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(54) Lift cage guidance system

(57) Lift system, comprising a lift cage (18), guide cables (15) which are arranged vertically next to the lift cage, holding members (19) which are arranged on the lift cage, hoisting means which are connected between the lift cage and a stationary point above the lift cage, and tensioning means (16) which are connected to the guide cables and a stationary point and are suitable for tensioning the guide cables, while the lift cage is in use, in such a manner that the floor (20) of the lift cage is held substantially horizontally. The lift cage is guided vertically by each combination of a holding member and a guide cable, the holding members being free from the hoisting means.

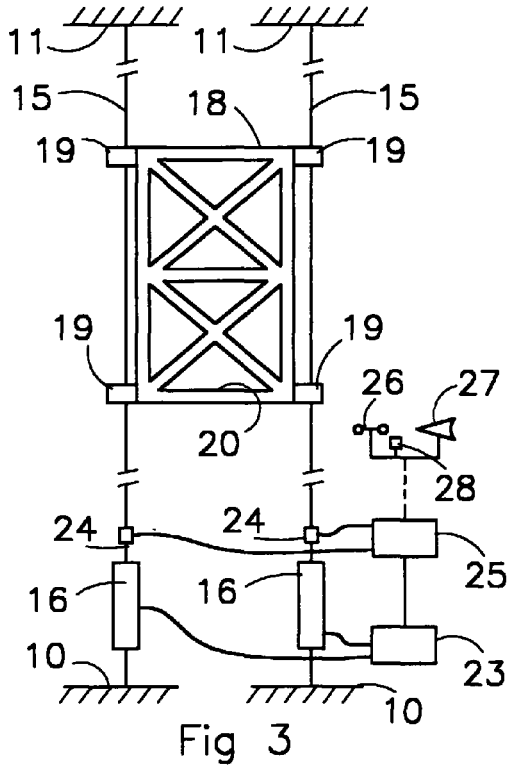

Fig 3

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Description

[0001] The invention relates to a lift system, comprising a lift cage, elongate, slack, vertical guide members which are arranged next to the lift cage and top ends of which are connected to stationary points above the lift cage, holding members which are arranged on the lift cage and, in combination with the elongate guide members, fulfil a guide function, and hoisting means which are connected to the lift cage and a stationary point above the lift cage.

[0002] A system of the abovementioned type is known from European patent application EP-A-0 117 862. In the known system, the elongate guide members comprise chains which hang freely downwards below the lift cage. For each chain, the holding members comprise a group of three chain wheels over which the chain is guided, in such a manner that when a chain wheel of each of the groups of chain wheels is driven by drive means arranged on the lift cage, the lift cage is displaced vertically. The drive means comprise a brake disc on which brake blocks act, which brake blocks come off the brake disc as a result of actuation from a hydraulic cylinder. Hydraulic valves, which are actuated by projections attached to the ends of the chains, are arranged on the lift cage, along the chains, above the top and below the bottom of the lift cage. When a valve is actuated by a projection, the cylinder is controlled so that the brake blocks act on the brake disc and vertical movement of the lift cage is stopped.

[0003] In the known system, the lift cage can easily be made to wobble or oscillate through the action of wind on the lift cage and on the chains or through movements of people in the lift cage. If a system of this nature is used in situations where the lift cage has to be able to pass through relatively narrow passages in a structure, the risk of the lift cage wobbling or oscillating may give rise to extremely dangerous situations. For this reason, a known lift system of this nature is in many countries prohibited from being used to transport people.

[0004] Generally, hoisting means act on a lift cage above its centre of gravity, with the result that it is often not necessary to guide the cage at the sides. This is the case, for example, if the cage is a workbridge which is moved vertically along a building structure, in which case the hoisting means may comprise lifting and latching means which are arranged on each short side of the bridge, for a hoisting cable or latching cable which are attached to high stationary points. Another situation involves, for example, a lift cage in a lift shaft of a building in which a hoisting cable engages, from hoisting means arranged at a high point on the building, on the centre of the top side of the cage. A suspended bridge system which is normally employed for use outside, and a lift system which is normally employed for use inside a building, have to satisfy various regulations. A lift system of this nature for transporting people must include fixed, stationary guide means, such as rails, in order to prevent the cage from wobbling and to prevent the formation of dangerous spaces between the floor of the cage and the floor of a storey. Therefore, a suspended bridge system is not suitable for transporting people.

