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(54) **AN ELECTRO-HYDRAULIC WINDER FOR WINDING A WIRE ROPE AND A WINCH WITH SAID WINDER**

(57) The present invention belongs to the field of constructional details of forestry winches, which are related to winding of a rope onto a drum. The present invention relates to an electro-hydraulic winder (5C) for winding a wire rope comprising:

- a holder (1, 5) of the winder (5C),

- a holder (1, 5) with redirecting cylinders (5A, 5), which are arranged to lead the rope towards the drum, wherein said holder (1, 5) of redirecting cylinders (5A, 5) is movably installed on the housing of the winder (5C) or is coupled to the said housing of the winder (5C) in a movable manner,

- a two-way hydraulic cylinder (5C), which is on one side mounted onto the holder (1, 5) with redirecting cylinders (5A, 5) and on the opposite side to the holder (1, 5) of the winder (5C),

- a controller, which is preferably controller of the winch, wherein the controller is connected to:

o an inductive sensor (2) mounted on the drum for sensing rotation speed of the drum, preferably by sensing grooves on the drum,

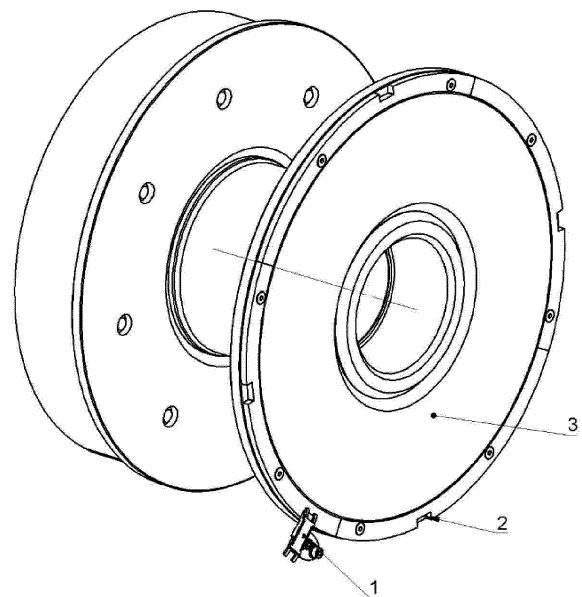


Figure 1

Description

Field of the invention

[0001] The present invention belongs to the field of forestry winches, more precisely to the field of constructional details of forestry winches, which are related to winding of a rope onto a drum. The present invention relates to an electro-hydraulic winder for winding a wire rope and a winch with said winder.

Background of the invention and the technical problem

[0002] During winch operation a pulling rope should be guided and evenly wound on a drum in layers. Construction of forestry winches is faced with requirements for compact design, which consequently leads to a short distance between a directing pulley for guiding the rope and the drum, which due to the too large angle of the rope with regards to the drum prevents reliable automatic winding of the rope on the drum. By increasing the width of the drum, which is needed to increase the capacity of the wire rope on the drum, the quality of winding is further reduced, i.e., the rope is unevenly wound.

[0003] The technical problem, which is solved by the present invention, is construction of a system that will enable even winding of the wire or the pulling rope on the drum. Mechanical assemblies that track the winding action and ensure approximately even winding are known, however, also these assemblies face deviations, as during tilting of the winch the weight of the winder affects the quality of rope winding. In addition, the disadvantage of mechanical winders are large dimensions consequently leading to challenging installation or reduced compactness of the construction.

State of the art

[0004] Patent US2662703 describes an automatic mechanism for leading rope during winding, said mechanism comprising mechanical components. This solution differs from the present invention in its design. Patent US2424380 discloses a winch with a guide or a rope winder, wherein the guide is slidably installed on a drive shaft, so as to allow rotation of the drum during rope winding, while the guide travels back and forth in parallel to the drum, thus guiding the rope which is being wound on the drum. This solution prevents entanglement of the rope and prevents clustering of the rope (several layers of rope on one end of the drum, while the other parts of the drum have no or few rope layers). A disadvantage of this solution is that it is not resistant to side loads. The invention differs from the solution described in US2424380 in the mechanical components.

