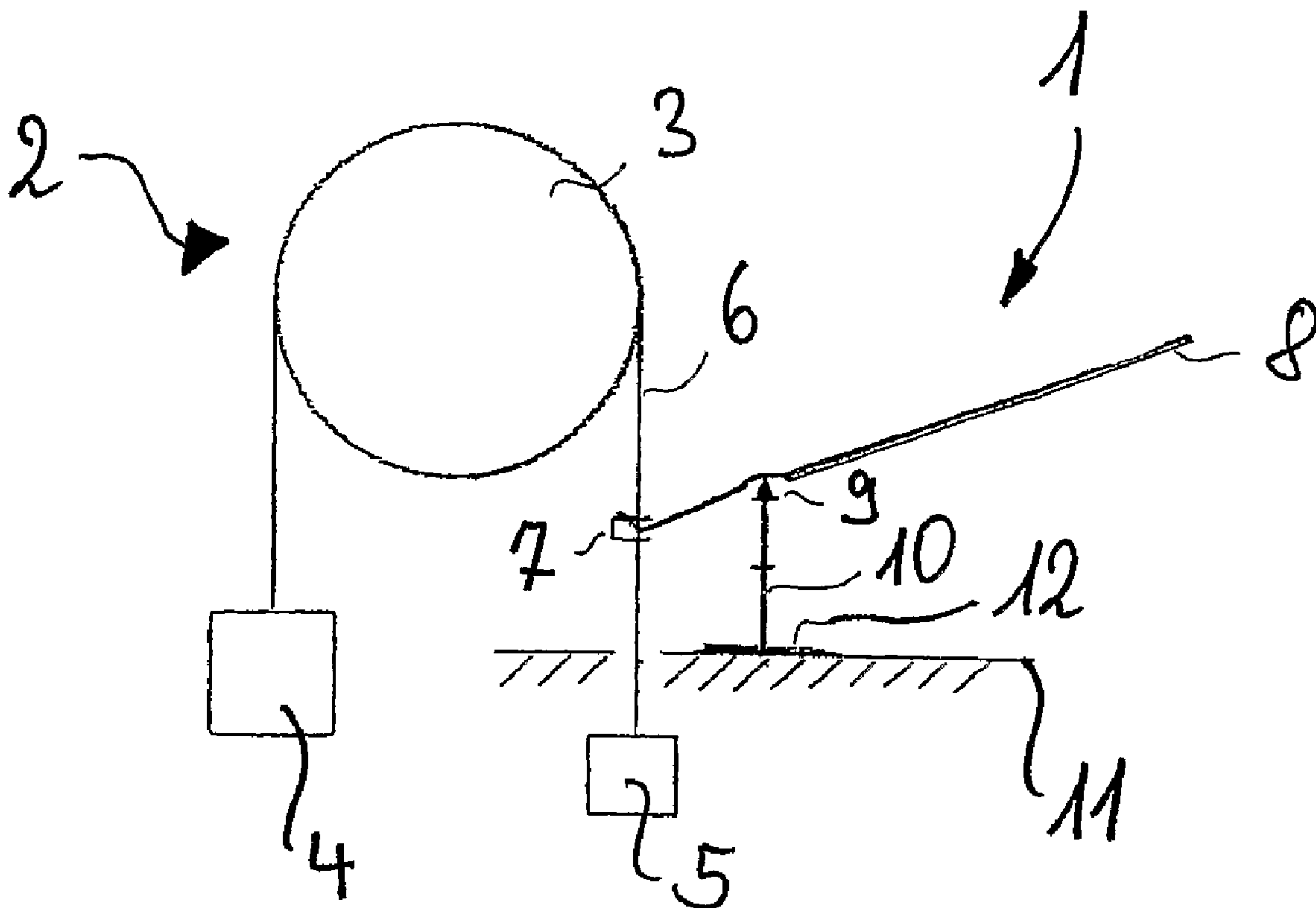




(86) Date de dépôt PCT/PCT Filing Date: 2005/06/14
(87) Date publication PCT/PCT Publication Date: 2005/12/29
(45) Date de délivrance/Issue Date: 2010/08/17
(85) Entrée phase nationale/National Entry: 2006/12/18
(86) N° demande PCT/PCT Application No.: EP 2005/006332
(87) N° publication PCT/PCT Publication No.: 2005/123561
(30) Priorité/Priority: 2004/06/17 (DE10 2004 029 133.0)

