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(54) Hoisting device.

(57) The device (103) of the invention is designed to be used in connection with a hoist (101) equipped with a driving power transmission gear, e.g. a chain hoist. The device (103) has a shaft (117) accommodating a driven power transmission gear (114) and at least two driving power transmission gears (115, 116) driving the hoisting elements (108, 109), which may be chains or ropes. The driven power transmission gear (114) and the driving power transmission gear (106) of the hoist (101) are coupled by a power transmission loop (120) which preferably consists of a closed loop of chain.

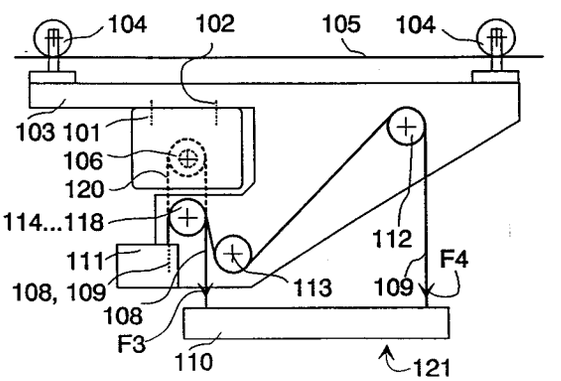

Fig. 2

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The present invention relates to a device for the hoisting of a load, designed to be used in connection with a hoist equipped with a driving power transmission gear, said device being provided with at least two hoisting elements.

Hoists equipped with a driving power transmission gear include e.g. chain hoists. Chain hoists are typically used as hoisting machines in a small-load range, i.e. for loads of about 100 kg... 2000 kg, at low hoisting speeds and low hoisting heights. In principle, there are two types of chain hoist. In one type, both ends of the shaft of the chain wheel are provided with a bearing, whereas in the other type one end of the chain wheel shaft is free. Chain hoists are favoured because of their advantageous price and small size. A small size is possible because the chain hoist has no drum but instead the hoisting chain "reeled" up is gathered into a container provided in conjunction with the hoist.

As is the case with all hoisting machines, there is a need for simultaneous hoisting with two load hooks in the case of chain hoists as well. To implement this, instead of using one driving chain wheel designed for one chain, chain hoists use two driving chain wheels mounted on the same shaft. One or both of the chains is then passed around one or more diverting pulleys to bring the load hooks to a suitable distance from each other. This construction works well in itself, but the shafts of the driving chain wheels are subjected to a torsional strain due to the pull of the load. This imposes a limit to the size of the load to be hoisted, even though the motor and gear system of the chain hoist itself have a sufficient capacity. Replacing the driving chain wheel with a double chain wheel is not possible in the case of all hoists having the chain wheel inside the hoist structure because the additional chain wheel needs more space in the axial direction of the drive wheel shaft. Chain hoists equipped with two load hooks represent a proportion of some 5...10% of all chain hoists, so reserving a space for an additional chain wheel inside the hoist in all hoists would make them more expensive. If the chain wheel is placed at one end of the hoist, then adding another chain wheel would mean that the shaft and its supporting elements would possibly have to be reinforced, which is also an expensive solution.

The object of the present invention is to eliminate some of the drawbacks of previously known technology.

The device of the invention is characterized by what is presented in the characterization part of claim 1. Other embodiments of the invention are characterized by what is said in the other claims.

The invention provides the advantage that it can be used in connection with standard chain hoists as there is no need to add another driving chain wheel to the chain hoist. The invention also makes it possible to avoid imposing an extra bending stress on the shaft of the driving chain wheel. A further advantage is that, by varying the diameters of the driven chain wheel and the wheels driving the hoisting chain of the device, the hoisting speed and therefore also the size of the permitted load can be varied. Moreover, providing the structure of the invention with two or more hoisting elements, i.e. hoisting chains, can be implemented in a reasonable way.

In the following, the invention is described by the aid of one of its embodiments by referring to the drawings, in which

Fig. 1. presents a chain hoist application for hoisting using two chains according to previously known technology,

Fig. 2 presents an embodiment of the present invention for hoisting with two hoisting elements,

Fig. 3 illustrates the arrangement of the chain wheels of the device of the invention.

