikationer:
WO-A2-99/66244
FR-A1- 2 148 191
US-A- 3 231 303
US-A1- 2005 161 654
US-A1- 2008 129 066
US-A1- 2008 145 189

DESCRIPTION

Field of the Invention

[0001] The present invention relates to a gripping tool for the fixation of an elongated object, such as a pole or a mast, according to the preamble of claim 1.

State of the Art

[0002] When elongate objects, such as lamp posts, flag poles, power poles, and the like are to be raised, it is known to first dig a hole or to otherwise establish a foundation, and then raise the object either manually or by means of a crane. However, this is difficult, hard and dangerous - especially when the elongate body is above a certain length and/or weight.

[0003] From the U.S. patent application U.S. 2008/145189 A1, it is known to handle elongate bodies by means of a gripping claw which can be fitted on a small excavator. But this gripping claw is only suitable for subjects with a very constant diameter, which is very undesirable as most elongate objects have varying diameter in the longitudinal direction - typically the object is thickest at the ground and then narrows upward either in stages or by a more or less constant conicity. In addition, this gripping claw presents a safety risk, since the object may be lost in case of system failures.

[0004] From the U.S. patent application U.S. 2005/161654 A1, it is known to hold the object by means of two individual staggered band that encircles the object during the handling process. This system can handle both cylindrical objects and tapered objects (and objects with otherwise varying diameter) and the system is also reasonably safe. But it is difficult to use and in particular releasing the object may cause dangerous situations.

[0005] The document FR 2 148 191 A1 discloses a gripping tool for fixing an elongated object, said gripping tool comprises a first gripping device and a second gripping device which are mutually displaced in the longitudinal direction, wherein both gripping devices comprises at least one gripping arm arranged to act on said object, whereby said gripping tool further comprises a gripping actuator which is connected to said at least one gripping arm of both gripping devices so that said gripping actuator drives the gripping action of both of the first gripping device and the second gripping device.

[0006] It is therefore an object of the invention to provide a versatile gripping tool that is easy to use.

The invention

[0007] The afore-mentioned goal is achieved by the provision of a gripping tool having all the technical features, in combination, of claim 1.

[0008] The invention relates to a gripping tool for the fixation of an elongated object, such as a pole or a mast. Said gripping tool comprising a first gripping device and a second gripping device, which are mutually displaced in the longitudinal direction, wherein both gripping devices comprise at least one gripping arm arranged to grip the object.

[0009] The use of two gripping devices, which are mutually displaced in the longitudinal direction of the elongated object and which have at least partially independent gripping action allows that both cylindrical bodies and objects of varying diameter can be firmly gripped. And by driving the gripping actions by means of a single gripping actuator, so that the gripping action of the first gripping device is substantially at least partially independent of the gripping action of the second gripping device ensures that the gripping force is distributed equally between the gripping devices regardless of whether the object is cylindrical, conical or other. It should be mentioned that by the term "at least partially independent" is meant that the gripping action of the first gripping device is independent of the gripping action of the second gripping device in at least some of the gripping motion. That is to say that at least until one of the gripping devices engage with the object to be gripped, the gripping devices are in principle moved fully independent of each other. However, since they are connected via the gripping actuator, the gripping action of the first gripping device be dependent upon the gripping action of the second gripping device as soon as the second gripping device grips the object.

[0010] In addition, this design results in lower costs, since two separate gripping devices is made possible with a single actuator.

[0011] One aspect of the invention is that said gripping actuator is arranged between said first gripping device and said second gripping device, thereby achieving a very compact gripping tool design.

[0012] One aspect of the invention is that said gripping actuator is an electric linear actuator comprising a motor-driven spindle.

[0013] Since the excavator arm of excavators is hydraulically driven and since the excavator arm often is equipped with a hydraulic outlet for supplying a tool attached to the excavator arm, it would be natural to drive the gripping action by means of a hydraulic cylinder. However, if a hose bursts or the hydraulic pressure of one reason or another drops, the gripping tool will release its grip and very dangerous situations can occur. An electric linear actuator is in contrast self-locking, so that if power is lost, it will only move under very large force. This ensures that a solid grip on the object is maintained even if a fault should occur.

[0014] One aspect of the invention is that said first gripping device and said second gripping device comprising at least two opposed gripping arms.

[0015] By providing each gripping device with two opposing gripping arms a larger work range is ensured work in an easy way.

[0016] One aspect of the invention is that said two opposing gripping arms are symmetrically arranged relative to an axis of symmetry that is substantially parallel to a longitudinal center axis of said elongate object, when this is fixed in said gripping tool. This provides a symmetrical gripping action, which ensures an easier gripping process.

[0017] One aspect of the invention is that the gripping arms are connected to said gripping actuator by means of one or more ball joints.

[0018] Ball joint can transfer forces in several directions, which is advantageous in this context since the gripping actuator extends substantially perpendicular to the plane the gripping arms are moving in.

[0019] One aspect of the invention is that the gripping tool comprises at least one adjustable backstop.