(51) Cl.Int./Int.Cl. *B66B 5/00* (2006.01)
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(54) Titre : PROCEDE DE MESURE A FORCE REDUITE POUR ENTRAINEMENTS DE TRACTION, EN PARTICULIER ENTRAINEMENTS A POULIE MOTRICE D'ASCENSEURS
(54) Title: FORCE-REDUCED MEASURING METHOD FOR TRACTION DRIVES, PARTICULARLY FRICTION PULLEY DRIVES FOR ELEVATORS



(57) Abrégé/Abstract:

The invention relates to a test lever system (1) for monitoring the traction behavior of a transport system (2), particularly an elevator system, comprising a test lever (8) which consists of a load arm (14) and a force arm (13). A discharge in the form of a monitoring force is introduced by means of the test lever (8), via a carrier cable securing device, into a cable which is to be tested



(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG(19) Weltorganisation für geistiges Eigentum
Internationales Büro(43) Internationales Veröffentlichungsdatum
29. Dezember 2005 (29.12.2005)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2005/123561 A1(51) Internationale Patentklassifikation⁷: **B66B 5/00**

(21) Internationales Aktenzeichen: PCT/EP2005/006332

(22) Internationales Anmeldedatum:
14. Juni 2005 (14.06.2005)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2004 029 133.0 17. Juni 2004 (17.06.2004) DE

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(81) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart): AE, AG, AL,

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(84) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Erklärung gemäß Regel 4.17:

— Erfindenerklärung (Regel 4.17 Ziffer iv) nur für US

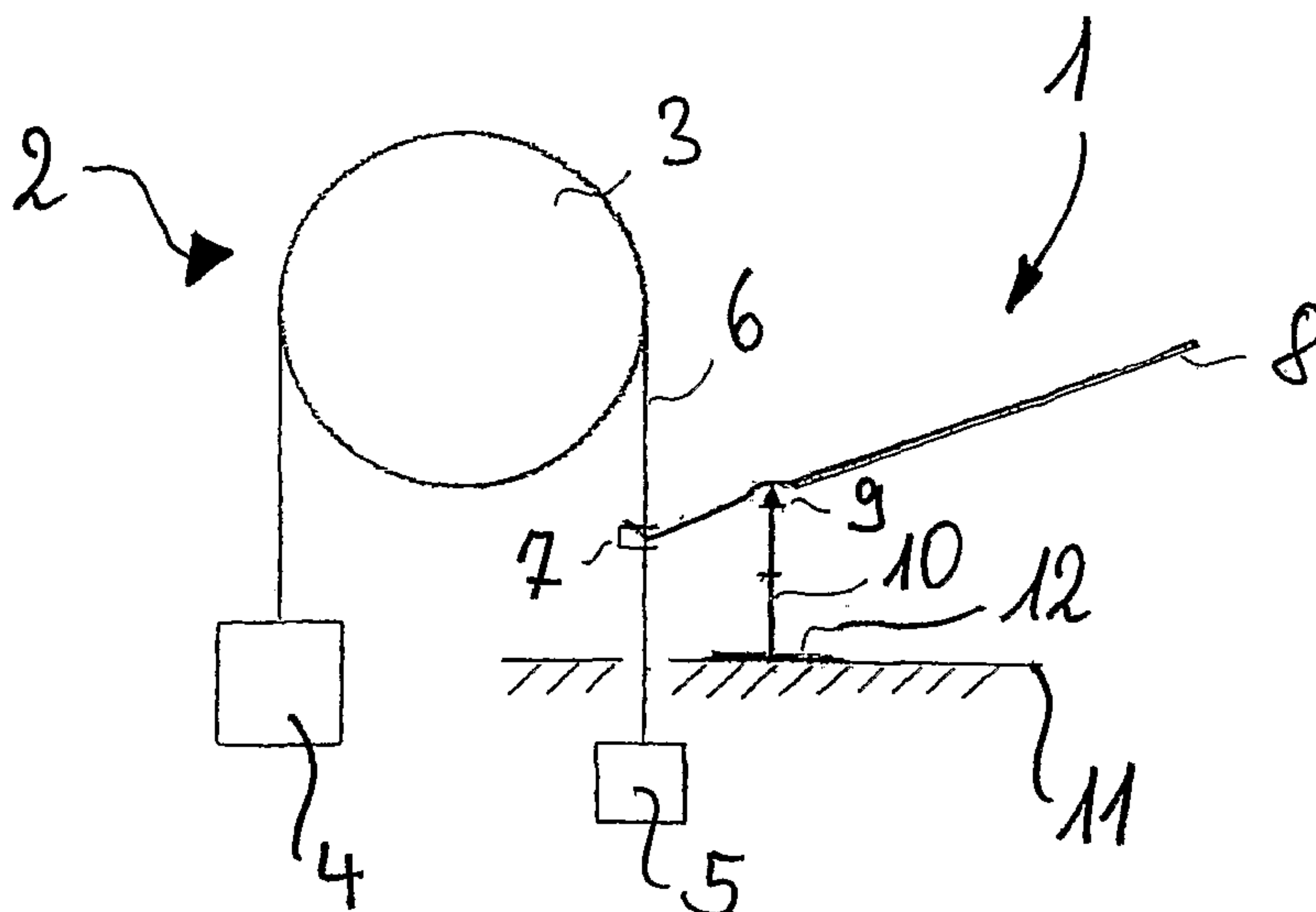
Veröffentlicht:

— mit internationalem Recherchenbericht
— vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen

[Fortsetzung auf der nächsten Seite]

(54) Title: FORCE-REDUCED MEASURING METHOD FOR TRACTION DRIVES, PARTICULARLY FRICTION PULLEY DRIVES FOR ELEVATORS

(54) Bezeichnung: KRAFTREDUZIERTES MESSVERFAHREN FÜR TRAKTIONSANTRIEBE, INSBESONDERE TREIBSCHEIBENANTRIEBE VON AUFZÜGEN



(57) Abstract: The invention relates to a test lever system (1) for monitoring the traction behavior of a transport system (2), particularly an elevator system, comprising a test lever (8) which consists of a load arm (14) and a force arm (13). A discharge in the form of a monitoring force is introduced by means of the test lever (8), via a carrier cable securing device, into a cable which is to be tested

(57) Zusammenfassung: Die vorliegende Erfindung betrifft ein Prüfhebelsystem (1) zur Überprüfung eines Traktionsverhaltens einer Förderanlage (2), insbesondere, einer Aufzugsanlage, mit einem Prüfhebel (8), der einen Lastarm (14) und einen Kraftarm (13) aufweist. Über eine Tragseilbefestigungsvorrichtung (7) wird eine Entlastung als Prüfkraft mittels des

Prüfhebels (8) in ein zu prüfendes Seil eingebracht.

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The present invention pertains to a test lever system for testing the traction behavior of a transport system, particularly an elevator system.

The traction behavior of elevator systems needs to be tested at regular intervals in order to ensure the safety of the system. To this end, for example, EP 39 09 72 B1 describes a method in which a distance sensor is used for measuring physical parameters that are determined in correlation with a motion sequence of the elevator by means of an evaluation unit. This method should also make it possible, in particular, to obtain information on the slipping resistance of the cable driven by a friction pulley.

The present invention makes it possible to test the traction behavior of a transport system, particularly an elevator system, by means of a test lever system.

The invention provides a test lever system for testing the traction behavior of a transport system, particularly an elevator system, in which the test lever system features a test lever with a load arm and a force arm, a carrying cable securing device with a receptacle for the load arm of the test lever, and a support for supporting the test lever, wherein the test lever system is realized in such a way that the interaction between the load arm and the carrying cable securing device causes relief of a carrying means to be tested, for example a cable, when a test force is exerted upon the force arm. It is also possible to test driving means other than a cable, such as chains, bands, belts or the like. The carrying means is subjected, in particular, to a test force in the form of relief by means of the test lever system.