[0005] Document CN101700859 describes a winch with an automatic rope winder, winch comprises a steel wire rope pulley, a rope releaser sliding block and a winch roller which are sequentially connected by a steel wire

rope. The steel wire rope pulley is placed on a disc rope releaser through a positioning shaft; the rope releaser sliding block is arranged on parallel slideways which are parallel vertically, and a rope release jack and a rope release positioning block are sequentially connected and arranged at one end of the rope releaser sliding block; the rope release jack is communicated with an electric hydraulic pump. This winder differs from the present invention in its construction.

[0006] Slovenian patent SI25917 discloses a winder for uniform winding of a wire rope onto a drum, said winder comprising a mechanical assembly of the winder and an electrohydraulic assembly. The mechanical assembly is directly connected to the drum, onto which wire rope is wound, and comprises a cross spindle with a nut and a drive assembly for translation of torque from the drum to the cross spindle. Left and right movement of the nut imitates the path and speed of movement of the wire rope during winding on the drum. A rotational angle sensor is attached to the nut, wherein the sensor is connected to a controller of the winch and measures deviation of the winder with regards to the nut. The controller corrects the pathway of the winder based on the measured deviations (angles) in order to harmonize movement of the nut and a holder for cylinders and consequently the wire rope. The present invention does not have the mechanical assembly, thus having a simpler construction.

Description of the solution to the technical problem

[0007] The essence of the electric-hydraulic winder for uniform winding of the wire rope onto a drum of a winch is in that the winder comprises:

- a holder (housing) of the winder,
- a holder with redirecting cylinders, which are arranged to lead the rope towards the drum, wherein said holder of redirecting cylinders is movably installed on the holder of the winder or is coupled to the said holder of the winder in a movable manner,
- a two-way hydraulic cylinder, which is on one side mounted onto the holder with redirecting cylinders and on the opposite side to the holder of the winder,
- a controller, which is preferably the controller of the winch, wherein the controller is connected to:
 - an inductive sensor or any other suitable sensor, mechanism or a switch mounted on the drum, wherein the said sensor is arranged to sense the rotation speed of the drum, preferably by sensing grooves on the drum,
 - rotational angle sensor installed on the holder of the winder, wherein said sensor is arranged to measure the angle between the holder with redirecting cylinders and the holder of the winder for adjusting the speed and direction of movement of the hydraulic cylinder,
 - a suitable valve, preferably a three-way elec-

trically controlled proportional valve, arranged to control the hydraulic cylinder, which is arranged to move the holder with redirecting cylinders in case the controller sense the need for correction of movement (path) of the holder with redirecting cylinders.

[0008] The drum has attached rings with suitably distributed grooves, preferably evenly (uniformly) or unevenly distributed grooves along the circumference. Alternatively, grooves may be made, cut or milled, directly in the side of the drum. These grooves are counted with the inductive sensor, which is preferably mounted on the housing of the winch in a fixed manner. On the basis of detected frequency of counted grooves, the controller can calculate the rotation speed of the drum and consequently the speed of movement of the wire rope left and/or right with regards to the pipe of the drum (on which the wire rope is wound). Thus, the controller knows the current position of the wire rope on the drum. The direction of drum rotation is known to the controller on the basis of signal caused by the user selecting either activation of pulling or opening of the brake.

[0009] The preferred option for movement of the holder with redirecting cylinders is the hydraulic cylinder, as winches are usually equipped with a hydraulic system and because forces for movement are large. However, it is also possible to achieve movement with a linear electromotor, but this solution is expensive. In addition, a strong electricity source is needed and further optimization of the winder and winch construction would be necessary.

[0010] The preferred embodiment of the winder with the angle sensor and forks on the holder of redirecting cylinders can also be replaced with a linear measuring rod or any other element that is suitable to measure or detect the position of the holder with redirecting cylinders. Instead of the holder with redirecting cylinders a suitable crankshaft mechanism could be used, said crankshaft mechanism being arranged to move the rope as it is wound along the width of the drum.

