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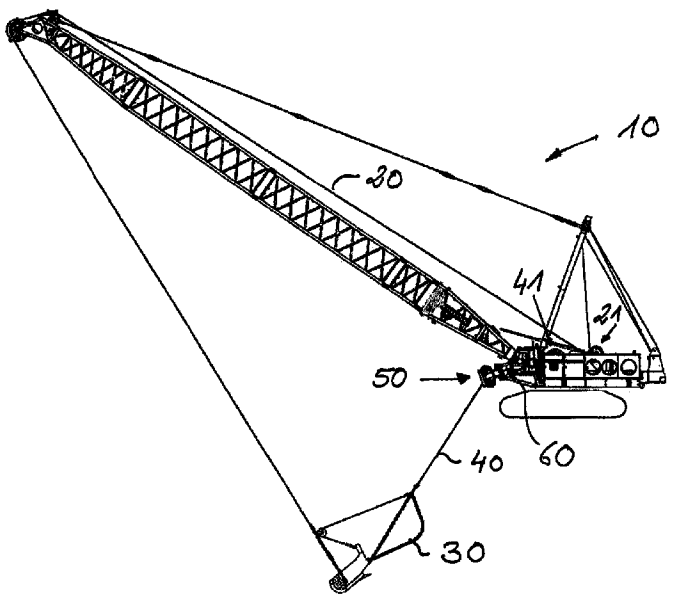
(54) Title: WORK MACHINE FOR DRAGLINE BUCKET OPERATION



(57) Abrégé/Abstract:
The invention relates to a work machine, in particular to a cable-operated excavator, for dragline bucket operation, comprising a dragline bucket taken up by a hoist rope, wherein the attachment can be retracted by means of at least one dragline for carrying out the dragging movement and a dragline guide for guiding the dragline is arranged at the work machine, wherein the dragline guide is designed as movable, in particular as linearly movable.

Abstract

The invention relates to a work machine, in particular to a cable-operated excavator, for dragline bucket operation, comprising a dragline bucket taken up by a hoist rope, wherein the attachment can be retracted by means of at least one dragline for carrying out the dragging movement and a dragline guide for guiding the dragline is arranged at the work machine, wherein the dragline guide is designed as movable, in particular as linearly movable.

Work Machine for Dragline Bucket Operation

The invention relates to a work machine, in particular to a cable-operated excavator, for dragline bucket operation, comprising a dragline bucket taken up by a hoist rope, wherein the bucket can be retracted by means of at least one dragline for carrying out the dragging movement and a dragline guide for guiding the dragline at the work machine.

The invention relates to the dragline bucket attachment of a work machine, in particular of a cable-operated excavator. The term "scraping" or "scraper attachment" is also used in the technical literature. Work machines or cable-operated excavators are equipped for this purpose with a so-called dragline bucket or also a dragline digger as the piece of working equipment. The bucket, which is trough-shaped as a rule, is connected to the machine by two ropes, namely the hoist rope and the dragline. The dragline bucket is cast as far away from the machine as possible via the hoist rope. The dragline runs directly from the superstructure of the work machine or of the excavator to the fastening point at the dragline bucket, with a dragging movement of the bucket along the earth's surface being achieved by retracting the dragline and the superficial earth material being taken up through the bucket opening.

The dragline bucket can subsequently be raised by the hoist rope with a taut dragline and can be emptied at the emptying location by slackening the dragline.

In previous machine designs for dragline bucket operation, standard winches having special grooves were used for the dragline. The dragline is in this respect guided on the dragline winch via a dragline guide fixedly installed at the excavator superstructure.

To be able to observe the maximum permitted angle of departure of the dragline from the winch, the dragline guide must have a minimum spacing from the winch.

With large winches, this means that the dragline guide has to be projected by a large amount in front of the machine.

It is the object of the present invention to disclose a possibility for an improved dragline guide which allows operation with lower wear as well as a higher flexibility with respect to the dragline winch used.

This object is achieved by a work machine, in particular a cable-operated excavator, in accordance with the features as described herein. Advantageous embodiments of the work machine or of the cable-operated excavator are described herein.

In accordance with the invention, a work machine, in particular a hydraulic cable-operated excavator, for dragline bucket operation is proposed, wherein the work machine has a dragline bucket attachment taken up by the hoist rope. In addition, the work machine comprises a dragline which can be actuated and which is fastened at the end side to the dragline bucket attachment. A dragging movement of the dragline bucket attachment can be carried out by retracting the dragline. The dragline in particular runs from the superstructure of the work machine or of the cable-operated excavator to the dragline bucket attachment, while the hoist rope is guided via the boom tip of the cable-operated excavator to the dragline bucket attachment.

In accordance with the invention, a dragline guide for guiding the dragline in the region of the body of the work machine or of the excavator body is provided, in particular in the region of the excavator superstructure, said dragline guide being designed as movable, in particular as linearly movable, so that the guide direction of the dragline guide is adjustable. The dragline guide is in particular designed as linearly movable relative to the work machine. The dragline guide serves the regulation of the deflection angle of the dragline on a dragline winch. The deflection angle of the dragline on the dragline winch can be varied by the linearly movable arrangement of the dragline guide at the work machine or at the cable-operated excavator; the deflection angle can in particular be kept as small as possible. The

Date Reçue/Date Received 2021-01-28

wear of the dragline and/or of the dragline winch can be reduced by the minimization of the deflection angle. In addition, the present invention allows a higher flexibility in the selection of a suitable winch shape or winch type as well as with respect to the positioning of the dragline winch at the cable-operated excavator.