[0020] Providing the gripping tool with one or more adjustable backstops ensures a greater field of application of the gripping tool - i.e. that the tool can be used for handling the elongate objects with smaller and larger diameter than without the adjustable backstops - without increasing the motion range of the gripping arms. This ensures that the gripping tool has a large working range without increasing the cost significantly.

[0021] One aspect of the invention is that the gripping tool comprises a connection unit for mounting on the excavator arm of a motorized excavator, which ensures that the gripping tool can easily be used.

[0022] One aspect of the invention is that the said elongate object has a varying diameter in the longitudinal direction.

[0023] One aspect of the invention is that the gripping arms are individually suspended in individual tilt joints.

[0024] By suspending each gripping arm in its own individual tilt joint, it is possible to ensure individual movement of each gripping arm, so that the gripping tool can be adapted to larger variation of objects.

[0025] One aspect of the invention is that said gripping actuator comprises an actuator rod arranged to slide in and out of an actuator housing and wherein said at least one gripping arm of said first gripping device is connected to said actuator rod and wherein said at least one gripping arm of said second gripping device is connected to the said actuator housing.

[0026] By connecting the gripping arms of the first gripping device to one end of the gripping actuator and connecting the gripping arms of the second gripping device to the other end of the gripping actuator it is ensured that the gripping force is distributed equally between the gripping devices regardless of whether the object is cylindrical, conical or otherwise.

Figures

[0027] The invention is explained in more detail below with reference to the drawings, in which

FIG. 1

shows a motorized excavator with an embodiment of a gripping tool according to the invention mounted on the end of the excavator arm, as seen in perspective,

FIG. 2

shows a cross section through an embodiment of a gripping tool according to the invention, as seen in perspective,

FIG. 3

shows a gripping tool with a gripping device in outer position and a gripping device in inner position, as view from above,

FIG. 4

shows a gripping tool without back covering in which the gripping actuator is contracted, as seen from the back,

FIG. 5

shows a gripping tool without back covering, in which the gripping actuator is extended, as seen from the back,

FIG. 6

shows a cross section through the center of a gripping tool, as seen from above,

FIG. 7

shows a cross section through the center of a gripping tool, as seen from the side, and

FIG. 8

shows an embodiment of a gripping tool, as seen in perspective.

Detailed description

[0028] FIG. 1 shows a motorized excavator 2 with an embodiment of a gripping tool 1 according to the invention mounted on the end of the excavator arm 5, as seen in perspective.

[0029] In this embodiment of the invention, the motorized excavator 2 of a compact type, also known as a mini excavator, but in another embodiment of the invention to the excavator could be of "standard" size, such as a standard excavator, a digger, a backhoe or the any other type of excavator 2, which via a motor-driven hydraulic system can be used also for digging-like

work.

[0030] An excavator 2 typically includes a supporting frame structure 6 or a chassis fitted with an open or closed driver's cab 3, which includes a driving seat and for example a steering wheel and/or various handles 4 to control the excavator's functions when the excavator 2 is driven from one place to another or when it is used for digging, for raking, for demolition or other.

[0031] The supporting frame structure 6 is placed on propelling means 15 which are in contact with the underlying ground. The propelling means 15 allow the excavator 2 to be self-propelled and thus by its own motion move from place to place.

[0032] At the front end of the frame structure 6 the excavator 2 is provided with an excavator arm 5. In this embodiment the excavator arm 5 can rotate on a frame joint 16 having a substantially horizontal axis of rotation and in another embodiment the excavator arm 5 could also be connected to the frame 6 via a joint with a vertical axis of rotation, but in this embodiment the excavator arm 5 is fixed against lateral movement relative to the frame 6. Instead, the entire frame 6 including the excavator arm 5 is rotated relative to the propelling means 15 to enable transverse movement of the excavator arm 5.

[0033] A typical excavator arm 5 includes a main arm 7, which is rotatable in a vertical plane through a main arm actuator 8. The main arm 7 is connected to a lower arm 9 through a middle joint 10 and the lower arm 9 can be rotated in a vertical plane around the middle joint 10 by means of a lower arm actuator 11.

[0034] The lower arm 9 is provided with a tool actuator 13 to rotate the gripping tool 1 around a front joint 14 in said vertical plane. The tool actuator 13 acts on the gripping tool 1 by means of a tool arm 17 and a connecting arm 18, which allow that the linear movement of the tool actuator 13 can rotate the gripping tool 1 further in both directions compared to if the tool actuator 13 was connected directly to the gripping tool 1 through a pivot joint. This means that via the tool arm 17 it is possible for the tool actuator 13 to rotate the gripping tool 1 at least 180°, in contrast to if the tool actuator 13 was directly coupled to the gripping tool 1, then it could only rotate about 140° and it would not be possible to rotate the gripping tool 1 very far in the direction of the cab 3.

[0035] In this embodiment the excavator arm 5 is connected to the gripping tool 1 through the connection unit 20. This connection unit 20 is provided with a number of connection parts 21, which ensures that the gripping tool 1 easily and quickly can be mounted on the excavator arm 5 so that it is also ensured that the connection is very safe - i.e. that the gripping tool 1 remains connected to the excavator arm 5, even when these are severely impacted.