[0011] In order to allow operation of the winder the controller is arranged to sense:

- speed of drum rotation, preferably by counting the movement of grooves on the drum,
- direction of the rotation of the drum, preferably by sensing activated winding or unwinding of the rope,
- the angle between the holder with redirecting cylinders and the holder of the winder, wherein on the basis of measured values the controller the controller is arranged to perform suitable correction of movement path of the holder with redirecting cylinders via the suitable valve in order to achieve synchronized movement of the redirecting cylinders with regards to the direction and speed of drum rotations, thus ensuring proper winding of the rope. When the controller detects deviation between drum rotation (sen-

sor on the drum) and movement of the holder with redirecting cylinders (angle sensor), the controller closes or opens the electrohydraulic valve, preferably the proportional three-way electrohydraulic valve in order to change the movement speed and direction of the hydraulic cylinder. In case the holder with redirecting valves is lagging behind the path of the rope on the drum, the speed of the holder with redirecting cylinders has to increase. Thus, the controller opens the valve, which increases the speed of oil flow in the cylinder. The valve controls the hydraulic cylinder in any known manner.

[0012] Monitoring of said winding parameters with the controller of the winder according to the invention is continuously performed, even when the winder is operating impeccably, as deviations can occur due to changes in winding conditions, such as speed of drum rotation due to change in motor operation, increase or decrease motor operation, and/or kinematics of the crankshaft mechanism, said exemplary conditions preventing uniform movement. In case synchronization of drum rotation speed and movement speed of the holder with redirecting valves is not performed, the rope is wound on the drum in an uncontrolled manner, i.e., the rope is accumulated to such extent that full-force load can damage and destroy it. The winder according to the invention allows choice of deviations from the ideal angle of 0° by choosing and correcting parameters in the controller. The deviation parameters and opening/closing of the valve, preferably the electrohydraulic proportional valve, may be changed in the controller in order to achieve optimal operation of the whole winder system.

[0013] The winch with the winder according to the invention may be any suitable winch, provided with one or two drums, wherein the winder enables optimal winding of the rope in even layers, thus significantly decreasing the possibility of rope damage. The winder is mounted on the winch in any known manner from the side where the wire rope exits or runs towards the drum.

[0014] The electro-hydraulic winder for winding a wire rope will be described in further detail based on an exemplary embodiments and figures, which show:

- Figure 1 The drum with the inductive sensor, which senses the speed of drum rotation
- Figure 2 The winder of the wire rope installed in a winch with two drums
- Figure 3 Control of the winder for a winch with one drum

[0015] Figure 1 shows a drum B provided with rings B1 with evenly distributed grooves B2 along the circumference of the drum or the grooves are made directly on the side of the drum. Said grooves are counted by the inductive sensor 2, which is preferably mounted on the housing of the winch in a fixed manner.

[0016] Figure 2 depicts the winder for uniform winding

of the wire rope onto the drum according to a possible embodiment for a double-drum winch, said winder comprising:

- a holder 1 of the winder with an outer part 4, 5
- a holder 5 with redirecting cylinders 5a, which are arranged to lead the rope towards the drum, wherein said holder of redirecting cylinders is movably installed on the holder 1 of the winder, 10
- an angle sensor 1a with a sensor installed on the holder 5 of the redirecting cylinders 5a, wherein the said sensor 1a via a handle mounted on the axis of the sensor 1a and movably installed on the holder 5 of redirecting cylinders 5a measures the offset angle of the holder 5 with redirecting cylinder 5a from the middle position of the sensor, 15
- a two-way hydraulic cylinder 5c, which is on one side mounted onto the holder 5 with redirecting cylinders 5a and on the opposite side to the holder 1 of the winder, said cylinder 5c arranged to horizontally move the holder 5 with redirecting valves 5a with a guide 6, 20
- a suitable valve (not shown), preferably a three-way electrically controlled proportional valve, for controlling the said hydraulic cylinder 5c, and 25
- a controller (not shown), which is preferably controller of the winch, for adjusting the speed and direction of movement of the hydraulic cylinder.

[0017] The holder 5 with redirecting cylinders 5a has transverse redirecting cylinders 5a for leading the wire rope as shown in figure 2. 30

[0018] A schematic view of control of the winder according to the invention is shown in figure 3, wherein the controller based on the calculated position of the wire rope on the drum (tracking data from both sensors) opens the electrohydraulic valve and tracks the angle with the angle sensor 1a. The hydraulic oil causes movement of the cylinder of the winder 5c and thus movement of repositioning cylinders 5 into a suitable direction and with a suitable speed, until the angle sensor reaches a neutral position. A minimum angle of the rope running between the cylinders 5a on the holder with redirecting cylinders 5 and the rope on the drum is thus achieved, which consequently leads to proper winding of the wire rope onto the drum. 35 40 45