A dragline winch having a Lebus™ grooving is particularly preferably used which allows a multilayer winding of the dragline for dragline bucket operation.

In an advantageous embodiment, the dragline guide is movable or shiftable transversely to the guide direction, i.e. transversely to the rope extent of the dragline, that is in the horizontal direction. The lateral guide of the dragline can thereby be simply regulated to keep the deflection angle of the dragline in a tolerable range with respect to the dragline winch.

It is particularly advantageous if one or more drive means are arranged at or in the region of the dragline guide to allow an automatic linear movement or an automatic shifting of the dragline guide. The arrangement of one or more drive means moreover allows an automated control and/or regulation of the dragline guide during dragline bucket operation.

Hydraulically or electrically actuable actuators or control adjustment cylinders can be considered as drive means. However, any type of drive for the automatic adjustment of the dragline guide is conceivable for the implementation of the idea in accordance with the invention as long as the required forces for carrying out the adjustment movement and/or for maintaining the position of the dragline guide can be applied.

In accordance with a further advantageous embodiment of the invention, control means are provided for controlling the one or more drive means. The automated control and/or regulation of the adjustment movement of the dragline guide during

dragline bucket operation is achieved via the control means. The adjustment movement of the dragline guide is preferably controlled or regulated in dependence on the detected rope deflection angle of the dragline with respect to the dragline winch. The rope deflection angle can, for example, be detected by a suitable sensor system, wherein the sensor system is in indirect or indirect communication with the control means for the measured value transfer.

The one or more control means preferably comprise control logics which carry out a control of the one or more drive means so that a winding up of the dragline takes place at a deflection angle lying in the tolerance range. The control means should in particular minimize the oblique pull of the dragline on the dragline winch as much as possible.

In an advantageous embodiment, the dragline guide comprises at least one upper and at least one lower rope pulley. The axes of rotation of the rope pulleys lie in parallel with one another. The at least two rope pulleys are advantageously arranged above one another; the dragline runs through the gap formed between the two rope pulleys. In addition to the arrangement of the pulley head of the dragline guide at the work machine which is linearly movable in accordance with the invention, it can moreover be arranged pivotable with respect to the work machine, in particular over a pivot angle of 360°. The rope pulleys have horizontal axes of rotation in the starting position.

The dragline guide additionally or alternatively comprises at least two roller bodies which are disposed opposite one another and are arranged in parallel with one another. The roller body can be supported or arranged rotatably or fixedly at the dragline guide. Ideally, the at least two oppositely disposed roller bodies are arranged at the front rope inlet region of the dragline guide. The lateral deflection of the dragline is prevented or limited with the aid of the roller bodies which are perpendicular in the starting position of the dragline guide. The axes of rotation of the roller bodies extend perpendicular to the axes of rotation of the rope pulleys. In

the preferred embodiment, the dragline runs between the formed gap of the oppositely disposed roller bodies to the subsequently arranged rope pulleys.

In addition to the work machine or to the cable-operated excavator, the present invention relates to a dragline guide for a work machine or cable-operated excavator in accordance with the present invention or with an advantageous embodiment of the present invention. The dragline guide accordingly has the same advantages and properties as the work machine in accordance with the invention, so that a repeat description will be dispensed with at this point.

In a preferred embodiment, the dragline guide is designed as releasably connectable to the work machine or to the cable-operated excavator, in particular to the superstructure of the cable-operated excavator. An arrangement at the pivotal connection piece of the superstructure is conceivable.

In accordance with a further preferred development of the invention, the maximum rope angle of the dragline on the winch can be ensured by the correct positioning of the adjustment device. For this purpose, a direction-dependent movement of the winch can be recognized via a measuring device on the winch. A control computer can now calculate the current rope departure position above the winch with the aid of the known geometrical data of the winch. The adjustment device of the dragline guide can thus be set to the correct position. The adjustment device is positioned such that the deflection angle of the rope on the winch amounts to zero degrees where possible or such that the maximum permitted deflection angle is not exceeded in any case. The current position of the adjustment device can be measured back via a further measuring device and can optionally be corrected.

Date Reçue/Date Received 2021-01-28

According to one aspect of the invention, there is provided a work machine for dragline bucket operation, comprising a dragline bucket taken up by a hoist rope, wherein the bucket is retractable by at least one dragline for carrying out a dragging movement and a dragline guide comprising a plurality of pulleys and roller bodies for guiding the dragline is arranged at the work machine,

wherein the dragline guide is linearly movable in a horizontal direction, transverse to a dragline pulling direction,

wherein an electronic controller is provided for controlling one or more drive elements, with the electronic controller taking account of a deflection angle of the dragline on a dragline winch; and

wherein a roller head of the dragline guide comprising the plurality of pulleys and roller bodies is pivotable about a pivot angle of 360° relative to a tubular receiver.