[0036] In this embodiment of the invention the excavator arm 5 and the connection unit 20 comprise mutually engaging connection parts 21 in the form of sheet metal parts, which grips axles and a peg mounted in the holes crosswise to the excavator arm 5 and the connection

unit 20. The connection parts 21 may be designed in a myriad of ways depending on local standards, manufactures standards, physical limitations and other things requiring that the connection unit 20 and/or the connection parts 21 must be designed in a certain way. Likewise, the connection parts 21 may include one or more quick couplings or the connection parts 21 may be prepared for or designed so that the connection unit 20 can be mounted via a quick release coupling ensuring that the excavator arm 5 and the connection unit 20 can be connected automatically - typically by means of one or more actuators - or at least reduce the manual labor associated with performing the interconnection.

[0037] In this embodiment the gripping tool 1 is in the process of lifting an elongate object 12 in the form of a conical lamppost. In this embodiment the object weighs 150 kg and is 4 meters long but the gripping tool 1 can in principle handle objects 12 at anything between 0.5 meters and 20 meters and between 1 kg and 2,000 kg depending on the size and design of the gripper tool 1 and excavator 1.

[0038] FIG. 2 shows a cross section through an embodiment of a gripping tool 1 according to the invention, as seen in perspective.

[0039] In this embodiment both the first gripping device 22 and the second gripping device 23 comprises two opposing gripping arms 19, but in another embodiment one or both gripping devices 22, 23 could comprises only one movable gripping arm 19 which would hold the object 12 against a fixed arm, a faceplate or the like.

[0040] In this embodiment the two gripping devices 22, 23 are displaced by about 0.45 meters, so that this gripping tool 1 cannot be used properly on objects that are shorter than this. However, in another embodiment the gripping devices 22, 23 can be mutually displaced in another distance, which could be either shorter or longer - possibly adapted to a given use.

[0041] Figure 3 shows a gripping tool 1 with a gripping device 23 in outer position and a gripping device 22 in inner position, as seen from above.

[0042] In this embodiment all the gripping arms 19 are provided with a gripping roller 28 outermost on the arms 19. The gripping rollers 28 are rotatably mounted on the gripping arms 19 in order to ensure that an object 12 can easily be guided in between the gripping arms 19. In this embodiment the gripping rollers 28 are made of a hard rubber material in order to ensure that the rollers 28 do not scratch the object 12 but in another embodiment the rollers 28 may be made of any other material which preferably is softer than steel to not scratch steel objects.

[0043] In another embodiment the arms 19 could instead be provided with bars, guides or other, which could facilitate the introduction of the object 12 into the gripping tool 1.

[0044] In this embodiment the internal distance between the gripping rollers 28 of the first gripping device 22 - in the inner position - is about 70 mm and the internal distance between

the gripping rollers 28 of the other gripping device 23 - in the outer position - is approx. 170 mm but in another embodiment the gripping arms 19 could be both closer together and further apart in inner and outer positions, respectively. Thus, in this embodiment the gripping tool 1 can be used to grip an object 12 having a diameter of slightly more than 70 mm to a little less than 170 mm.

[0045] Figure 4 shows a gripping tool 1 without back covering with the gripping actuator 24 retracted, as seen from the back and figure 5 shows a gripping tool 1 without back covering with the gripping actuator 24 expanded, as seen from the back.

[0046] In this embodiment the gripping actuator 24 extends between the gripping devices 22, 23 so that one end of the gripping actuator 24 is connected to both of the gripping arms 19 at the first gripper device 22 and the other end of gripping actuator 24 is connected to both of the gripping arms 19 at the second gripping device 23 via four ball joint rods 31. The ball joint rods 31 are so "loosely" connected to the gripping actuator 24 that they can transmit forces even though the arm is moved both up and down by the gripping arm's tilting movement (explained in more details in connection with Figure 6) and the back and forth by the actuator 24. And at the other end the ball joint rods 31 are connected to the gripping arms 19 via ball joints 26, which also permit movement in various directions. However, it is apparent to those skilled in the art that the actuator 24 can be connected to the gripping arms 22, 23 in other equally effective ways - such as by means of several joint connections.

[0047] In this embodiment the gripping actuator 24 is an electric linear actuator comprising an actuator rod 33 in the form of a motor-driven spindle, which is extruded into and out of an actuator housing 34. In this embodiment the spindle has a pitch which ensures that the actuator 24 is self-locking to loads up to 4700 N. In this embodiment the actuator 24 presses with a force of up to 3100 N but in another embodiment both the self-locking force and the pressure force could be bigger or smaller e.g. customized for a specific use.

[0048] In another embodiment the gripping actuator 24 could be formed as a hydraulic cylinder, a pneumatic cylinder, a motor with pinion and a rack or other. In the event that the gripping actuator 24 is a hydraulic or pneumatic cylinder the piston rod will be the actuator rod 33 and the cylinder body would be the actuator housing 34.

