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- (71) **Applicant (for all designated States except US):** **WS-CESKE VYTAHY S.R.O.** [CZ/CZ]; Nadrazni 167, 252 46 Vrane nad Vltavou (CZ).
- (72) **Inventors; and**
(71) **Applicants :** **VOKURKA, Miroslav, Sr.** [CZ/CZ]; Osecka 547, 184 00 Praha 8 - Dolni Chabry (CZ). **VOKURKA, Miroslav, Jr.** [CZ/CZ]; Milana Kadlece 1037/17, 184 00 Praha 8 - Dolni Chabry (CZ).
- (72) **Inventor; and**
(75) **Inventor/Applicant (for US only):** **VOKURKA, Martin** [CZ/CZ]; Osecka 547, 184 00 Praha 8 - Dolni Chabry (CZ).
- (74) **Agent:** **HARTVICOVA, Katerina;** Inventia s.r.o., Na Belidle 3, 150 00 Praha 5 (CZ).
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[Continued on nextpage]

(54) **Title:** VERTICAL HOIST SYSTEM

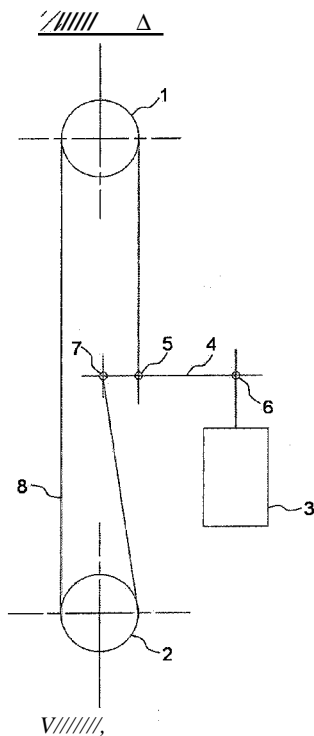


Fig. 1

(57) **Abstract:** A vertical hoist system without a counterweight is provided comprising a lever (4), an elevator car (3) attached to the lever (4) through an attachment means (6), a traction and load bearing means (8) having a first end (5) and a second end (7), an upper sheave assembly (1) and a lower sheave assembly (2), and a traction machine, wherein the first end (5) of the traction and load bearing means (8) is attached to the lever (4), the traction and load bearing means (8) is led over the upper sheave assembly (1) and over the lower sheave assembly (2) and attached to the lever (4) through its second end (7), wherein the point of attachment of the first end (5) of the traction and load bearing means (8) is located on the lever (4) between the point of attachment (6) of the elevator car (3) and the point of attachment of the second end (7) of the traction and load bearing means (8).

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TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

Declarations under Rule 4.17:

Vertical hoist system

Field of Art

- 5 The present invention relates to a vertical hoist system for transportation of persons and/or load comprising an elevator car, a traction machine and a traction and load bearing means, wherein said vertical hoist system does not require a counterweight.

Background Art

10

The majority of existing designs of elevators for transportation of loads and/or persons comprise a traction machine, an elevator car suspended on a traction and load bearing means such as roping, and a counterweight positioned on the opposite end of the traction and load bearing means. The traction and load bearing means is led over a traction sheave connected to the traction machine. The counterweight balances the weight of the elevator car and during its upward movement leads to a lower power consumption of the traction machine. The disadvantage of this solution is that the counterweight moves in the hoistway and decreases the space available inside the hoistway. Also, it causes an increased energy consumption.

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Several vertical hoist systems without the need for counterweight are known. The common technical problem to be solved is the maintenance of sufficient traction of the traction and load bearing means in order to achieve the desired movement and position of the elevator car. In the documents US 2006/0225965, WO 2004/094289, WO 2004/094287 and others, a system of deflection sheaves attached to the top and bottom of the hoistway and to the elevator car and a more or less complex external tensioning device acting directly on the traction and load bearing means are used to maintain the sufficient traction. WO 2005/049470 uses a system of deflection sheaves and parallel ropes.