According to another aspect of the invention, there is provided a method for a work machine carrying out dragline bucket operation, the work machine including a dragline bucket taken up by a hoist rope, comprising:

retracting the bucket by a dragline for carrying out a dragging movement;

guiding the dragline via a dragline guide, wherein the dragline guide comprises a roller head comprising pulleys, rollers, and side plates; and

moving the dragline guide linearly in a horizontal direction that is transverse to a dragline pulling direction, where movement of the dragline guide is controlled by an electronic controller that takes into account an angle of the dragline with respect to a dragline winch;

wherein the electronic controller controls hydraulically releasable adjustment cylinders for adjustment of the dragline guide; and

wherein the hydraulically releasable adjustment cylinders are connected to a pivotal connection plate and a base plate for horizontal displacement of the dragline guide relative to the pivotal connection plate.

Further advantages and properties of the invention will be explained in more detail with reference to an embodiment shown in the drawings. There are shown:

Date Reçue/Date Received 2021-01-28

Figure 1: a side view of the cable-operated excavator in accordance with the invention during dragline bucket operation;

Date Reçue/Date Received 2021-01-28

Figure 2: a sectional representation through the dragline guide in accordance with the invention;

Figure 3: a perspective detailed view of the dragline guide in accordance with the invention;

Figure 4: two detailed views of the drive mechanism of the dragline guide in accordance with the invention; and

Figure 5: a schematic representation of a dragline guide.

Figure 1 shows a side view of the cable-operated excavator in accordance with the invention for dragline bucket operation. The invention will be explained in the following with reference to a cable-operated excavator. The dragline guide used can, however, be used generally as a piece of working equipment for any work machine as long as the required conditions of the work machine, for example a hoist rope, are present.

The cable-operated excavator 10 shown is configured as a crawler excavator. The hoist rope 20 is guided, starting from the superstructure of the crawler excavator 10, via the lattice mast boom and the roller head arranged at the tip, up to the dragline bucket 30. The dragline bucket 30 can be raised via the hoist rope 20 and can be cast with a distance from the superstructure which is as large as possible. The actuation of the hoist rope 20 takes place by means of the hoist rope winch 21.

The dragline bucket 30 is moreover connected to the dragline 40 of the cable-operated excavator 10, said dragline being able to be wound up and unwound by a dragline winch 41 arranged at the superstructure. The retraction movement of the dragline 40 produces a dragging movement of the dragline bucket 30. The dragline bucket 30 shown is shaped in the form of a trough and drags along its contact surface with the bucket opening to the front, over the earth's surface, when the

dragline 40 is retracted so that the inner space of the bucket 30 is filled with the earth material to be taken up.

A dragline guide 50 by which the dragline 40 is guided, starting from the bucket 30, up to the dragline winch 41, is arranged at the pivotal connection piece 60 of the excavator superstructure.

A sectional view of the dragline guide 50 in accordance with the invention along a vertical sectional plane can be seen from Figure 2. The two rope guide pulleys 52 can be recognized which are arranged above one another and which form a gap in the adjacent region through which the dragline 40 is guided. The axes of rotation of the two rope pulleys 52 are arranged in parallel with one another and both lie in the horizontal plane. The direction of rotation of the rope pulleys is in the opposite direction.

Two oppositely disposed rollers 53 are provided at the inlet of the dragline guide and bound the lateral deflection angle of the dragline 40 in the horizontal plane. The rollers 53 have vertical axes of rotation which are arranged in parallel with one another, with only one of the two rollers 53 being able to be recognized in Figure 2 due to the sectional representation.

The total dragline guide is fastened to the pivotal connection piece 60 of the superstructure. The dragline winch 41 onto which the dragline 40 is wound up can be recognized at the right Figure margin. The dragline winch 41 has a so-called Lebus™ grooving which allows a multiple winding of the dragline 40 in dragline operation.

The arrangement of the dragline guide 50, which is movable or adjustable with respect to the cable-operated excavator or to the pivotal connection piece 60, can be explained with reference to the perspective representation of Figure 3. The rope pulleys 52 of the dragline guide 50 are received between the two side plates 54 at

Date Reçue/Date Received 2021-01-28

whose frontmost point a respective one of the above-described rollers 53 is rotatably clamped.

Both side plates 54 are designed as tapered on the side facing the pivotal connection piece 60 to be taken up by the tubular receiver 56 of the base plate 55. The base plate 55 of the dragline guide 50 is moreover supported relatively displaceable to the pivotal connection plate 57 via two guide rails 58 of the pivotal connection plate. The base plate 55 can be displaced in the horizontal direction with respect to the pivotal connection piece 60 by means of the guide rails 58. The pivotal connection plate 57 is releasably bolted to the pivotal connection piece via the bolt points 61 so that, on regular cable-operated excavator operation, the dragline guide 50 could be removed or an existing cable-operated excavator could be simply retrofitted with a suitable pivotal connection piece.

The displacement is effected by two hydraulically releasable adjustment cylinders 80 which are connected to the pivotal connection plate 60 at the cylinder side and to the base plate at the piston side. Both cylinders 80 are in parallel with one respective guide rail 58. In the center position of the piston, the guide axis of the dragline guide 50 is flush with the central axis of the pivotal connection piece 60. The dragline guide 50 can be shifted to the right or to the left in the horizontal direction with respect to the central axis of the pivotal connection piece 60 by a moving out or moving in movement.