[0005] Nevertheless, it is desirable, for high structures such as building cranes or in towers of modern windmills, to provide an installation with a lift cage for transporting specialist staff which is less complex than an installation as used for passengers lifts in buildings.

[0006] French patent FR-A-326 895 has disclosed a lift system with one or more vertical cables which are each guided around a drive roller of a stationary motor and a number of pulleys. Each cable is tensioned by a spring or by a weight which is attached to one end of the cable or which hangs in a loop of the cable via a pulley. The cables are tensioned in order to increase the friction which occurs between the cable in question and the respective drive roller, in order to increase the efficiency of the lifting action. The known system is relatively complex, and installing the system, in particular positioning and correctly guiding the cables, will be time-consuming and therefore expensive. If, in order to prevent the lift cage from wobbling, the cables are tensioned to a greater extent by increasing the size of the weights, this affects the hoisting function. Not only will the friction forces between the cables and the associated drive rollers increase, but also the friction forces in bearings of the pulleys will increase, with the result that the power of the motor has to be higher than if the tension in the cables is lower. Since it must be possible to move the lift cage over a relatively great vertical distance with a maximum permissible wobble, it will be necessary to increase the tension in each cable, and therefore for the power of the motor to be increased. In the case of a great displacement height, such as in or along a tower, this may lead to an undesirably large structure, an undesirably high power of the motor and therefore high costs.

[0007] To achieve the abovementioned object and to eliminate the abovementioned drawbacks, the system of the type mentioned in the preamble is characterized, according to the invention, in that the elongate guide members are guide cables, the guide cables are free from the hoisting means, the bottom ends of the guide cables are connected to stationary points below the lift cage, and tensioning means are connected between the guide cables and stationary points, which tensioning means are suitable for tensioning the guide cables while the lift cage is in use, in such a manner that the floor of the lift cage is held substantially horizontally.

[0008] The lift cage guidance system according to the invention makes it possible to provide a relatively simple and inexpensive installation for hoisting and guiding a passenger lift cage.

[0009] The fact that the guide means comprise cables makes it possible to adapt the height over which the lift cage has to be guided easily and inexpensively to the prevailing situation.

[0010] Other features and advantages of the inven-

tion will emerge from the following explanation in combination with the appended drawings, in which:

Fig. 1 diagrammatically shows a tower crane in which a lift cage guidance system according to the invention is used;
Fig. 2 diagrammatically depicts the guidance system from Fig. 1 on a larger scale and seen from the same viewpoint; and
Fig. 3 shows the system from Fig. 2, viewed towards one side of this system.

[0011] Fig. 1 shows a tower crane 1 comprising a base 2, a tower 3 which is arranged on the base 2, a lifting arm 4 which is coupled to the top of the tower 3 and a counterweight arm 5. The lifting arm 4 has rails (not shown) over which a hoisting carriage 6 can travel, on which there are pulleys for guiding one or more cables to which a hoisting hook 7 is coupled. A counterweight 8 is attached to the free end of the arm 5. At the top of the tower 3, there is a cab 9 for an operator working the crane 1.

[0012] According to the invention, at least two vertical cables 15 are arranged at a distance from the tower 3, for example each between two retaining bars 10, 11 which are optionally temporarily attached to the tower 3. The cables 15 are tensioned with a specific stress, in such a manner that lateral bending of the cables 15 is significantly limited.

[0013] The cables 15 can be tensioned by tensioning means 16 which are connected to the cables and may be hydraulic means. As an alternative, it would be possible to use screw tensioning means or a platform which is supported on a thickened section arranged on the cable 15 in question and weights which are stacked on the platform.

[0014] As also shown in Figs. 2 and 3, the cables 15 are used to guide a lift cage 18 which is suitable for transporting people. On the top side, the lift cage 18 has gripper members 19 which each engage around an associated cable 15. The gripper members 19 (or guide pieces) can slide or roll along the length of the cable 15 in question. Preferably, gripper members 19 of this nature are also arranged at the bottom of the cage 18. This ensures that, given a suitable tensile stress in the cable 15, the floor 20 of the cage 18 will always form the same angle, in particular horizontally, with respect to the cable 15. Consequently it is sufficient, given a suitable tensile stress in the cables 15, to use only two cables 15 at a distance from one another.