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In WO 2010/059167 a system of deflection sheaves and a lever-weight assembly is used for maintaining the sufficient traction. One end of the traction and load bearing

means is attached to a lever and the tension is maintained by means of a traction weight mounted on a spring.

The aim of the present invention is, therefore, the development of a simple design of a vertical hoist system for transportation of persons and/or loads, which will not require the counterweight and will consequently enable utilization of the entire space inside the hoistway resulting in larger dimensions of the elevator car and a higher maximum load of the elevators. The novel vertical hoist system is reliable and automatically adjusts the force used to maintain the sufficient traction to the actual weight of the elevator car. This enables an optimum use of energy, since the energy is consumed only on the hoisting of persons and/or load and no energy has to be used for hoisting any counterweight.

Disclosure of the Invention

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The object of the present invention is a vertical hoist system comprising a lever, an elevator car attached to the lever through an attachment means, a traction and load bearing means having a first end and a second end, an upper sheave assembly and a lower sheave assembly, and a traction machine,

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wherein the first end of the traction and load bearing means is attached to the lever, the traction and load bearing means is led over the upper sheave assembly and over the lower sheave assembly and attached to the lever through its second end, wherein the point of attachment of the first end of the traction and load bearing means is located on the lever between the point of attachment of the elevator car and the point of attachment of the second end of the traction and load bearing means.

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From the first end, the traction and load bearing means leads upwards towards the upper sheave assembly, and from the second end, the traction and load bearing means leads downwards towards the lower sheave assembly.

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In the present vertical hoist system, the suspension of the elevator car on the lever creates a sufficient tension in the traction and load bearing means and a sufficient traction on both sheave assemblies. Consequently, no counterweight is required in

order to balance the weight of the elevator car. Due to the fact that the elevator car itself creates the tension, the tension corresponds to its momentary weight.

5 The vertical hoist system of the present invention includes any system for hoisting persons and/or loads, such as an elevator, a lift, a lifting platform, a lifting system etc. Consequently, the term "elevator car" includes any suitable transportation container or platform.

10 The upper sheave assembly comprises one or a plurality of sheaves. The lower sheave assembly comprises one or a plurality of sheaves.

The upper sheave assembly is located in the upper part of the hoistway or above the hoistway. The lower sheave assembly is located in the lower part of the hoistway or next to the hoistway. One sheave assembly (the upper sheave assembly or the lower
15 sheave assembly) is a traction sheave assembly and the other sheave assembly (the lower sheave assembly or the upper sheave assembly) acts as a diverting pulley assembly. The power for the traction sheave assembly is provided by the traction machine, which is usually located close to the traction sheave assembly. In a preferred embodiment, the traction sheave assembly together with the traction
20 machine are located in the upper part of the hoistway or above the hoistway and the diverting pulley assembly is located in the lower part of the hoistway. In another preferred embodiment, the traction machine and the traction sheave assembly are located in the lower part of the hoistway and the diverting pulley assembly is located in the upper part or above the hoistway.

25 Preferably, the traction machine is equipped with a frequency convertor. This embodiment results in an accurate levelling of the elevator and elimination of the vibrations. This in turn prolongs the traction machine lifespan and leads to an improvement of travel comfort during start and stopping of the elevator.

30 The traction and load bearing means can be any means used in the field of elevators for transmission of traction and for bearing (raising and lowering) the elevator car. Most commonly used traction and load bearing means is, e.g., roping or cabelling,

including one or a plurality of ropes, flat cables or flat belts. The ropes can be, e.g., traction steel ropes.

Attachment of the first end and the second end of the traction and load bearing means
5 on the lever can be achieved by any means known to a person skilled in the art, such
as screws, hinged screws or swiveling suspensions. It is preferably achieved through
a right-hand swiveling suspension and a left-hand swiveling suspension.

The attachment means for attaching the elevator car to the lever is preferably a
10 swiveling suspension. This enables free load balancing and a more fluent elevator
travel, particularly levelling.

The present invention provides a vertical hoist system which has a simple design and
is cost-effective in terms of production materials and installation, as well as energy
15 consumption during its day to day operation. In contrast to other known vertical hoist
systems the power consumption is proportional to the weight of transported persons
and/or load.