In addition, the dragline guide 50 can be pivoted with respect to the cable-operated excavator 10 or the mount 56. The roller head of the dragline guide 50 comprising side plates 54, pulleys 52 and rollers 53 can be pivoted about a pivot angle of 360°, for example.

A further detailed view of the base plate 55 and of the receiver plate 57 can be seen from the two representations of Figure 4. Both representations show the combination of base plate and pivotal connection plate 55, 57 without the received side plates 54, including the pulley arrangement 52, 53 of the dragline guide 50.

The two hydraulic adjustment cylinders 80 can be recognized which are inwardly fastened next to the guide plate 58 and are bolted to the base plate 55 at the piston side and to the pivotal connection plate 60 at the cylinder side.

The actuation of the hydraulic adjustment cylinders 80 takes place by the central control unit of the cable-operated excavator. The shift movement of the dragline guide 50 is in this respect controlled or regulated such that a minimal deflection angle of the wound up dragline is maintained with respect to the dragline winch 41. The wear of the dragline 40 and of the dragline winch 41 can thereby be reduced. In addition, the movable design of the dragline guide 50 allows the use of a dragline winch 41 having Lebus™ grooving, whereby a multilayer winding is also possible for the dragline winch 41.

A control behavior for controlling the dragline guide 50 can be described with reference to the schematic representation in Figure 5. The maximum rope angle of the dragline 40 on the dragline winch 41 can be ensured by the correct positioning of the adjustment device 100 of the dragline guide 50. For this purpose, a direction-dependent movement of the dragline winch 41 can be recognized via a measuring device 110 on the dragline winch 41. A control computer 120 can now calculate the current rope departure position from the dragline winch 41 with the aid of the known geometrical data of the dragline winch 41. The adjustment device 100 of the dragline guide 50 can thus be set to the correct position. The adjustment device 100 is positioned such that the deflection angle of the dragline 40 on the dragline winch 41 amounts to zero degrees where possible or such that the maximum permitted deflection angle is not exceeded in any case. The current position of the adjustment device 100 can be measured back via a further measuring device 130 and can optionally be corrected.

The winch movement has to be detected so that the control computer 120 can calculate the current rope departure position. The speed of the dragline winch 41 and the direction of rotation of the dragline winch 41 are detected by the measuring device. An incremental encoder, not shown in any more detail here, or a speed of

rotation measurement via proximity switches can be used as the measuring device, for example.

A path measurement on the adjustment device 100 is used for a back measurement of the current position of the adjustment device 100. Said adjustment device delivers the current position to the control computer. An integrated cylinder path measurement can, for example, be used on an adjustment via a cylinder 80.

The dragline guide in accordance with the invention can be configured substantially shorter. Dragline winches 41 having a special grooving can also advantageously be used. The use of dragline winches 41 having a special grooving also allows the use of the dragline winch 41 with the dragline guide 50 at higher rope positions.

Claims:

1. A work machine for dragline bucket operation, comprising a dragline bucket taken up by a hoist rope, wherein the bucket is retractable by at least one dragline for carrying out a dragging movement and a dragline guide comprising a plurality of pulleys and roller bodies for guiding the dragline is arranged at the work machine,

wherein the dragline guide is linearly movable in a horizontal direction, transverse to a dragline pulling direction,

wherein an electronic controller is provided for controlling one or more drive elements, with the electronic controller taking account of a deflection angle of the dragline on a dragline winch; and

wherein a roller head of the dragline guide comprising the plurality of pulleys and roller bodies is pivotable about a pivot angle of 360° relative to a tubular receiver.

2. The work machine in accordance with claim 1, wherein the work machine is a cable-operated excavator, and wherein the dragline guide is only linearly movable in the horizontal direction.

3. The work machine in accordance with claim 1, wherein the dragline is retracted by at least one dragline winch having Lebus™ grooving.

4. The work machine in accordance with claim 1, wherein the one or more drive elements are provided for generating the linear movement of the dragline guide in the horizontal direction.

5. The work machine in accordance with claim 4, wherein the one or more drive elements comprise a hydraulic cylinder.

6. The work machine in accordance with claim 1, wherein the dragline guide is automatically moved via the electronic controller.

Date Reçue/Date Received 2021-01-28

7. The work machine in accordance with claim 5, wherein the electronic controller is configured such that an oblique pull of the dragline on the dragline winch is minimized by control of the one or more drive elements.

8. The work machine in accordance with claim 1, wherein the dragline guide comprises at least one upper rope pulley and at least one lower rope pulley each having a horizontal axis of rotation.

9. The work machine in accordance with claim 1, wherein at least two oppositely disposed rollers are supported rotatably at a front rope inlet region of the dragline guide with a vertical axis of rotation, the vertical axis of rotation perpendicular to the horizontal direction.

10. The work machine in accordance with claim 1, wherein the dragline guide is releasably connectable to the work machine.

11. The work machine in accordance with claim 1, wherein the linear movement of the dragline guide in the horizontal direction is perpendicular to the dragline pulling direction.