The support for supporting the test lever serves, in particular, for creating a fixed point. This fixed point is at least connected to a hinge point and/or a fulcrum for the test lever. For example, the test lever may feature an element that is compatible with the support and not only creates a connection between the support and the test lever, but preferably also secures this connection. The support may simultaneously form the hinge point and the fulcrum.

This makes it possible to test, in particular, passenger elevators, warehouse elevators, freight elevators, building elevators, service elevators, passenger lifting mechanisms as well as other traction drives. The test lever system is particularly suitable for elevators that feature a friction pulley, around which a carrying means, particularly one or more cables, is at least partially guided, wherein an elevator car is suspended on one end of the carrying means and a counterweight is suspended on the other end. The test lever system can also be used in machines with an endless carrying means that is guided and driven by means of pulleys.

Embodiments of the invention are described below with reference to examples featuring one or more carrying cables. However, these embodiments can also be realized with other carrying means.

According to one additional development, the carrying cable securing device simultaneously encompasses a multitude of carrying cables. This makes it possible to perform a comprehensive functional test of all carrying cables. Alternatively, it is also possible to test only one individual carrying cable or to simultaneously test only a few selected carrying cables. The carrying cable securing device preferably can be separably arranged on the cable to be tested. Depending on the system, the carrying cable securing device may also be permanently connected to the cable to be tested, particularly in an inseparable fashion. The carrying cable securing device makes it possible, in particular, to exert a force upon the cables to be tested in such a way that a uniform relief of all cables is achieved. To this end, the carrying cable securing device makes it possible, in particular, to relieve the carrying cables in parallel. This can be realized, for example, with a carrying cable securing device that is composed of several parts. This makes it possible to utilize and secure the carrying cable securing device on the carrying cables differently depending on the respective installation conditions.

The support serving, for example, as a fulcrum for the test lever preferably forms part of a telescopic support. The leg region of such a telescopic support makes it possible to ensure that the test lever system is sufficiently stable and supported in a non-slip fashion. In addition, the height of the support can be adjusted with such a telescopic support. The height of the support can be adjusted with respect to the installation conditions of the elevator system, as well as with respect to the ease of operation. For example, the telescopic support may feature a leg region with a three-point support, wherein each of these support points can be adjusted individually. Another option consists of mounting the telescopic support on installations or similar stationary structures. This can be realized, for example, with the aid of screws, clamps or the like.

A suitable test lever is disclosed, for example, in DE 103 231 75, particularly the design of the test lever, the sensors used, the test lever attachments, and the devices connected to the test lever.

The test lever system may be realized, in particular, in the form of a mobile system. It is preferred that the test lever system can be stowed in a single carrying case. This enables an individual inspector to transport the test lever system to the test site. In addition, an individual inspector is able to test a transport system of this type without requiring further assistance. The invention proposes, in particular, that the carrying case accommodate the test lever, the carrying

cable securing device and the telescopic support, as well as the tools required for the assembly of the system. A transmitting/receiving unit, a data storage unit and/or a mobile computer can also be accommodated in the carrying case.

According to another embodiment, the dimensions of the test lever are variable. This variability makes it possible to adapt the test force to be exerted to the inspector utilizing the test lever. Due to this measure, excessively high test forces are not required for the traction measurement. On the contrary, it suffices to subject the test lever to the forces exerted by the hand of a person.

According to another aspect of the invention, a method is provided for testing the traction behavior of a transport system, particularly an elevator system. The method is carried out with a test lever that is secured on at least one carrying cable on a carrying means side and causes relief of the carrying cable when a test force is exerted upon the test lever. In this case, the carrying means side is the side that is connected to a cage, an elevator car or another device for transporting a load.

A carrying cable securing device is preferably attached to the carrying cable to be tested, wherein the test lever engages into the carrying cable securing device in order to exert the test lever force. The test lever force causes relief of the carrying cable. This makes it possible to determine whether the respective system has a sufficient traction behavior, namely by increasing the test force until a minimum value is reached without causing the carrying cable being tested to slip. It is therefore also possible, in particular, to test a multitude of carrying cables or all carrying cables simultaneously. To this end, the carrying cable securing device is fixed, for example, on a multitude of carrying cables and these carrying cables are subsequently relieved by means of the test lever. It is preferred that all carrying cables be relieved equally. However, is also possible to realize varying relief by exerting different forces upon the carrying cables.