[0015] An upright side section 21 which is located approximately between two adjacent cables 15 is suitable for the attachment of a hoisting cable of a hoisting installation which is attached, for example, to the top retaining bars 11, or for the arrangement of lifting and latching means for a hoisting cable or latching cable, as with a suspended bridge installation for maintenance work carried out on the outside of buildings. Consequently, it is possible to use a hoisting installation for the cage 18 which uses only one hoisting cable. Consequently, the hoisting means, for example the hoisting means which are attached to the top retaining bars 11 or the lifting and latching means which are arranged on the cage 18, can be of simple and therefore relatively inexpensive design. Moreover, the use of simple hoisting and latching means arranged on the cage provides more space inside the cage 18 for transporting people or allows the cage 18 to be of correspondingly smaller design.

[0016] The tensioning means 16 are preferably adjustable tensioning means, such as of the hydraulic form mentioned above, and are controlled by drive means 23. The drive means 23 which, if hydraulic tensioning means 16 are used, may comprise a hydraulic pump, are suitable, on receiving an external command, for actuating the tensioning means 16 to a greater or lesser extent, in order to correspondingly vary the tensile strength on the cable 15 which is connected to the tensioning means 16. The external command may comprise a simple on/off function.

[0017] When the lift cage guidance system according to the invention is used in a building crane as shown in Fig. 1, it may be desirable to control the drive means 23 so as to reduce the tensile stress on the cables 15 for the period in which the lift cage 18 remains at the same height and does not hold any people or goods, so that the action of the crane 1 is not adversely affected by the possibility of an excessive tensile stress in the cables 15.

[0018] The tensile stress which is generated in a cable 15 can be measured by means of a stress sensor 24, which is connected to a measuring and control circuit 25 for controlling the drive means 23.

[0019] The control means 25 may also be connected to sensors for measuring climatological conditions, such as a wind speed sensor 26, a wind direction sensor 27 and a temperature sensor 28. The control circuit 25 may be suitable for taking into account one or more measured signals obtained by means of the sensors 26, 27, 28 when controlling the drive means 23.

[0020] By using adjustable tensioning means 16 and one or more of the sensors 24 to 28 in combination with the drive means 23 and the control circuit 25, the system is suitable for varying the stress in the cables 15, for example in order to prevent differences in stress between the cables 15, to counteract oscillation in the cables 15 and to anticipate the effects of the weather.

[0021] Although the lift cage guidance system according to the invention has been explained above in the context of using tensioning means 16 and tension sensors 24 for each cable 15, it is alternatively possible to use common tensioning means 16 and a common tension sensor 24 for a plurality of cables 15. This can be made possible by connecting the cables 15 to one another at suitable locations (beneath the cage 18 in Figs. 2 and 3).

[0022] The lift cage guidance system according to the invention which is explained above for use in a building crane 1 can also be used in shafts of buildings or towers which, over the movement height of the lift cage 18, offer insufficient facilities for securing permanent guide rails and/or where the costs need to be minimized in view of the limited use made of the lift cage 18. Towers of this nature are, for example, towers of modern windmills, which may be higher than 50 m, may have a diameter of more than 4 m and in which a number of platforms are arranged at different heights. When using a lift cage, it must be possible to guide this cage through holes which are formed in the platforms with little space in between. This is made possible by means of the guidance system according to the invention.

Claims

1. Lift system, comprising a lift cage (18), elongate, slack, vertical guide members which are arranged next to the lift cage and top ends of which are connected to stationary points above the lift cage, holding members which are arranged on the lift cage and, in combination with the elongate guide members, fulfil a guide function, and hoisting means which are connected to the lift cage and a stationary point above the lift cage, characterized in that the elongate guide members are guide cables (15), the guide cables are free from the hoisting means, the bottom ends of the guide cables are connected to stationary points below the lift cage, and tensioning means (16) are connected between the guide cables and stationary points, which tensioning means are suitable for tensioning the guide cables while the lift cage is in use, in such a manner that the floor (20) of the lift cage is held substantially horizontally.