[0049] In this embodiment, the gripping tool 1 is designed so that when the actuator 24 is in the outer position - and the gripping arms 22, 23 thus are in the inner position - the ball joint rods 31 extend substantially perpendicularly from the longitudinal direction of the actuator 24 so that there is a self-locking function achieved in that an outward pressure on the gripping arms 19 will substantially press directly onto the opposed gripping arm 19. The pressure will therefore essentially not try to push the actuator 24 together and thus it is ensured that the holding power of the gripping devices 22, 23 far exceeds the nominal thrust and self-locking ability of the actuator 24. By further supplying the mechanism with a safety contact surface 32 as shown at the upper right ball joint rod 31 in Figure 5 then a possible overload of ball joints 26 will only cause the ball joint 26 to be pressed against the safety contact surface 32 so that this

additional safety ensures that it takes an exceptionally great force to push the gripping arms 19 apart once they have established a grip around an object 12. This design makes this gripping tool 1 very safe to use. In a preferred embodiment there would be arranged safety contact surfaces 32 at all ball joint rods 31

[0050] The individual connection from the actuator 24 for each gripping arm 19 also means that when the actuator is contracted to clamp a object 12, then one of the arms 19 first strike object 12. The arm 19 will then typically be stopped while the other arms movement continues until all arms 19 are in contact with the object 12. Subsequently, the symmetrical design supplied with the actuator 24 will try to pull the member 12 to a position where it is parallel with the gripping tool's symmetry axis 25 - a symmetrical central position.

[0051] The individual connection from the actuator 24 to each gripping arm 19 also ensures that when the actuator 24 retracts to squeeze around an object 12 one of the arms 19 will hit the object 12 first. This arm 19 will typically stop while the movement of the remaining arms continues until all arms 19 are in contact with the object. The symmetrical design will then cause that the actuator 24 will try to pull the object 12 to a position where it is parallel with the axis of symmetry 25 of the gripping tool - a symmetric center position.

[0052] The individual connection from the actuator 24 to each gripping arm 19 also ensures that the actuator 24 will try to pull the object 12 to a position where it is parallel with the axis of symmetry 25 of the gripping tool even though the object 12 has one diameter at the first gripper device 22 and another at the second gripping device 23. Also, this design ensures that the gripping force from the actuator 24 is divided equally between the gripping arms 19 whether the subject 12 is cylindrical, conical or otherwise.

[0053] Figure 6 shows a cross through the center of a gripping tool 1, as seen from above.

[0054] In this embodiment all of the gripping arms 19 are supported in separate individual tilt joints 29 around which they tilt so that the arms 19 describe a circular motion. In another embodiment, the gripping arms 19 could be displaced in and out more or less linearly.

[0055] In this embodiment the gripping tool 1 is provided with two adjustable back stops 27 located at each end of the tool 1. In another embodiment the gripping tool 1 may be fitted with another number of adjustable backstops 27 such as three, four or possibly only one arranged in between gripping devices 22, 23.

[0056] The adjustable backstops 27 ensure that the tool 1 can better be adjusted to a given object 12 - both in terms of the diameter of the object 12 and the variation thereof.

[0057] In this embodiment the adjustable back stops 27 are provided with an abutment layer 30 intended to prevent the object 12 from being scratched. This abutment layer 30 could be made of a similar material as the gripping rollers 28.

[0058] Figure 7 shows a cross section through the center of a gripping tool 1 - seen from the side.

[0059] Figure 8 shows an embodiment of a gripping tool 1, seen in perspective.

[0060] In the foregoing primarily round elongate objects 12 have been mentioned but it will be apparent to the skilled person that this gripping tool 1 can also be used for objects with a square, triangular, oval, polygonal or other cross-sections.

[0061] In the foregoing the invention is described in connection with specific embodiments of a gripping tools 1, elongated objects 12, gripping devices 22, 23 and other as shown in the drawings. However, it will be apparent to one skilled in the art that the invention can be varied in numerous ways within the scope of the claims.

List

[0062]

1. Gripping Tool
2. Excavator
3. Drivers cab
4. Handle
5. Excavator arm
6. Frame Structure
7. Main arm
8. Main arm actuator
9. Lower arm
10. Middle joint
11. Lower arm actuator
12. Elongated object
- 13.

- Tool actuator
- 14. Front joint
- 15. Propelling means
- 16. Frame joint
- 17. Tool arm
- 18. Connecting arm
- 19. Gripping arm
- 20. Connection unit
- 21. Connection part
- 22. First gripping device
- 23. Second gripping device
- 24. Gripping actuator
- 25. Axis of symmetry
- 26. Ball joint
- 27. Adjustable backstop
- 28. Gripping rollers
- 29. Tilt joint
- 30. Abutment layer
- 31. Ball joint rod
- 32. Safety contact surface
- 33. Actuator rod
- 34. Actuator housing

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- [US2008145189A1 \[0003\]](#)
- [US2005161654A1 \[0004\]](#)
- [FR2148191A1 \[0005\]](#)

PATENTKRAV

1. Gribeværktøj (1) til fiksering af en aflang genstand (12), såsom en stang eller mast, hvilket gribeværktøj (1) omfatter

en første gribeanordning (22) og en anden gribeanordning (23), der gensidigt forskydes i længderetningen, hvor begge gribeanordninger (22, 23) omfatter mindst én gribearm (19), der er anbragt til at indvirke på genstanden (12), hvor gribeværktøjet (1) endvidere omfatter en gribeaktuator (24), der er forbundet med begge gribeanordningers (22, 23) mindst ene gribearm (19), således at gribeaktuatoren (24) styrer gribebehandlingen for både den første gribeanordning (22) og den anden gribeanordning (23),

kendetegnet ved, at

gribearmene (19) er båret i separate individuelle vippeled (29), hvor omkring gribearmene (19) vipper, således at armene (19) beskriver en cirkelbevægelse omkring en rotationsakse, der i alt væsentligt er parallel med aktuatorens (24) længderetning,

hvor gribeanordningerne (22, 23) er anbragt, således at den første gribeanordnings (22) gribehandling i alt væsentligt er mindst delvist uafhængig af den anden gribeanordnings (23) gribehandling.