According to one additional development, the test force is measured and a positive measurement is automatically acknowledged when a predetermined test force is reached. A positive measurement is defined in that a previously input or calculated minimum force is established. A sufficient traction behavior of the transport system and therefore a positive measurement is acknowledged if this minimum force is reached or exceeded during the measuring process. It is therefore preferable to determine the minimum force to be exerted upon the specific system by means of the test lever before the test is carried out.

According to another aspect of the invention, a data carrier with a computer program is provided for a method for testing the traction behavior of a transport system, particularly an elevator system, and/or for a test lever of the above-described type. The data carrier preferably forms part of a data-processing unit, particularly a mobile computer. The computer program contains an algorithm that makes it possible to determine the traction behavior based on at least

one of the following parameters: safety constant, carrying capacity of an elevator car, counterweight, number of carrying means, particularly carrying cables, and/or transmission ratio of the suspension. In this case, the minimum force for relief of at least one carrying cable is calculated in order to test the traction behavior.

The transmission ratio of the suspension describes the arrangement of carrying means, particularly carrying cables, relative to a drive and their attachment to stationary structures. Consequently, the minimum force for realizing relief of either one or all carrying cables can be determined with a corresponding safety margin beforehand for each specific transport system with the aid of a formula. This value of the minimum force may also be input into the test lever, particularly transmitted thereto automatically, for example via a radio link. If designed accordingly, the test lever may display whether or not the required minimum force for acknowledging a positive measurement was reached while the test lever was subjected to the test force. In this case, the minimum force may also be subject to a safety margin. It may also be stipulated that the minimum force needs to be exerted over a minimum time period (see script, page 4 below). This enables the inspector to estimate when a measurement can be aborted at the test site. The invention furthermore proposes that information on the measurement can be recorded and stored, particularly by means of the test lever. These measuring values, in particular, may also be evaluated directly or transmitted to an evaluation unit. The transmission can be realized, for example, via a corresponding interface on the test lever or a radio link. This makes it possible, in particular, to automate the evaluation such that not only an individual measurement, but also a multitude of individual measurements can be correlated. In addition, long-term behavior can be generated from the accumulated data.

Other advantageous embodiments and additional refinements are specified in the following figures. However, the characteristics are not limited to the individual embodiments. On the contrary, these characteristics can be combined with earlier-described characteristics in order to realize additional refinements. Shown are:

- Figure 1, a test lever system on a transport system;
- Figure 2, an enlarged detail of Figure 1 with a first cable securing device;
- Figure 3, a second cable securing device;
- Figure 4, a third cable securing device;
- Figure 5, a detail of a test lever, and
- Figure 6, an overview of a compact mobile test lever system.

Figure 1 schematically shows an exemplary test lever system 1 for a transport system 2. The transport system 2 features a friction pulley 3, wherein a counterweight 4 is secured on one side of said friction pulley and an elevator car 5 to be moved is secured on the other side of the friction pulley with the aid of a carrying means, particularly in the form of a carrying cable 6. A

fixing element in the form of a first carrying cable securing device 7 is arranged on the carrying means side of the carrying cable 6. The first carrying cable securing device 7 on the carrying cable 6 preferably can be attached in a non-destructive fashion and removed again after the measurement. A test lever 8 can engage into the first carrying cable securing device 7. To this end, the test lever 8 may have a corresponding shape. The test lever 8 is supported on a support 9 for the test lever 8 that forms a fulcrum for the test lever 8. The support 9 is preferably arranged on a telescopic support 10, wherein the telescopic support 10 features a leg region 12 that can be adapted to the respective floor space 11. The test lever 8 may have, in particular, such a geometry that the support 9 is prevented from slipping relative to the test lever 8. The support 9 divides the test lever 8 into a load arm 14 and a force arm 13.