12. The work machine in accordance with claim 1, wherein the dragline guide is fastened to a pivotal connection piece of a superstructure of the work machine, wherein the linear movement of the dragline guide in the horizontal direction is relative to a central axis of the pivotal connection piece, and wherein a base plate of the dragline guide is displaceable in the horizontal direction with respect to the pivotal connection piece by means of guide rails.

13. The work machine in accordance with claim 1, wherein the linear movement of the dragline guide in the horizontal direction is transverse to a guide direction of the dragline guide.

14. A method for a work machine carrying out dragline bucket operation, the work machine including a dragline bucket taken up by a hoist rope, comprising:

Date Reçue/Date Received 2021-01-28

retracting the bucket by a dragline for carrying out a dragging movement;

guiding the dragline via a dragline guide, wherein the dragline guide comprises a roller head comprising pulleys, rollers, and side plates; and

moving the dragline guide linearly in a horizontal direction that is transverse to a dragline pulling direction, where movement of the dragline guide is controlled by an electronic controller that takes into account an angle of the dragline with respect to a dragline winch;

wherein the electronic controller controls hydraulically releasable adjustment cylinders for adjustment of the dragline guide; and

wherein the hydraulically releasable adjustment cylinders are connected to a pivotal connection plate and a base plate for horizontal displacement of the dragline guide relative to the pivotal connection plate.

15. The method of claim 14, wherein the work machine is a cable-operated excavator, wherein the dragline guide is only linearly movable in the horizontal direction, and wherein the dragline is retracted by at least one dragline winch having Lebus™ grooving.

16. The method of claim 14, wherein the linear movement of the dragline guide is automated, and where the linear movement of the dragline guide is generated via a drive element controlled by the electronic controller.

17. The method of claim 16, further comprising controlling the drive element in response to the angle of the dragline with respect to the dragline winch.

18. The method of claim 17, further comprising reducing, via the electronic controller, an oblique pull of the dragline on the dragline winch by adjusting the drive element.

19. The method of claim 14, wherein the linear movement of the dragline guide in the horizontal direction is perpendicular to the dragline pulling direction.