Fig. 1 shows a typcial solution according to known technology for simultaneous hoisting with two hoisting chains using one chain hoist. The chain hoist 1 is fixed to a hoisting trolley 3 by means of fixing elements 2. The trolley 3 moves on wheels 4 along a track 5. The hoist is provided with a driving double chain wheel 6 mounted on a shaft 7. One end of the first and second hoisting chains 8 and 9 are attached to the load 10 (hoisting chain 9 by the intermediate of pulleys 13 and 12) and the chains are then passed around one of the wheels of the double chain wheel 6 to a chain box 11. The forces F1 and F2 exerted on the chains by the motion and hoisting act on the shaft 7 of the driving double chain wheel 6. A disadvantage with this previously known structure is the bending of the shaft 7 caused by the forces F1 and F2. The figure presents a hoist in which the driving double chain wheel is placed inside the hoist, but such a structure cannot be implemented in all hoists because of insufficient space. If the driving chain wheel is placed at one end of the hoist, providing the hoist with a double chain wheel is easier but the longer shaft involved means that the load 10 generates a still larger bending moment on the shaft 7. Providing previously known chain hoists with more than two driving chain wheels leads to unreasonable solutions due to the shaft length required.

Fig. 2 presents a hoist 101 with a driving power transmission gear and a device 103 according to the invention, provided with two hoisting elements 108 and 109. A "hoist 101 with a driving power transmission gear" means a hoist without a drum. An example is the chain hoist. The hoist 101 is attached by means of fixing elements 102 to the device 103, which moves on wheels 104 along a track 105. The hoist 101 and the device 103 con-

stitute a hoisting apparatus 121.

The hoist 101 has a driving power transmission gear 106 mounted either inside the hoist as in the figure or at one end of the hoist. Mounted near the driving power transmission gear of the hoist 101, the device 103 has a driven power transmission gear 114. Mounted on the shaft of this gear 114, there are two further driving power transmission gears 115 and 116 for moving the hoisting elements 108 and 109 for the hoisting of the load 110. When the hoist is attached to the device 103, the driving power transmission gear 106 and the driven power transmission gear 114 are coupled by a closed power transmission loop 120 consisting of a closed loop of chain or cogged belt. Also, the driving power transmission gear 106 and the driven power transmission gear 114 may be mounted with their teeth meshing, in which case power transmission occurs directly from the driving power transmission gear to the driven power transmission gear via the teeth.

The hoisting elements 108 and 109 consist of hoisting chains, and the power transmission gears 115 and 116 driving them are chain wheels. The chains may be link chains or roller chains. One end of each hoisting element 108 and 109 is passed via the power transmission gear 115,116 driving the hoisting element to a chain box 111 attached to the device 103. The other end of the first hoisting element 108 is attached to tie load 110 to be hoisted. The second hoisting element 109 is first passed over two diverting pulleys 113 and 112 and then attached to the load 110. The load 110 may be either a loading device or the actual disposable load.

Many variations of the device 103 are possible.

Instead of chains as described above, the hoisting elements 108 and 109 may consist of ropes, in which case the device has rope drums in place of the driving power transmission gears 115 and 116, one end of each rope being attached to the appropriate drum.

By varying the diameters of the driving power transmission gear 106 and the driven power transmission gear 114, the hoisting speed and therefore also the max. load size can be varied, so the device 103 is capable of hoisting loads exceeding the rated load of the hoist 101 or, with a smaller load, of achieving a higher hoisting speed.

The load size can also be increased by using a set of pulleys for suspending the load, e.g. by having the load 110 suspended on diverting pulleys around which the hoisting elements are passed and fixing the other ends of the hoisting elements to the device 103.

The device 103 can also be easily equipped so as to allow the use of more than two hoisting elements. E.g. hoisting by means of three hoisting chains acting as hoisting elements can be implemented by mounting three driven chain wheels on the shaft 117 and providing the device 103 with three hoisting chains.

If the horizontal distance between the hoisting elements 108 and 109 at the fixing points of the load is large, then one of the hoisting elements (chains, ropes) may undergo a larger elongation than the other. To avoid this, the other hoisting element can as well be passed via diverting pulleys to the load 110 to be hoisted, as has been done with hoisting element 109 in Fig. 2. This procedure can be applied to render the hoisting elements interchangeable.

Fig. 3 presents the power transmission gears of the hoist 101 and the device 103, as well as their shafts. The power ouput of the hoist 101 occurs via a shaft 107 supported by bearings 119, the driving power transmission gear 106 being fixed to the shaft.

The device 103 has another shaft 117 with a driven power transmission gear 114 and two more driving power transmission gears 115 and 116 fixed to it. The driving power transmission gear 106 and the driven power transmission gear 114 are coupled by means of a power transmission loop 120 which may consist of a closed loop of link chain, roller chain or cogged belt, the power transmission gears 106 and 114 being implemented as corresponding types. Fig. 3 shows toothed power transmission gears 106 and 114 for roller chain. The shaft 117 is supported by bearings 118. The figure also shows the hoisting elements 108 and 109 passed around the additional driving power transmission gears 115 and 116. The hoisting elements 108 and 109 are subject to forces F3 and F4 resulting from the movement of the hoisting elements and from the load 110. These forces cannot exert a pull on the shaft of the driving power transmission gear 106 of the hoist, but instead the pull is applied to shaft 117. Therefore, no torsional strain is imposed on the shaft 107 of the driving power transmission gear 106 of the hoist.