2. System according to claim 1, characterized in that the holding members (19) are distributed over the height of the lift cage (18).

3. System according to claim 1 or 2, characterized in that a vertical distance between the holding members (19) is substantially equal to the height of the lift cage (18).

4. System according to claim 2 or 3, characterized in that the hoisting means act on a section (21) of the lift cage (18) between the cables (15).

5. System according to one of the preceding claims, characterized in that the tensioning means (16) can be adjusted in order, by means of an external command, to change the tensile force exerted on at least one cable (15).

6. System according to claim 5, characterized in that the tensioning means (16) are suitable for exerting different tensile forces on the cables (15) by means of an external command.

7. System according to claim 5 or 6, characterized by measuring means (24) for measuring tensile stresses currently arising in the cables (15) and control means (25) for controlling the tensioning means (16) as a function of a difference between the current tensile stress and a desired tensile stress for a cable (15), in order to minimize the difference.

8. System according to claim 7, characterized by means (26, 27, 28) for measuring one or more climatological factors in the environment and for determining the desired tensile stresses on the basis of these factors.

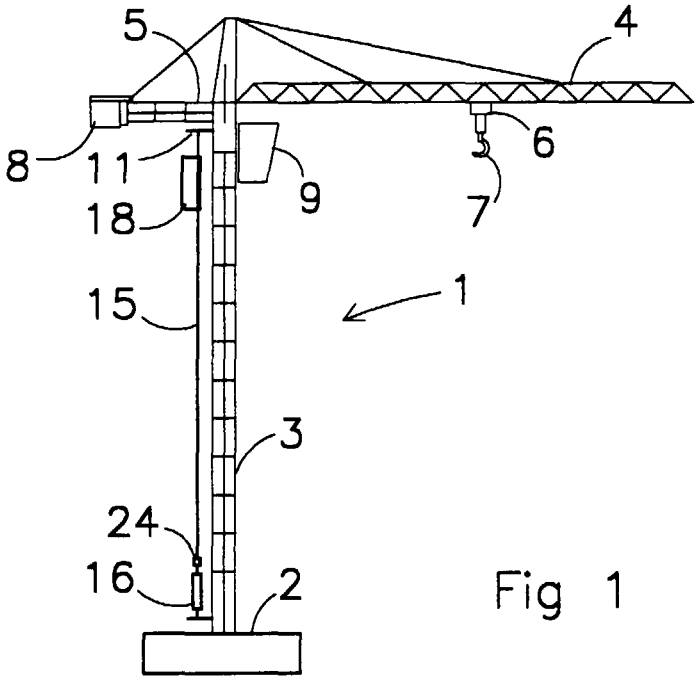

Fig 1

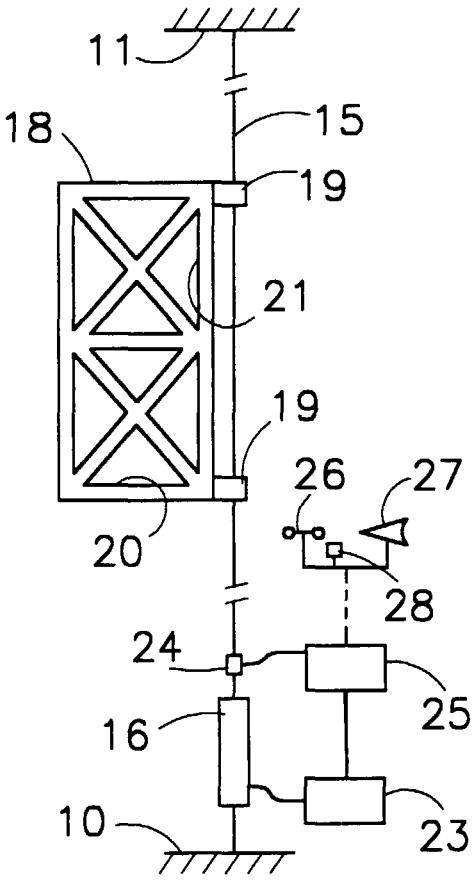

Fig 2

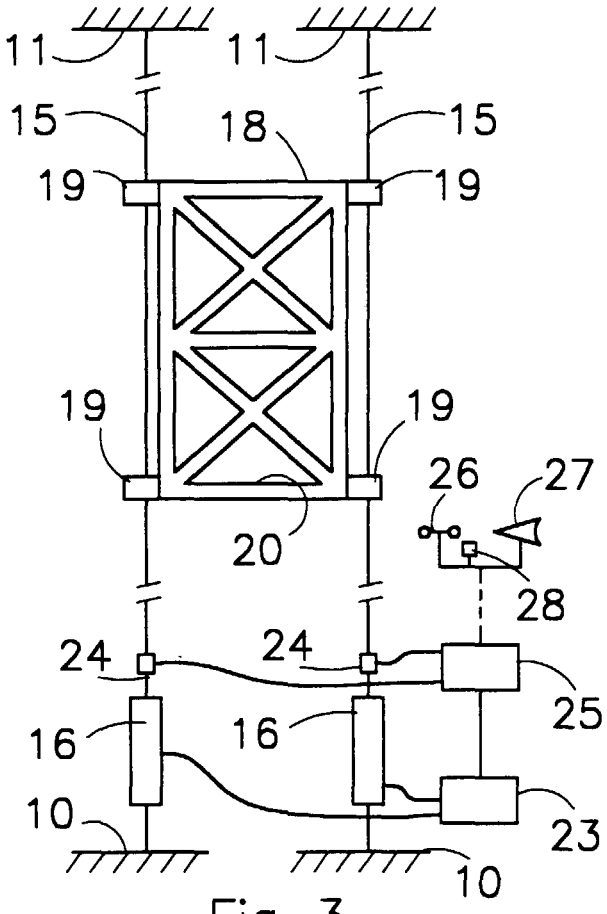

Fig 3

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EUROPEAN SEARCH REPORT

Application Number
EP 99 20 4436

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.7)