Date Reçue/Date Received 2021-01-28

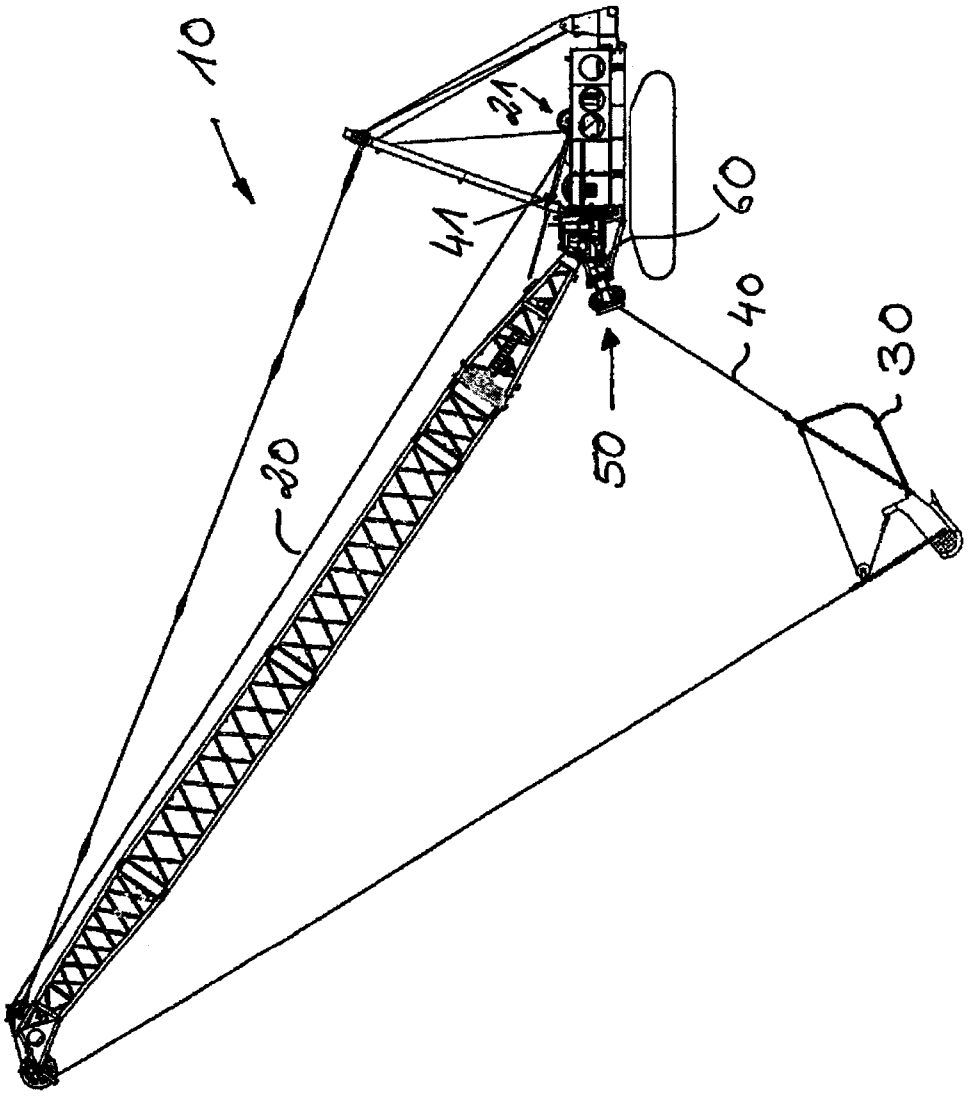


Fig. 1

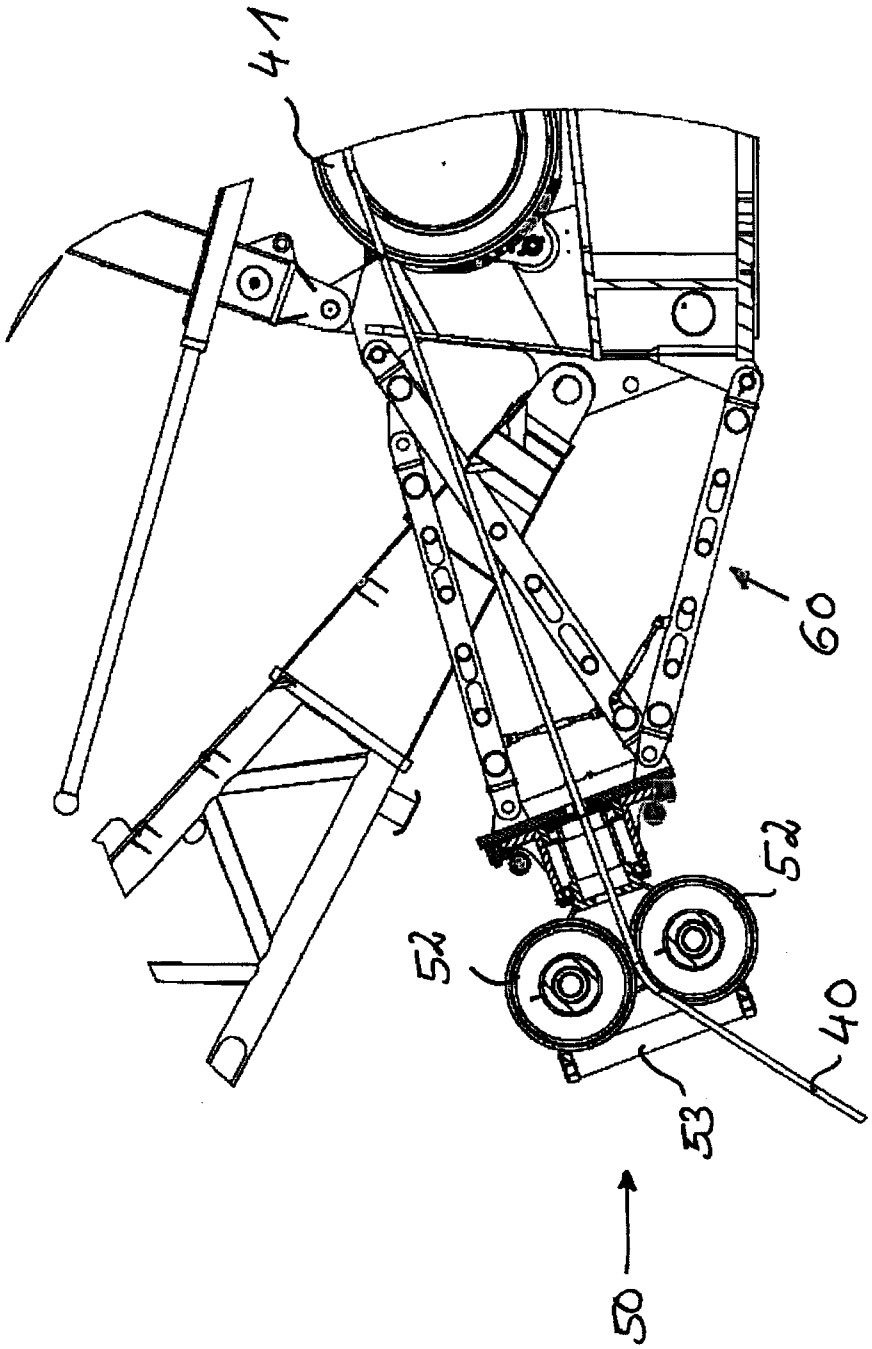


