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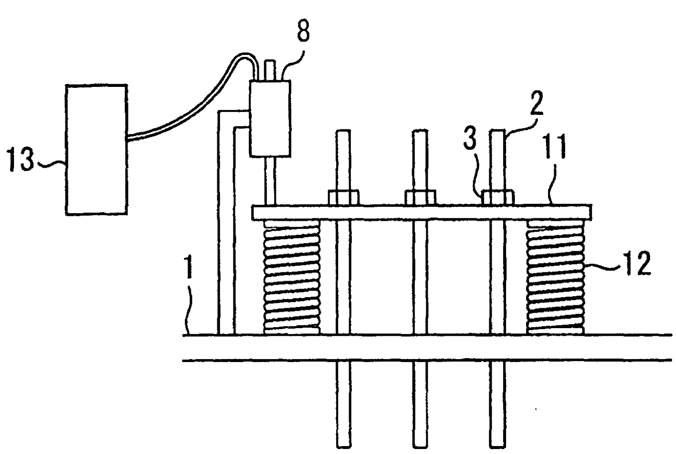
(54) **ELEVATOR CAGE-IMPOSED WEIGHT DETECTOR**

(57) The present invention aims at providing an elevator car load sensor of simple construction capable of detecting the weight of an elevator car with superior accuracy.

The weight of a car acting on respective cable anchors 2 is collectively supported by elastic members 12 by way of a cable anchor plate 11. Even when the number of cable anchors 2 is increased, there is no necessity of increasing the number of elastic members 2 and the number of detectors 8. Consequently, a mechanism of detecting the weight of the car can be simplified and readily set up. Further, expenses to be incurred by a car weight detection mechanism can be saved.

A plurality of cable anchors 2 are engaged with a single cable anchor plate 11. Accordingly, there is prevented occurrence of inclination of cable anchors, which would otherwise be caused by the weight of the car. Further, there can be prevented occurrence of a drop in the accuracy of detection of weight of the car, which would otherwise be caused by inclination of the cable anchors 2.

Fig. 1



EP 1 357 072 A1

Description

Technical Field

[0001] The present relates to an elevator car load sensor for detecting the weight of a car whose load changes during the course of operation.

Background Art

[0002] Fig. 9 shows the configuration of an example related-art elevator car load sensor and is a front view conceptually showing a joint of a main cable suspending a vertically-movable member. As shown in Fig. 9, reference numeral 1 designates a cable anchor engagement member which is formed from a member for supporting the load of an elevator car (not shown but situated in a lower position outside the drawing); for example, a cable anchor beam provided in a machinery room (not shown) of an elevator system.

[0003] Reference numeral 2 designates a plurality of cable anchors which are coupled to main cables suspending an elevator car, are clearance-fitted into the cable anchor engagement member 1, and are arranged side by side. Reference numeral 3 designates a nut that is screw-engaged to the end of each of the cable anchors 2; 4 designates a spring bearing which is clearance-fitted to the end of each of the cable anchors 2 and is provided on the side of the nut 3 facing the anchor cable engagement member 1; and 5 designates a compressed coil spring which is clearance-fitted to each of the cable anchors 2 and interposed between the cable anchor engagement member 1 and the spring bearing 4.

[0004] Reference numeral 6 designates a coupling tube which is fitted around each of the cable anchors 2 and clearance-fitted into the anchor cable engagement member 1, and one end of the coupling tube 6 is connected to the spring bearing 4. Reference numeral 7 designates a detection plate into which all the cable anchors 2 are inserted with clearance and which is connected to the other end of each of the coupling tubes 6. Reference numeral 8 designates a detector constituted of a differential transformer disposed on a stationary member. Reference numeral 9 designates a transmission line which is connected at one end thereof to an operating section of the detector 8, is coiled around a pulley 10 rotatably attached to the stationary member, and is connected at the other end thereof to the detection plate 7.

[0005] The related-art elevator load sensor is constituted in the above-described manner. The cable anchors 2 connected to the main cables suspending the elevator car are supported by the cable anchor engagement member 1 via the respective compression coil springs 5. The compression springs 5 are compressed in accordance with the load of the elevator car; that is, by an amount corresponding to a sum of the self-weight of the elevator car and a combined weight of passenger(s) in the elevator car. The detection plate 7 is displaced in accordance with the power of the pressure by the compression springs 5. The detector 8 outputs an output corresponding to the amount of displacement in the detection plate 7. In accordance with an output from the detector 8, vertical movement of the elevator car is controlled.

[0006] In relation to the related-art elevator car load sensor, each of the cable anchors 2 is provided with the compression coil springs 5. In this case, one detection plate 7 is provided for three cable anchors 2, and one detector 8 is provided for the detection plate 7. As mentioned above, a complicated mechanism is constructed for detecting the weight of an elevator car, thus adding to manufacturing costs. Another problem is a deficiency in space for setting up hardware, thus posing difficulty in installing the hardware. In accordance with the inclinations of the respective cable anchors 2, an error in the amount of displacement of the detection plate 7 increases, thus deteriorating the accuracy of detection of weight of an elevator car.

Disclosure of the Invention

[0007] The present invention has been conceived to solve the above-described problems and aims at providing an elevator car load sensor of simple construction capable of detecting the weight of an elevator car with superior accuracy.