The invention has been described above in the light of one of its embodiments, but the description is not to be regarded as constituting a restriction, but the scope of the invention is determined according to the sphere of protection of the claims presented below.

Claims

1. Device for the hoisting of a load, provided with at least two hoisting elements (108,109) and designed to be used in conjunction with a hoist (101) equipped with a driving power transmission gear (106), **characterized** in that the device (103) can be attached to the hoist (101)

and that the device (103) is provided with a driven power transmission gear (114) and that it has at least two other power transmission gears (115,116) mounted on the shaft (117) of said power transmission gear (114) to drive the hoisting elements (108,109) for the hoisting of the load (110).

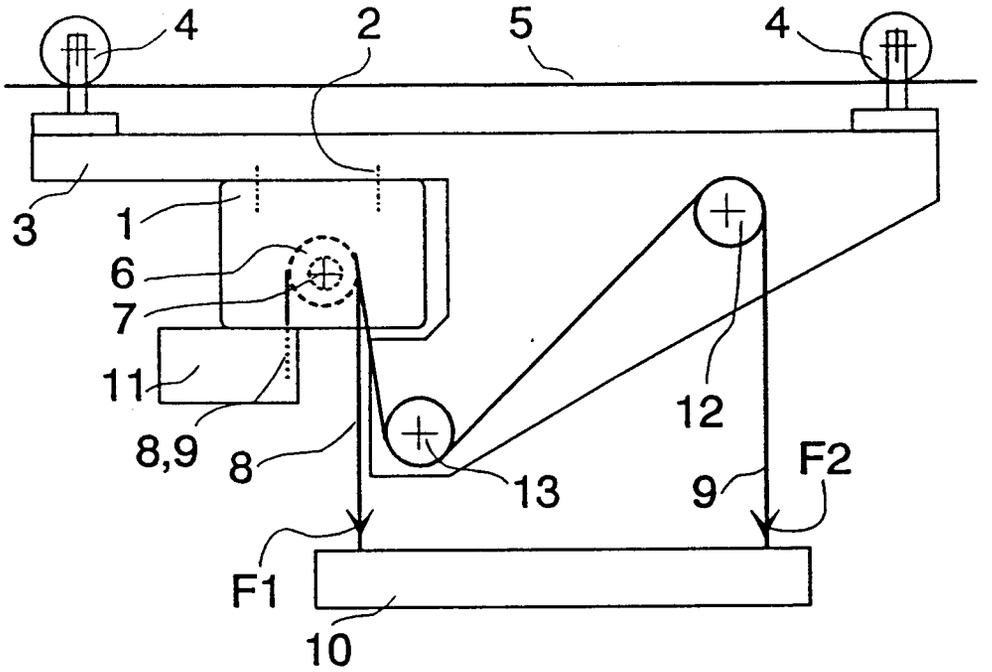
2. Device according to claim 1, **characterized** in that when the device (103) is attached to a hoist (101), the power (F3, F4) needed for driving the hoisting elements (108, 109) and hoisting the load (110) is transmitted from the driving power transmission gear (106) to the driven power transmission gear (114).

3. Device according to claim 2, **characterized** in that, for the transmission of the power (F3, F4) needed for driving the hoisting elements (108, 109) and hoisting the load (110) from the driving power transmission gear (106) to the driven power transmission gear (114), the device (103) is provided with a power transmission loop (120) consisting of a closed loop of chain or cogged belt mounted between the driving power transmission gear (106) and the driven power transmission gear (114).

4. Device according to claim 2, **characterized** in that the driving power transmission gear (106) of the hoist (101) and the driven power transmission gear (114) of the device (103) are toothed wheels and the power (F3, F4) needed for driving the hoisting elements (108, 109) and hoisting the load is transmitted directly from the driving power transmission gear (106) to the driven power transmission gear (114) by means of their teeth.

5. Device according to any one of claims 1 - 4, **characterized** in that the other two driving power transmission gears (115, 116) of the device (103) are chain wheels and the hoisting elements (108, 109) are chains.

6. Device according to any one of claims 1 - 4, **characterized** in that the other two driving power transmission gears (115, 116) of the device (103) are rope drums and the hoisting elements (108, 109) are ropes, one end of each rope being attached to a rope drum.