Brief Description of Drawings

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Fig. 1 shows a schematic representation of one embodiment of the vertical hoist
system according to the invention.

Example of Carrying Out of the Invention

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The present invention is herein illustrated by way of example which should not be
construed as further limiting.

Fig. 1 shows a schematic representation of the vertical hoist system according to the
invention, more particularly an elevator system. The vertical hoist system comprises
30 a lever 4, an elevator car 3 attached to the lever 4 through an attachment means 6, a
traction and load bearing means 8 having a first end 5 and a second end 7, an upper
sheave 1 and a lower sheave 2, and a traction machine (not depicted). The first end 5
of the traction and load bearing means 8 is attached to the lever 4, the traction and

load bearing means 8 is led first over the upper sheave 1 and then over the lower sheave 2 and then is attached to the lever 4 through its second end 7. The point of attachment of the first end 5 of the traction and load bearing means 8 is located on the lever 4 between the point of attachment 6 of the elevator car 3 and the point of attachment of the second end 7 of the traction and load bearing means 8. This construction results in the elevator car 3 creating a sufficient tension in the traction and load bearing means 8 and a sufficient traction on both sheaves 1 and 2. The end of the lever 4 on which the elevator car 3 is suspended is pulled downwards by the weight of the elevator car 3, thereby the other end of the lever 4 is pushed upwards, which results in the increase of the tension in the traction and load bearing means 8.

In this example the upper sheave 1 acts as a traction sheave and the lower sheave 2 acts as a diverting pulley. The elevator car 3 travels vertically in the hoistway and this vertical movement is linked to the movement of the traction and load bearing means 8 powered by the traction sheave 1 connected to the traction machine (not depicted). The tension in the traction and load bearing means 8 is achieved through the momentary weight of the elevator car 3 suspended on the lever 4, which creates tension in the traction and load bearing means 8 and the traction of traction sheave 1.

The traction machine can be equipped with a frequency converter and together with the traction sheave 1 is located in the upper part of the hoistway. This embodiment results in an accurate levelling of the elevator car 3 and the elimination of the vibrations. This in turn prolongs the traction machine lifespan and leads to the improvement of travel comfort during start and stopping of the elevator car 3.

CLAIMS

1. A vertical hoist system comprising
 - a lever (4),
 - 5 - an elevator car (3) attached to the lever (4) through an attachment means (6),
 - a traction and load bearing means (8) having a first end (5) and a second end (7),
 - an upper sheave assembly (1) and a lower sheave assembly (2), and
 - a traction machine,wherein the first end (5) of the traction and load bearing means (8) is attached to the
10 lever (4), the traction and load bearing means (8) is led over the upper sheave assembly (1) and over the lower sheave assembly (2) and attached to the lever (4) through its second end (7), wherein the point of attachment of the first end (5) of the traction and load bearing means (8) is located on the lever (4) between the point of attachment (6) of the elevator car (3) and the point of attachment of the second end
15 (7) of the traction and load bearing means (8).
2. The vertical hoist system according to claim 1, wherein the upper sheave assembly (1) acts as a traction sheave assembly and the lower sheave assembly (2) acts as a diverting pulley assembly.
20
3. The vertical hoist system according to claim 1, wherein the lower sheave assembly (2) acts as a traction sheave assembly and the upper sheave assembly (1) acts as a diverting pulley assembly.
- 25 4. The vertical hoist system according to claims 2 or 3, wherein the traction machine is equipped with a frequency converter.
5. The vertical hoist system according to any of the preceding claims, wherein the first end (5) and the second end (7) of the traction and load bearing means (8) are
30 attached on the lever (4) through a right-hand swiveling suspension and a left-hand swiveling suspension.

6. The vertical hoist system according to any of the preceding claims, wherein the attachment means (6) for attaching the elevator car (3) to the lever (4) is a swiveling suspension.