Fig. 2

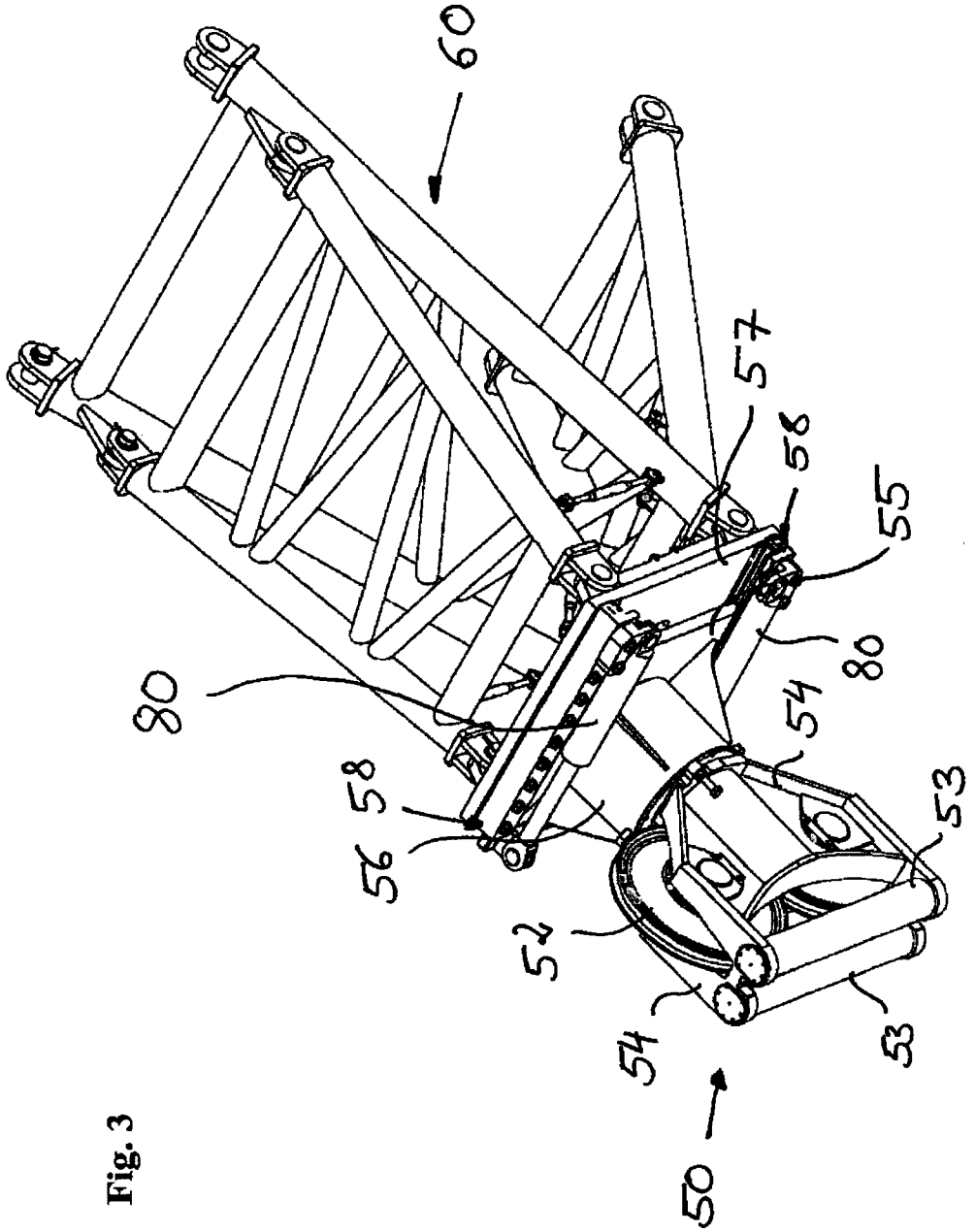


Fig. 3

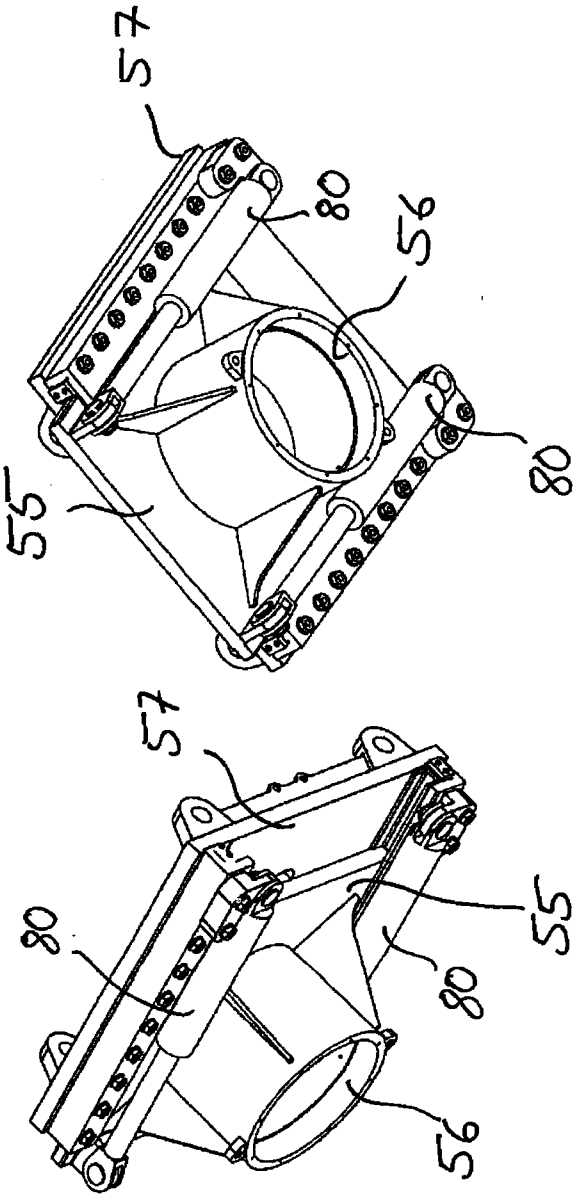
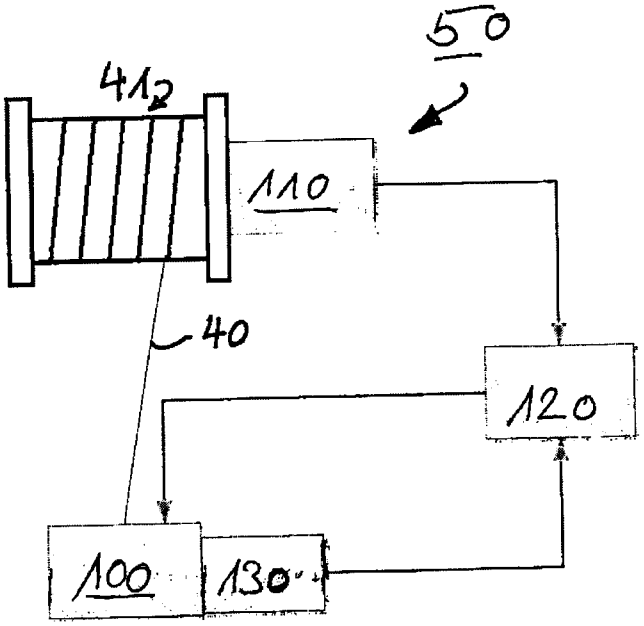