4
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4
3
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6
7
11
8,9
8
13
12
9
F2
F1
10

Fig. 1

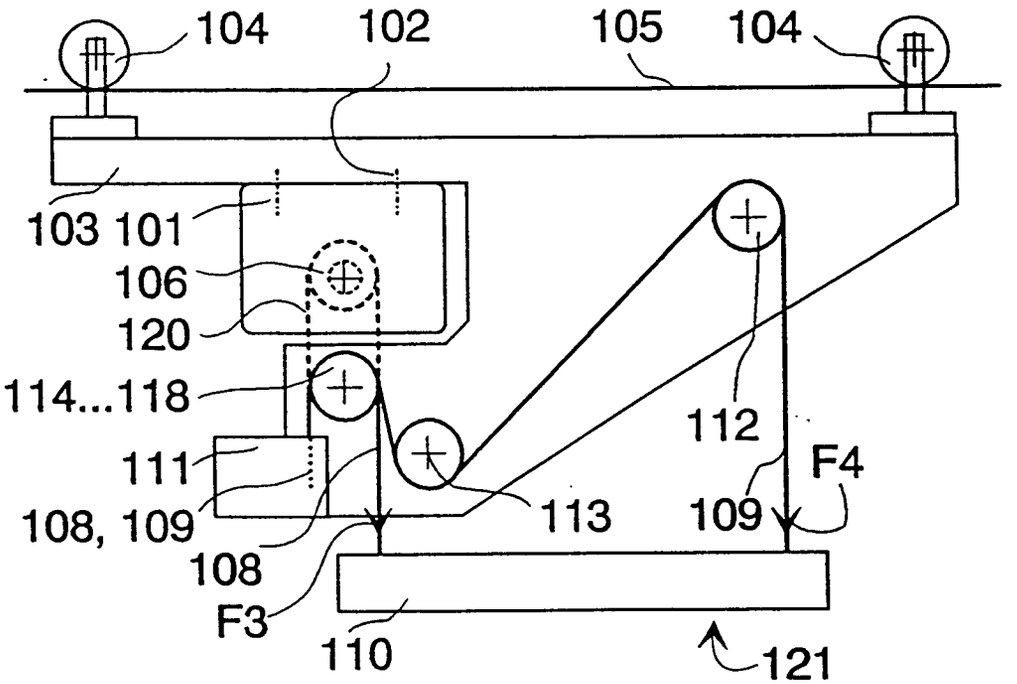
104
102
105
104
103
101
106
120
114...118
111
108, 109
108
F3
110
113
112
F4
109
121

Fig. 2

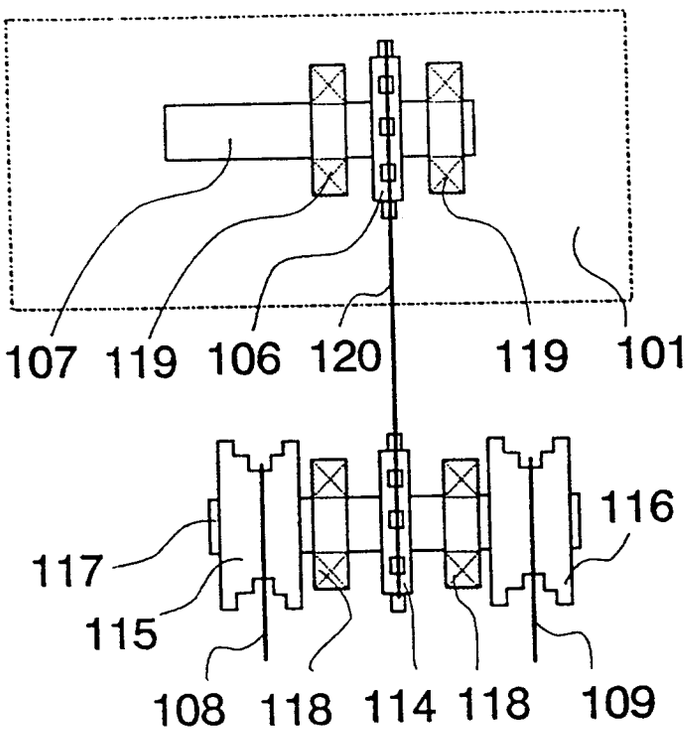

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 94 11 9515

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	DE-A-35 11 656 (UTTSCHEID) * the whole document *	1-3,5 4,6	B66D3/18
Y	CH-A-104 859 (SAHLI) * the whole document *	4,6	
A	EP-A-0 499 814 (R. STAHL FÖRDERTECHNIK)		
A	EP-A-0 189 525 (MANNESMANN)		
A	DE-A-38 29 213 (UHDE)		
A	US-A-4 114 855 (ADAMSON)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B66D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 February 1995	Van den Berghe, E

CATEGORY OF CITED DOCUMENTS

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