2. Gribeværktøj (1) ifølge krav 1, hvor gribeaktuatoren (24) er anbragt mellem den første gribeanordning (22) og den anden gribeanordning (23).

3. Gribeværktøj (1) ifølge krav 1 eller krav 2, hvor gribeaktuatoren (24) er en elektrisk lineær aktuator, der omfatter en motordrevet spindel.

4. Gribeværktøj (1) ifølge et hvilket som helst af de foregående krav, hvor den første gribeanordning (22) og den anden gribeanordning (23) omfatter mindst to modstående gribearme (19).

5. Gribeværktøj (1) ifølge krav 4, hvor de to modstående gribearme (19) er symmetrisk anbragt i forhold til en symmetriakse (25), der i alt væsentligt er parallel med en central længdeakse af det aflange legeme (12), når det er fikseret i gribeværktøjet (1).

6. Gribeværktøj (1) ifølge et hvilket som helst af de foregående krav, hvor gribearmene (19) er forbundet med gribeaktuatoren (24) ved hjælp af ét eller flere kugleled (26).

7. Gribeværktøj (1) ifølge et hvilket som helst af de foregående krav, hvor gribeværktøjet (1) omfatter mindst ét justerbart bagstop (27).

5 8. Gribeværktøj (1) ifølge et hvilket som helst af de foregående krav, hvor gribeværktøjet (1) omfatter en forbindelsesanordning (20) til montering på gravemaskinearmen (5) på en motoriseret gravemaskine (2).

9. Gribeværktøj (1) ifølge et hvilket som helst af de foregående krav, hvor gribearmene (19) er individuelt monteret i individuelle vippeled (29).

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10. Gribeværktøj (1) ifølge et hvilket som helst af de foregående krav, hvor gribeaktuatoren (24) omfatter en aktuatorstang (33), der er anbragt til at glide ind og ud af et aktuatorhus (34), og hvor den første gribeanordnings (22) mindst ene gribearm (19) er forbundet med aktuatorstangen (33), og hvor den anden gribeanordnings (23) mindst ene gribearm (19) er
15 forbundet med aktuatorhuset (34).