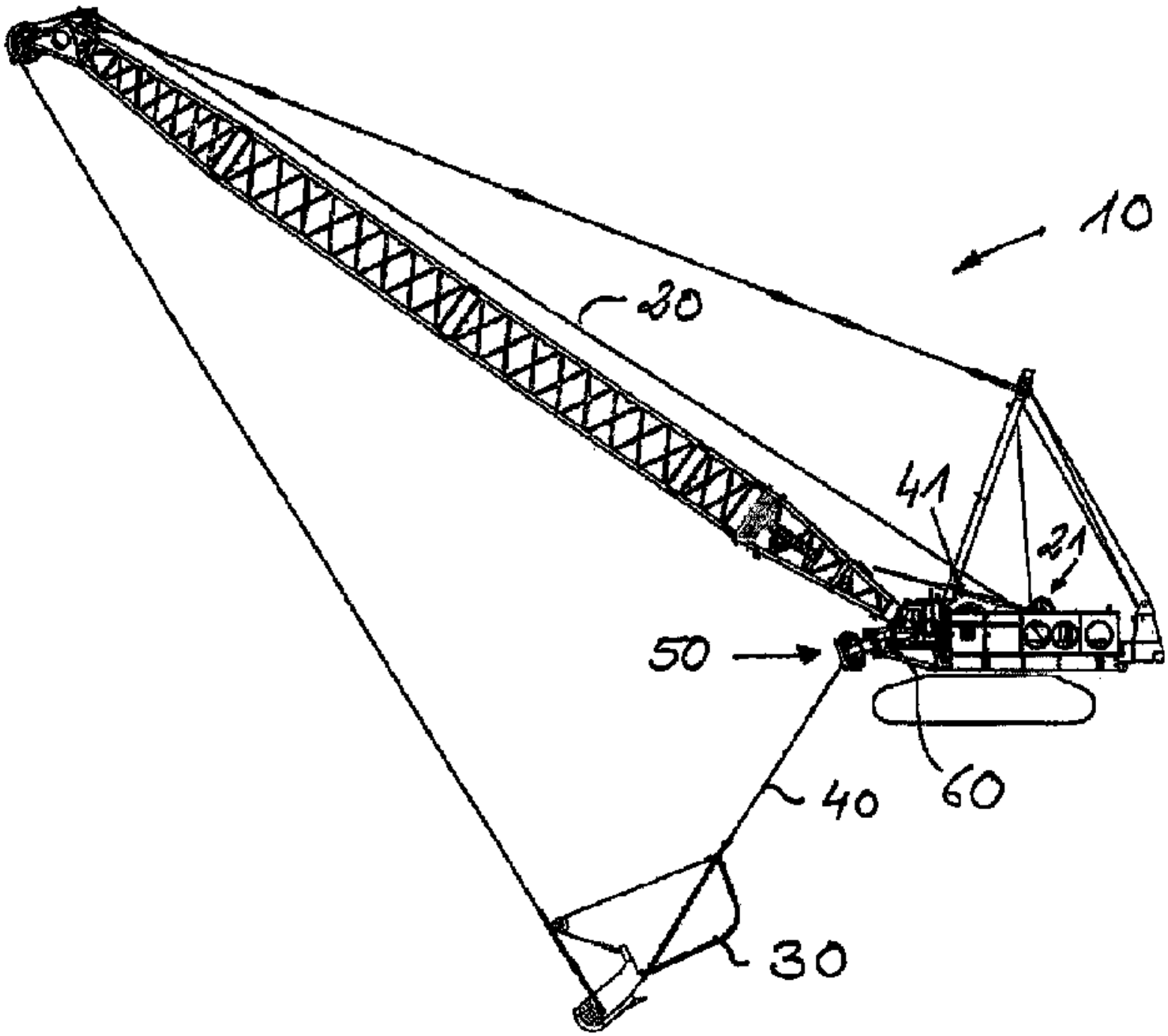


Fig. 4

Fig. 5

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