P,X	DE 197 26 408 C (GERHARD REINEKE SCHLOSSEREI UN) 18 March 1999 (1999-03-18) * column 6, line 12 - line 50; figures 1,2,12 *	1-5	B66B9/187 B66B7/02 E04G3/00 B66D1/74
X	US 2 645 531 A (RECTOR) 14 July 1953 (1953-07-14) * column 4, line 9 - line 48; figures 1-4 *	1	
A	US 5 343 979 A (GOTO HIDEO) 6 September 1994 (1994-09-06) * column 3, line 3 - line 9; figures 1-8 *	1-8	
A	EP 0 117 862 A (HUSSON ROGER) 5 September 1984 (1984-09-05) * page 5, line 7 - line 8; figures 1,4 *	1	
A	FR 326 895 A (HISS) 2 December 1902 (1902-12-02) * page 2, line 93 - page 3, line 2; figures 3,7 *	1	
A	EP 0 876 987 A (KIM KYUNG JOO) 11 November 1998 (1998-11-11) * abstract; figures 3,10 *	1	
A	FR 1 406 277 A (PARISOT) 19 November 1965 (1965-11-19) * page 1, column 1, paragraph 7 - paragraph 8; figure 2 *	1	
A	US 2 508 187 A (NIEMIC) 16 May 1950 (1950-05-16) * figure 1 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
B66B
B66D
E04G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 March 2000	Sozzi, R

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21-03-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19726408 C	18-03-1999	DE 29723595 U	28-01-1999
US 2645531 A	14-07-1953	NONE	
US 5343979 A	06-09-1994	JP 2968627 B	25-10-1999
		JP 5103736 A	27-04-1993
		JP 2528739 B	28-08-1996
		JP 5179797 A	20-07-1993
		AU 637273 B	20-05-1993
		AU 8827191 A	25-06-1992
		GB 2251594 A,B	15-07-1992
EP 0117862 A	05-09-1984	BE 897720 A	02-01-1984
		AT 39467 T	15-01-1989
		BE 896004 A	16-06-1983
FR 326895 A		NONE	
EP 0876987 A	11-11-1998	CN 1198499 A	11-11-1998
		JP 11070179 A	16-03-1999
		US 6009979 A	04-01-2000
FR 1406277 A	19-11-1965	NONE	
US 2508187 A	16-05-1950	NONE	

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