Figure 2 shows an enlarged detail of Figure 1, in which the test lever 8 rests on the support 9. The force arm 13 and the load arm 14 make it possible to divide the test lever 8 into a load lever a and a force lever b. For this purpose, the test lever 8 features, in particular, a test lever head section 15, for example, of the type described in DE 103 23 175. The first carrying cable securing device 7 features a receptacle 16 for the load arm 14. The geometry of the load arm 14 is preferably realized such that it is able to engage into the receptacle 16. To this end, the load arm 14 can be connected, particularly in a separable fashion, to the first carrying cable securing device 7, e.g., by means of a screw connection, a clamping connection or a snap-on connection. Due to this measure, the first carrying cable securing device 7 can also serve as a guideway, preferably a bearing, for the test lever 8. The first carrying cable securing device 7 may be constructed in the form of a clamping system or a screw-type system and consist of a first component 17 and a second component 18. These components can be connected to one another, for example, with a screw system 19 in order to exert a clamping force on the carrying cable 6. The carrying cable 6 can be subjected to a lever force F_2 by exerting a manual force F_1 . The support 9 forms a fulcrum for the test lever 8 and the attached test lever head section 15. The manual force F_1 is increased in accordance with the transmission ratio b/a and is exerted upon the carrying cables 6. The test lever detects the instantaneous force in the load arm, preferably by means of integrated evaluation electronics. However, it is also possible to forward measuring values to an evaluation unit realized separately of the test lever 8 via an interface in order to obtain information on the measurement or other parameters.

Figure 3 shows a second carrying cable securing device 20 that was mounted on a multitude of carrying cables 6. A bridge element 21 extends over the carrying cables 6, wherein each carrying cable 6 is individually connected to the bridge element 21. This is preferably realized with a screw system, for example, according to Figure 2. The bridge element 21 can be balanced in such a way that all carrying cables 6 are equally relieved when a force is exerted via

the bridge element 21. To this end, the bridge element 21 features a coupling element 22 that is arranged, in particular, in a displaceable or variable fashion. For example, the coupling element 22 features a receptacle 16 for a load arm of the test lever. The receptacle 16 may be realized, for example, such that the test lever engages therein in a prong-like fashion. The coupling element 22 is adjusted by means of an adjusting device 23, for example, with respect to its height as well as along the bridge element 21 such that the force is exerted uniformly. The coupling element 22 may also be arranged on the other side of the bridge element 21 referred to the carrying cables 6. Due to this measure, the test lever is able to engage centrally on an odd number of carrying cables that are equidistantly spaced apart from one another.

Figure 4 shows a third carrying cable securing device 24. Three carrying cables 6 are coupled to one another by means of the bridge element 21. However, the coupling element 22 with the receptacle 16 connects force transmitting means 25 to one another in such a way that the carrying cables 6 can be relieved equally. In this case, the bridge element 21 serves as the force transmitting means because it supports lateral forces and only makes it possible to exert the test force for relief of the carrying cables 6 via the connecting means 26 that clamp the carrying cables 6, in particular, in order to realize the transmission of the test force and said relief.

Figure 5 shows a detail of the test lever 8. For example, signaling means 27 are arranged on the test lever 8. These signaling means may consist, for example, of LEDs that make it possible to indicate whether a minimum force exerted upon the test lever is already reached or said minimum force was not yet reached and the traction behavior therefore cannot be acknowledged yet. In addition to a display option, for example, in the form of the signaling means 27, the test lever 8 may also feature an input option 28. Data may be input, for example, with the aid of a keypad or other control panels. It is possible, in particular, to select from a pre-installed menu, particularly a pre-installed menu for specific transport systems that contains the predetermined minimum forces to be reached. The test lever 8 may furthermore feature one or more interfaces for wire-bound or wireless data transmission.