DRAWINGS

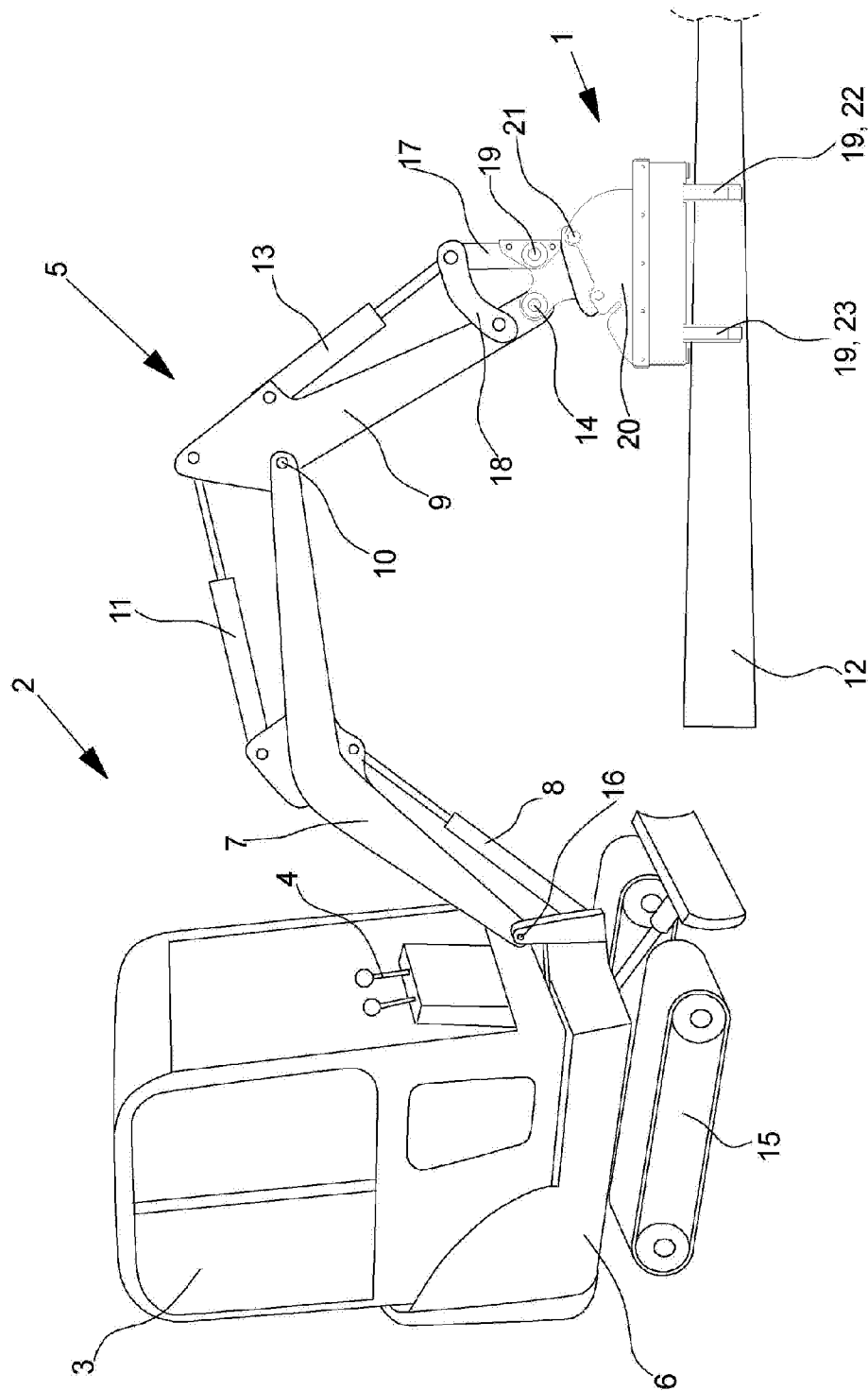


Fig. 1

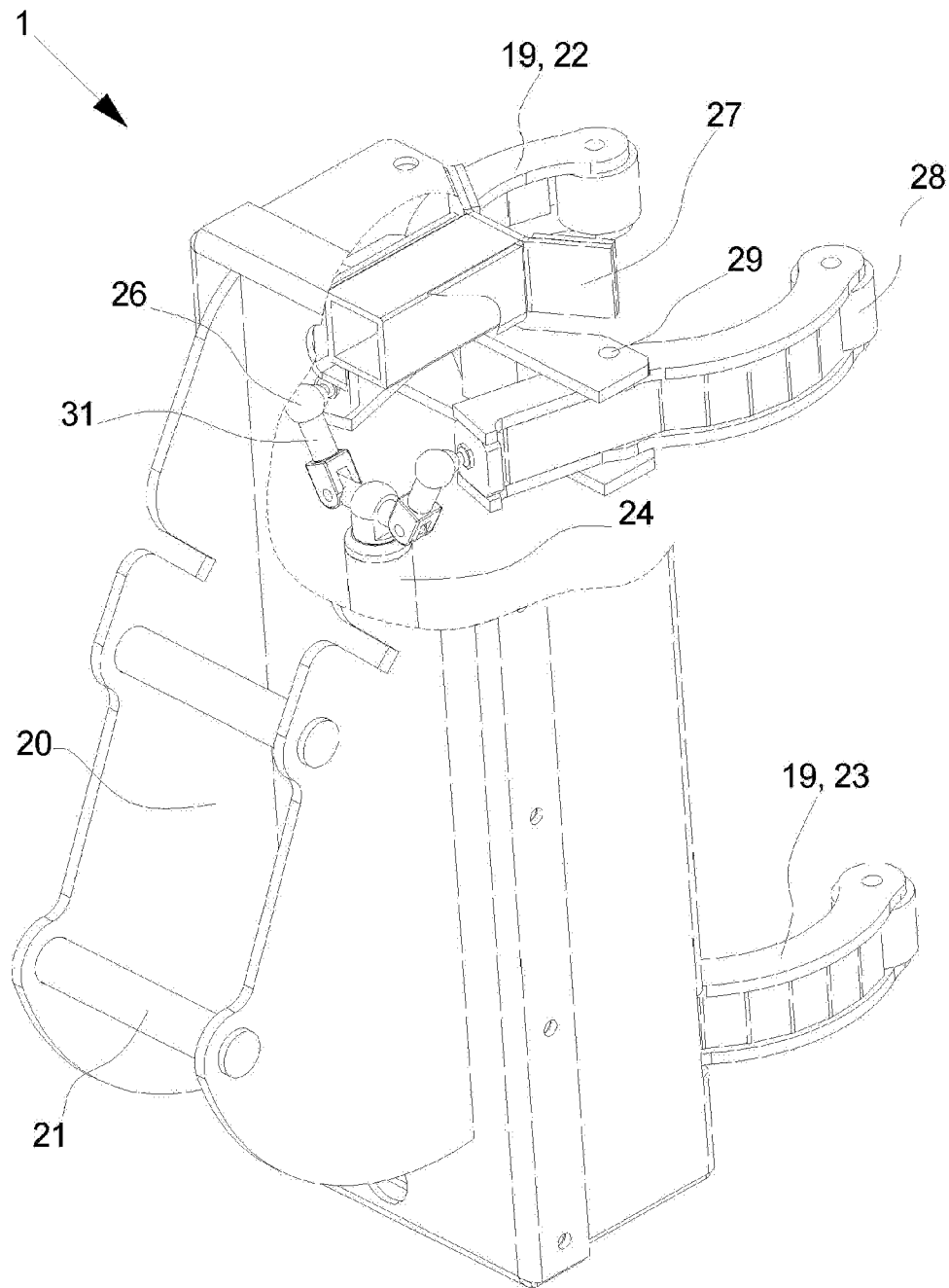