Claims

1. An electro-hydraulic winder for winding a wire rope for a forestry winch, **characterized in that** the winder comprises:

- a holder of the winder, 50
- a holder with redirecting cylinders arranged to lead the rope towards the drum, wherein said holder of redirecting cylinders is movably in-

stalled on the holder of the winder or is coupled to the said holder of the winder in a movable manner,

- a two-way hydraulic cylinder, which is on one side mounted onto the holder with redirecting cylinders and on the opposite side to the holder of the winder,
- a controller, which is preferably controller of the winch, wherein the controller is connected to:

- an inductive sensor or any other suitable sensor, mechanism or a switch mounted on the drum, wherein said sensor is arranged to sense the rotation speed of the drum, preferably by sensing grooves on the drum,
- rotational angle sensor installed on the holder of the winder, wherein said sensor is arranged to measure the angle between the holder with redirecting cylinders and the holder of the winder for adjusting the speed and direction of movement of the hydraulic cylinder,
- a suitable valve, preferably a three-way electrically controlled proportional valve, arranged to control the hydraulic cylinder, which is arranged to move the holder with redirecting cylinders in case the controller sense the need for correction of movement path of the holder with redirecting cylinders.

2. The electro-hydraulic winder for winding a wire rope for a forestry winch according to claim 1, **characterized in that** the controller senses:

- speed of drum rotation, preferably by counting the movement of grooves on the drum,
- direction of the rotation of the drum, preferably by sensing activated winding or unwinding of the rope,
- the angle between the holder with redirecting cylinders and the holder of the winder,

wherein on the basis of measured values the controller is arranged to perform suitable correction of movement path of the holder with redirecting cylinders via the suitable valve in order to achieve synchronized movement of the redirecting cylinders with regards to the direction and speed of drum rotations, thus ensuring proper winding of the rope. 50

3. The electro-hydraulic winder for winding a wire rope for a forestry winch according to any of the preceding claims, **characterized in that** the controller is arranged to sense mismatch between drum rotation and movement of the holder with redirecting cylinders, wherein based on sensed mismatch the controller is arranged to adjust the hydraulic cylinder with the hydraulic valve, wherein in case the holder with

redirecting cylinder is determined to be lagging behind the rope on the drum, the speed of movement of the redirecting cylinders has to be increased by increasing the speed of oil flow into the cylinder by opening the hydraulic valve.

ceding claims.

4. The electro-hydraulic winder for winding a wire rope for a forestry winch according to any of the preceding claims, **characterized in that** the drum is provided with attached rings with a suitably, preferably evenly, distributed grooves present on the circumference or the grooves are made directly in the side of the drum. 10
5. The electro-hydraulic winder for winding a wire rope for a forestry winch according to the preceding claim, **characterized in that** said inductive sensor counts the said grooves, said inductive sensor being preferably mounted on the housing of the winch in a fixed manner, wherein on the basis of detected movement frequency of grooves the controller calculates drum rotation speed and consequently speed of movement of the wire rope on the drum pipe left or right, respectively. 15 20
6. The electro-hydraulic winder for winding a wire rope for a forestry winch according to any of the preceding claims, **characterized in that** the direction of drum rotation is determined by the controller based on the signal caused by the user due to activation of pulling or by opening the brake. 25 30
7. The electro-hydraulic winder for winding a wire rope for a forestry winch according to any of the preceding claims, **characterized in that** the hydraulic cylinder is replaced with a linear electromotor. 35
8. The electro-hydraulic winder for winding a wire rope for a forestry winch according to any of the preceding claims, **characterized in that** the angle sensor is replaced with a linear measuring rod, a measuring scale or any other element arranged to measure or detect the position of the holder with redirecting cylinders. 40
9. The electro-hydraulic winder for winding a wire rope for a forestry winch according to any of the preceding claims, **characterized in that** the guide of the holder with redirecting cylinders is instead with the preferred linear guide achieved with a crankshaft mechanism. 45 50
10. The electro-hydraulic winder for winding a wire rope for a forestry winch according to any of the preceding claims, **characterized in that** parameters of deviation and opening of the valve can be set and changed on the controller in order to achieve optimal winding of the rope. 55
11. A winch with the winder according to any of the pre-