Figure 6 schematically shows an example of a carrying case 29. The components of the test lever system can be accommodated in the carrying case 29 in such a way that an individual operator is able to transport the test lever system to the test site, as well as assemble the system and carry out a functional test of the traction behavior of the transport system. For example, the test lever, a base for the support, particularly in the form of a telescopic support, at least one carrying cable securing device, the corresponding tools and other materials can be accommodated in the carrying case 29. The system may also comprise, for example, a mobile data-processing device 30. A radio transmitter 31 may be assigned to this data-processing device. This radio transmitter makes it possible to realize the remote transmission of data recorded on the respective transport system with the aid of the test lever system. Consequently, other data,

measuring sequences and the like can be recorded and stored. In addition, information on the long-term behavior of the transport system can be obtained in this fashion. This furthermore makes it possible to estimate the presumed future state of the transport system. Before the test begins, a stored program is able to determine the minimum force to be reached in each specific transport system during the test of its traction behavior. This value can be transmitted to the test lever via an interface or in a wireless fashion and stored therein. During the subsequent test, the value that is specifically adapted to the respective transport system can be monitored while the manual force is exerted and the exceeding of this minimum value can be displayed accordingly.

The invention makes it possible to test the traction behavior of different mechanical systems, particularly transport systems or elevator systems in which system components are moved in the horizontal, vertical or any arbitrary direction by means of one or more drive elements. The present invention can be used, in particular, for testing transport systems or machines, particularly elevator systems in which significantly higher carrying or tractive forces occur and which could only be tested with extremely large and therefore heavy test equipment until now. The test can be carried out in a time-efficient fashion due to the ability to test individual carrying means, for example carrying cables, as well as several carrying means or an entire carrying means suspension simultaneously.

Claims

1. A test lever system for testing the traction behavior of a transport system with a test lever that features a load arm and a force arm, a carrying means securing device having a receptacle for the load arm of the test lever, and a support for supporting the test lever in such a way that the interaction between the load arm and the carrying means securing device causes relief of one or more carrying means to be tested when a test force is exerted upon the force arm.

2. The test lever system according to Claim 1, wherein that the support forms part of a telescopic support.

3. The test lever system according to Claim 1, wherein the carrying means securing device simultaneously encompasses a multitude of carrying means.

4. The test lever system according to any one of Claims 1 to 3, wherein the test lever system is storable in a carrying case.

5. A method for testing the traction behavior of a transport system with a test lever that is connected to at least one carrying means on a carrying means side and causes relief of the carrying means when a test force is exerted upon the test lever.

6. The method according to Claim 5, wherein a carrying means securing device is arranged on at least one carrying means and wherein the test lever engages into said carrying means securing device.

7. The method according to Claim 5 wherein a carrying means securing device is secured on a multitude of carrying means and these carrying means are then relieved simultaneously by means of the test lever.

8. The method according to any one of Claims 5 to 7 wherein the test force is measured and a positive measurement is automatically acknowledged when a predetermined minimum force is at least reached.

9. The method according to Claim 8, wherein the minimum force is determined before the test.

10. A test lever system according to claim 1 or 2 wherein the transport system is an elevator system.

11. A test lever system according to any one of claims 1, 2 and 10 wherein said carrying means securing device is a carrying cable securing device.

12. A test lever system according to claim 11 wherein the interaction between the load arm and the carrying cable securing device causes relief of one or more of carrying cables to be tested.

13. A test lever system according to claim 11 wherein the carrying cable securing device simultaneously encompasses a multitude of carrying cables.

14. A method according to claim 5 wherein said transport system is an elevator system and said at least one carrying means is a carrying cable.

15. A method according to claim 6 wherein said carrying means securing device is a carrying cable securing device and at least one carrying means is a carrying cable.

16. A method according to claim 7 wherein said carrying means securing device is a carrying cable securing device and said multitude of carrying means are carrying cables.

17. Data carrier in form of a data-processing device of a mobile computer, said data carrier including a computer program for the data-processing device containing an algorithm to determine traction behavior based on at least one of the following parameters: safety constant, carrying capacity of an elevator car, counterweight, number of carrying means, and transmission ratio of a suspension in order to determine a minimum force for realizing a relief of at least one carrying means during a test of the traction behavior having access to a test lever system for testing the traction behavior of a transport system.

18. The data carrier according to Claim 17, wherein the computer program utilizes at least the following parameters to be input: the safety constant, the carrying capacity of an elevator car, the counterweight, the number of carrying means, and the transmission ratio of the suspension.