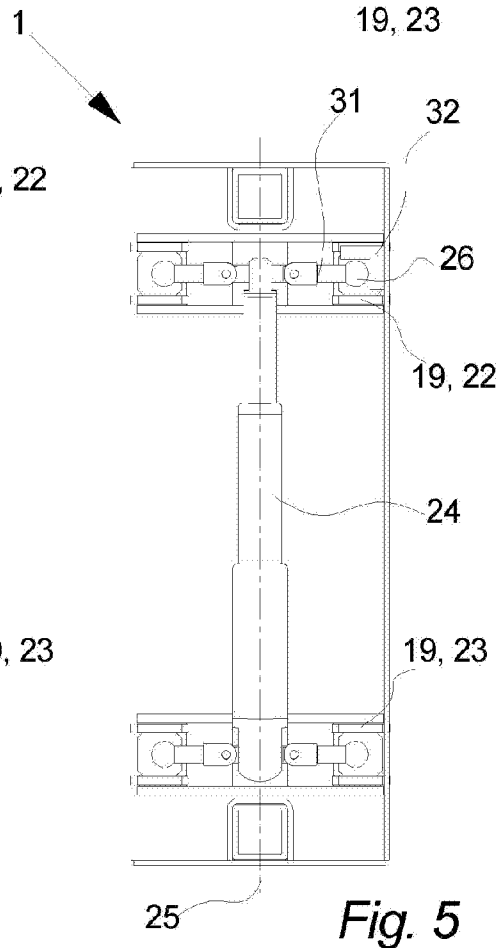
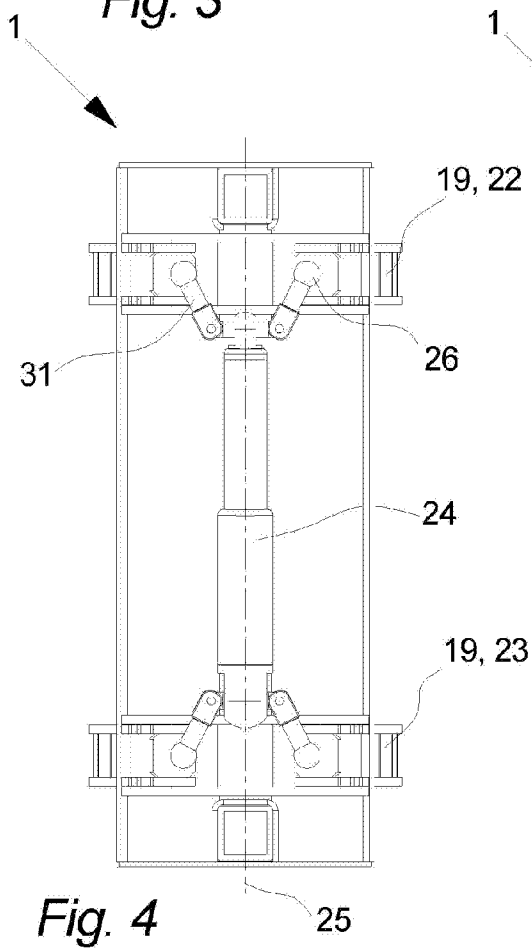
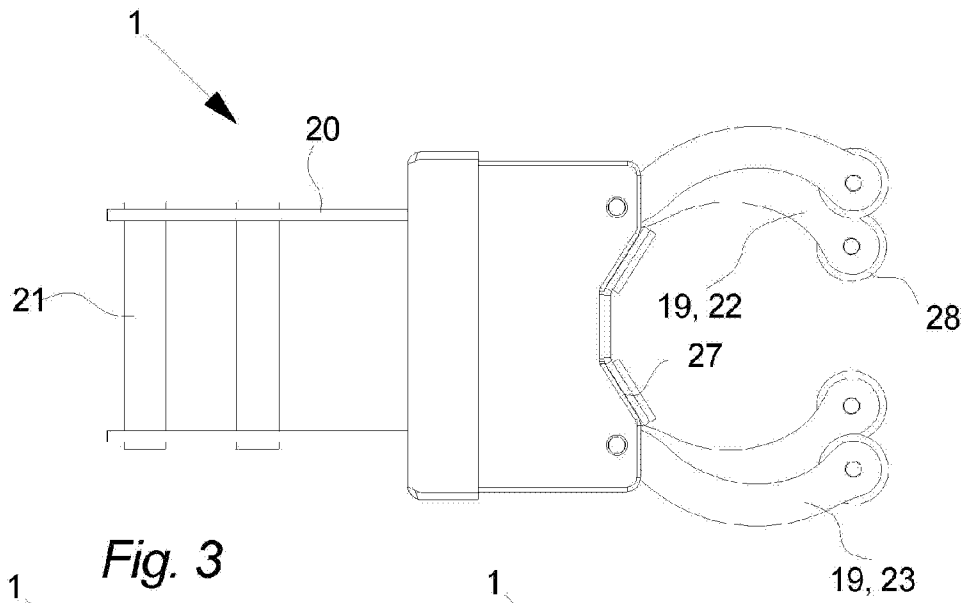