12. The winch according to the preceding claim, **characterized in that** the winch has one or two drums.

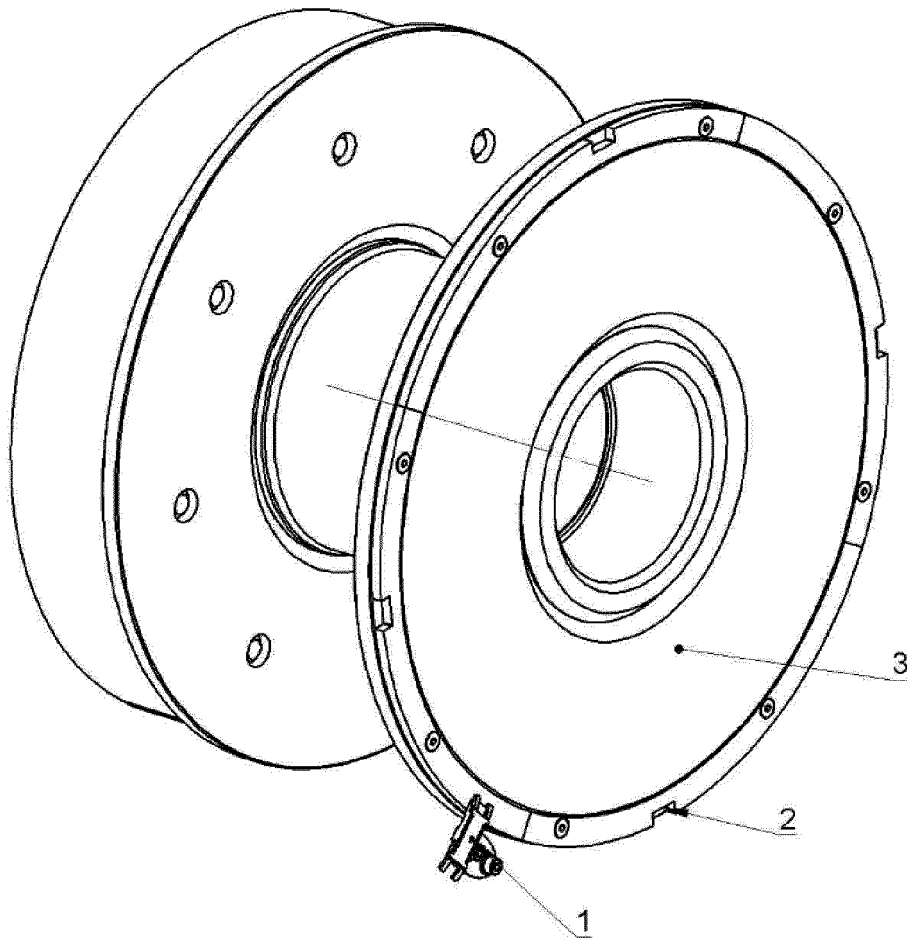


Figure 1

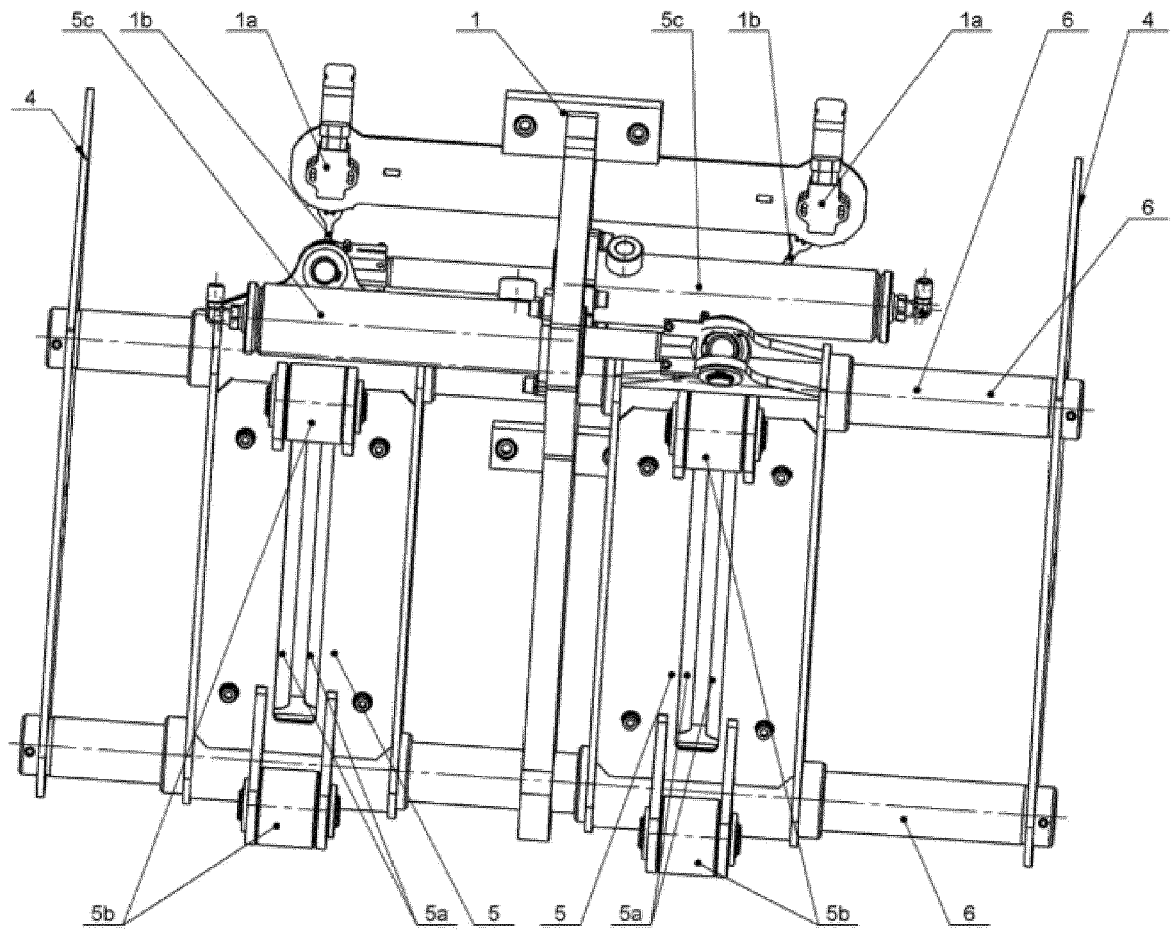


Figure 2

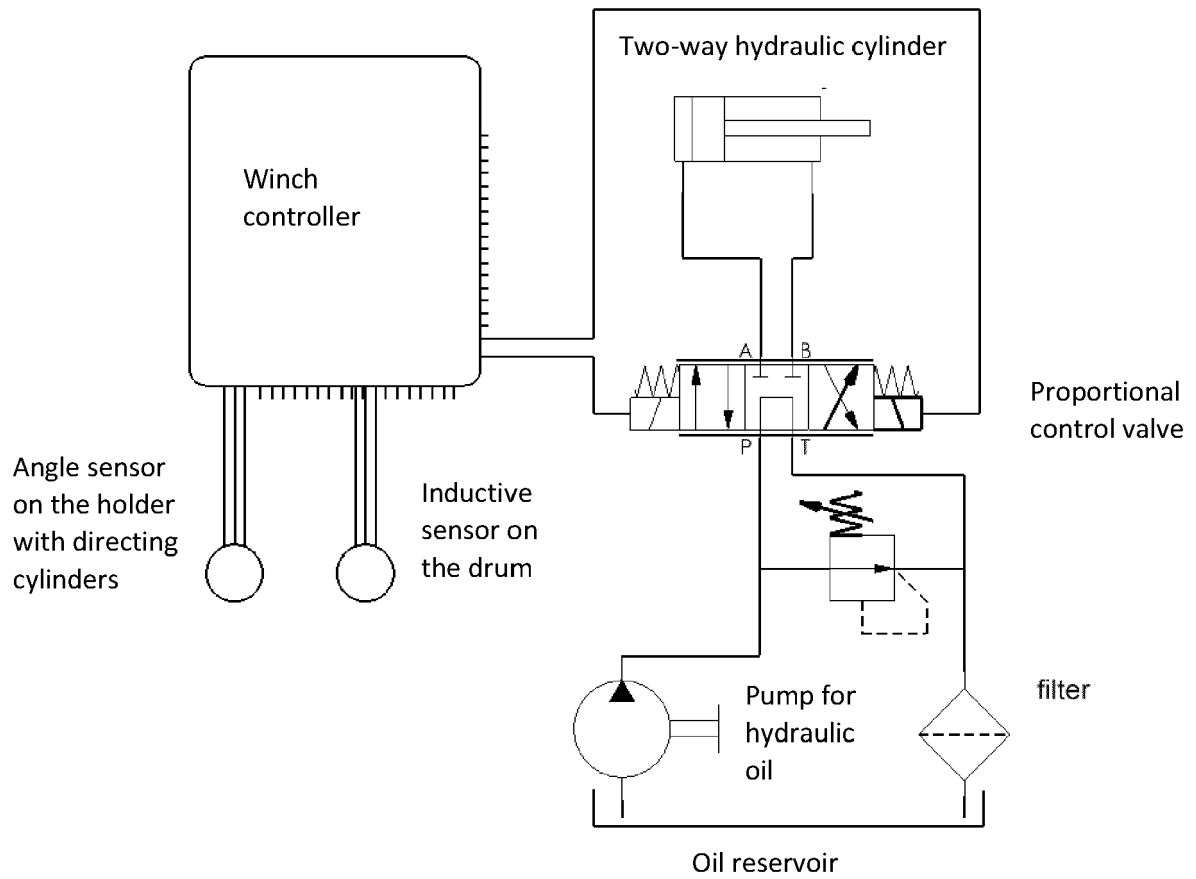


Figure 3



EUROPEAN SEARCH REPORT

Application Number

EP 21 20 6869

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 202 766 182 U (UNIV DALIAN TECH; DALIAN YILIYA CONSTR MACH CO) 6 March 2013 (2013-03-06)	1-3, 10-12	INV. B66D1/28 B66D1/38 B66D1/48 B66D1/26
Y	* abstract; figures * -----	4-9	
X	CN 104 355 253 A (XUZHOU HEAVY MACHINERY CO LTD) 18 February 2015 (2015-02-18) * abstract; figures * -----	1, 11, 12	
X	CN 202 358 865 U (SHEYANG OCEAN GOING SHIP AUX Y CO LTD) 1 August 2012 (2012-08-01) * abstract; figures * -----	1, 11, 12	