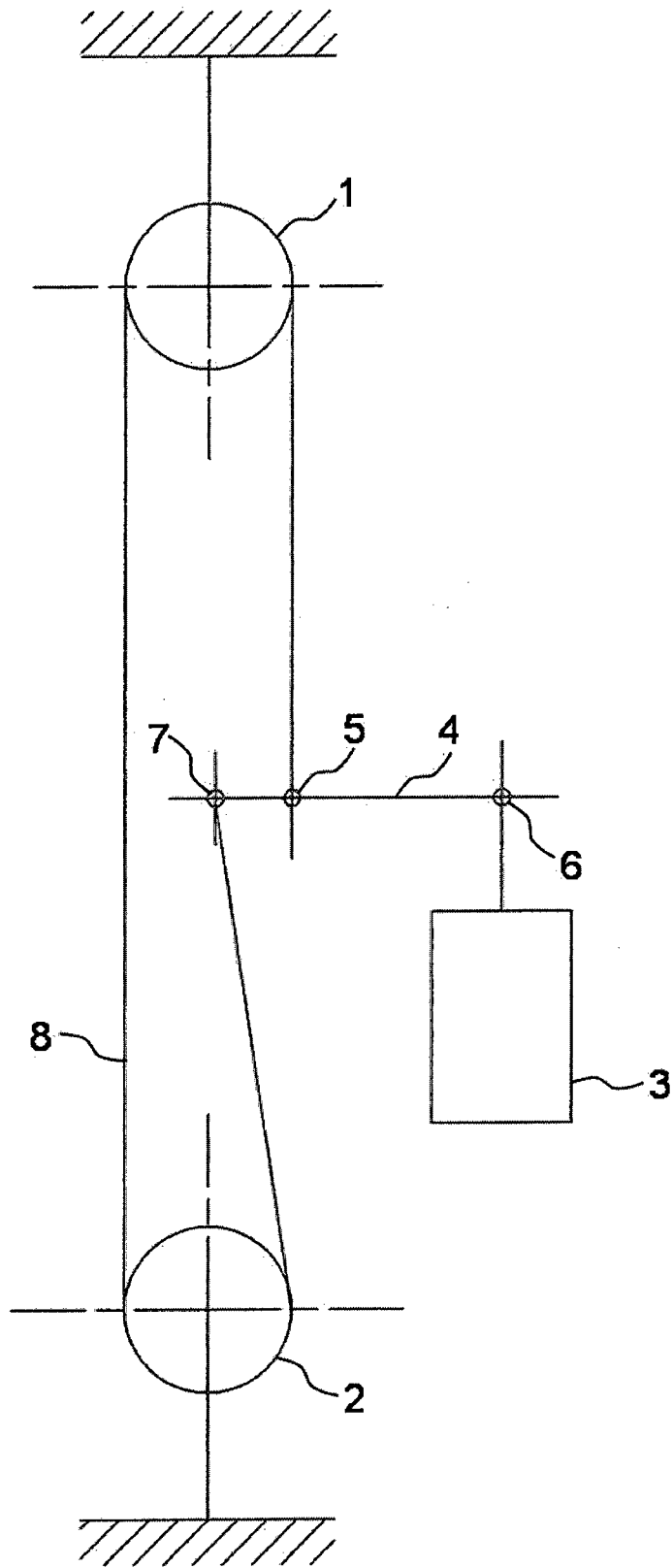


Fig. 1

INTERNATIONAL SEARCH REPORT

International application No PCT/CZ2011/000020
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A. CLASSIFICATION OF SUBJECT MATTER
INV. B66B11/00
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	pages 7-9 ; figure 1 -----	4-6
Y	wo 2006/095048 AI (KONE CORP [FI] ; SIIKONEN MARJA-LISA [FI] ; SORSA JANNE [FI] ; AULANKO ES) 14 September 2006 (2006-09-14)	4
A	page 18, lines 8-28; figure 4a -----	1-3 , 5, 6
Y	JP 6 234475 A (TOSHIBA CORP) 23 August 1994 (1994-08-23)	5, 6
A	abstract; figures 3,5 -----	1-4

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 27 September 2011	Date of mailing of the international search report 06/10/2011
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer <p style="text-align: center;">lul i ano, Emanuel a</p>
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Information on patent family members

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