Fig. 2



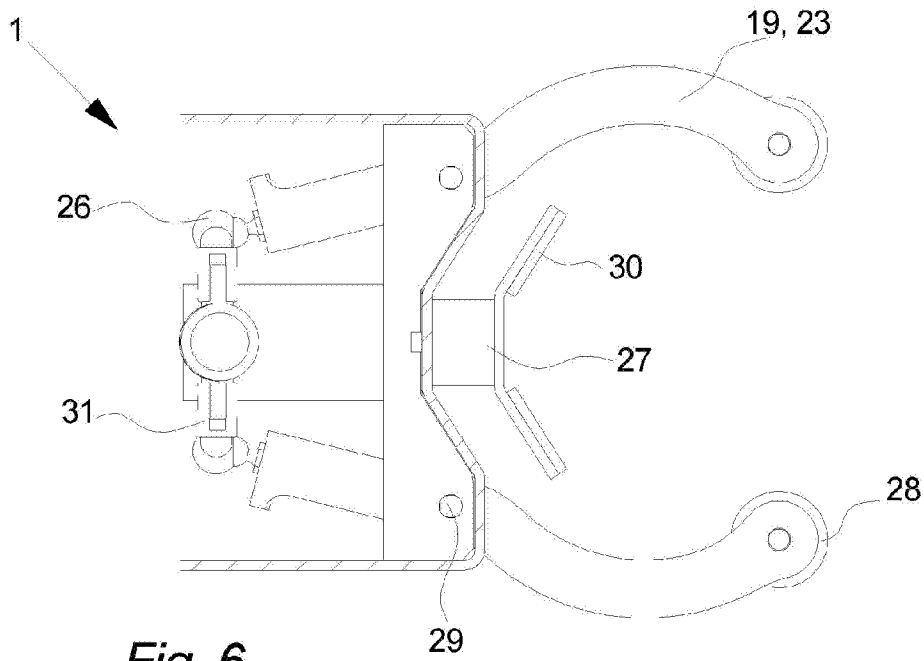


Fig. 6

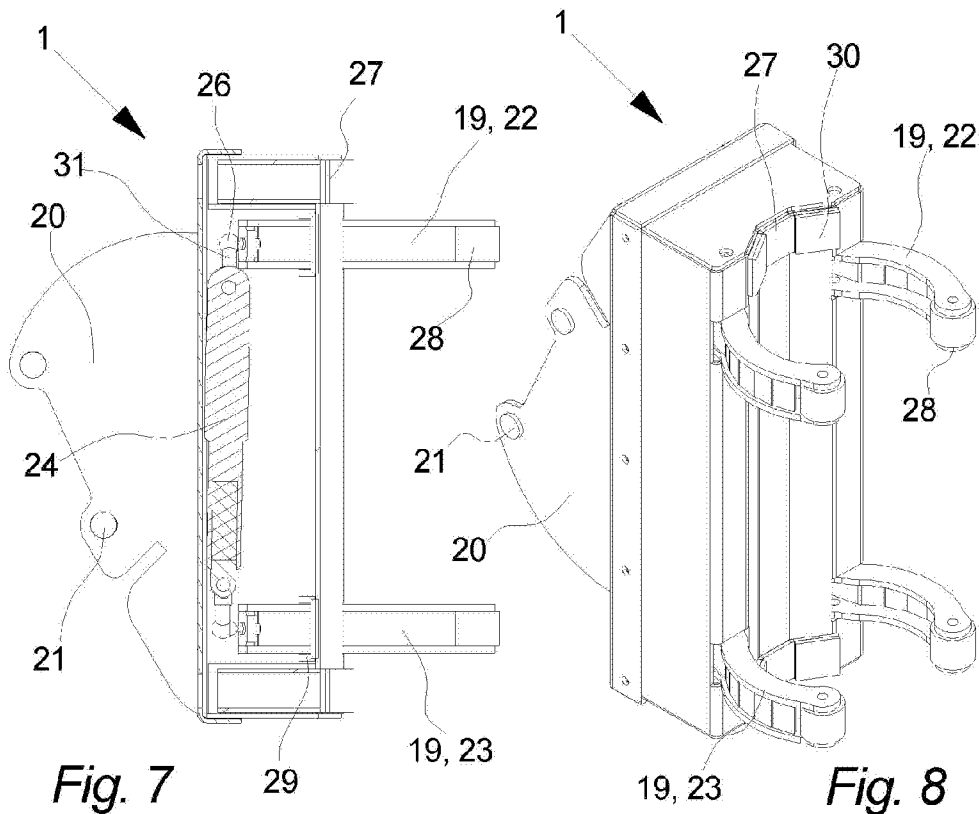


Fig. 7

Fig. 8