Y	CN 106 477 472 A (SANY AUTOMOBILE MFG CO LTD) 8 March 2017 (2017-03-08)	4, 5	
A	* abstract; figures * -----	1	
Y	JP S56 82793 A (HITACHI CONSTRUCTION MACHINERY) 6 July 1981 (1981-07-06)	6	
A	* figures * -----	1	
Y	CN 203 903 872 U (BAOJI OILFIELD MACHINERY CO) 29 October 2014 (2014-10-29)	7	TECHNICAL FIELDS SEARCHED (IPC)
A	* abstract; figures * -----	1	B66D
Y	DE 23 22 687 A1 (AUKRA BRUK AS) 22 November 1973 (1973-11-22)	8	
A	* paragraph [0015] - paragraph [0018]; figure * -----	1	
Y	CN 211 594 863 U (SINOHYDRO BUREAU 5 CO LTD) 29 September 2020 (2020-09-29)	9	
A	* abstract; figures * -----	1	
X,D,P	EP 3 819 253 A1 (PISEK VITLI KR PAN DOO [SI]) 12 May 2021 (2021-05-12) * the whole document * -----	1, 3, 4, 7, 8, 10-12	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 4 April 2022	Examiner Özsoy, Sevda
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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ON EUROPEAN PATENT APPLICATION NO.**

EP 21 20 6869

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 202766182 U	06-03-2013	NONE	
CN 104355253 A	18-02-2015	NONE	
CN 202358865 U	01-08-2012	NONE	
CN 106477472 A	08-03-2017	NONE	
JP S5682793 A	06-07-1981	NONE	
CN 203903872 U	29-10-2014	NONE	
DE 2322687 A1	22-11-1973	BE 799278 A DE 2322687 A1 ES 415080 A1 FR 2184017 A1 GB 1393193 A IT 986682 B JP S4955045 A NL 7306302 A	31-08-1973 22-11-1973 16-02-1976 21-12-1973 07-05-1975 30-01-1975 28-05-1974 13-11-1973
CN 211594863 U	29-09-2020	NONE	
EP 3819253 A1	12-05-2021	EP 3819253 A1 SI 25917 A	12-05-2021 31-05-2021

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2662703 A [0004]
- US 2424380 A [0004]
- CN 101700859 [0005]
- SI 25917 [0006]