[0008] In an elevator car load sensor according to the present invention, main cables supporting a car are coupled with respective cable anchors which are arranged side by side. The cable anchors are inserted into a cable anchor engagement member. Insertion ends of the cable anchors are coupled to a cable anchor plate. Elastic members which become deformed in accordance with the weight of the car are interposed between the cable anchor engagement member and the cable anchor plate. The elastic members are arranged symmetrically with reference to the cable anchors when viewed in a horizontal direction. Moreover, there is provided a detector which produces an output corresponding to the amount of displacement of the cable anchor plate, and an operating section of the detector is engaged with the cable anchor plate.

[0009] A plurality of cable anchors are engaged with one cable anchor plate, and the cable anchor plate is resiliently supported by the elastic members arranged symmetrically with reference to the cable anchors. The displacement of the cable anchor plate is detected by the detector without being affected by inclinations of the cable anchors. Hence, the configuration of the sensor can be simplified, and the accuracy in detection of the car's weight can be improved.

Brief Description of the Drawings

[0010]

Fig. 1 is a view showing a first embodiment of the present invention; that is, a front view conceptually showing joints of main cables suspending a vertically-movable member;
Fig. 2 is a view showing a second embodiment of the present invention; that is, a front view conceptually showing joints of main cables suspending a vertically-movable member;
Fig. 3 is a view showing a third embodiment of the present invention; that is, a front view conceptually showing joints of main cables suspending a vertically-movable member;
Fig. 4 is a view showing a fourth embodiment of the present invention; that is, a front view conceptually showing joints of main cables suspending a vertically-movable member;
Fig. 5 is a view showing a fifth embodiment of the present invention; that is, a front view conceptually showing joints of main cables suspending a vertically-movable member;
Fig. 6 is a view showing a sixth embodiment of the present invention; that is, a front view conceptually showing joints of main cables suspending a vertically-movable member;
Fig. 7 is a view showing a seventh embodiment of the present invention; that is, conceptually showing the routing of a main cable in a hoistway for an elevator;
Fig. 8 is a view showing an eighth embodiment of the present invention; that is, conceptually showing the routing of a main cable in a hoistway for an elevator; and
Fig. 9 is a view showing a related-art elevator car load sensor; that is, a front view conceptually showing joints of main cables suspending a vertically-movable member.

Best Modes for Implementing the Invention

[0011] In order to describe the present invention in more detail, an embodiment of the present invention will now be described by reference to Fig. 1. Fig. 1 shows a first embodiment of the invention and is a front view conceptually showing joints of main cables suspending a vertically-movable member.

[0012] As shown in Fig. 1, reference numeral 1 designates a cable anchor engagement member (or a cable anchor plate) for supporting an elevator car (not shown but located in a lower position outside the drawing). The cable anchor engagement member 1 is formed from, e. g., a cable anchor beam provided in a machinery room (not shown) of an elevator system.

[0013] Reference numeral 2 designates a plurality of cable anchors (or rope shackles). A plurality of main cables 2A supporting an elevator car are coupled to the respective cable anchors 2, are clearance-fitted into the cable anchor engagement member 1, and are provided side by side. Reference numeral 3 designates nuts screwed to insertion ends of the respective cable anchors 2. Reference numeral 11 designates a cable anchor plate (or detection plate) which is interposed between the cable anchor engagement member 1 and the nuts 3 and into which the cable anchors 2 arranged side by side are clearance-fitted.

[0014] Reference numeral 12 designates elastic members (e.g., coil springs). The elastic members 12 are interposed between the cable anchor engagement member 1 and the cable anchor plate 11. The elastic members 12 are disposed symmetrically with respect to the cable anchors 2 when viewed in a horizontal direction and become deformed in accordance with the weight of the car. The elastic members 12 are provided on, e.g., respective ends of the cable anchor plate 11. Consequently, the cable anchor plate 11 becomes linearly and vertically deformed in accordance with the weight of the car.

[0015] Reference numeral 8 designates a detector constituted of a differential transformer disposed on a stationary member, and an operating section of the detector 8 is engaged with the cable anchor plate 11 and operates through forward and backward displacement actions. Reference numeral 13 designates a control circuit which is connected to the detector 8 and acquires, in real time, an output from the detector 8 responsive to the amount of displacement of the anchor plate 11 corresponding to the weight of the car, to thereby control vertical movement of the car. For instance, an output from the detector 8 can be utilized for detecting overload by way of the control circuit 13, regulating motor torque on startup (an improvement in ride comfort), and group management (an improvement in service).

[0016] In relation to the elevator car load sensor constructed in the above-described manner, the weight of the elevator car acting on each of the cable anchors 2 is collectively supported by the plurality of elastic members 12 by way of the single cable anchor plate 11. In other words, the loads exerted on the respective main cables 2A (e.g., ropes) are temporarily summed by the cable anchor plate 11. The thus-summed load is distributed to the respective springs. For this reason, if the number of cable anchors 2 or ropes is increased, there is no necessity for increasing the number of elastic members 12 and detectors 8.

[0017] Consequently, a mechanism for accurately sensing the weight of a car can be simplified and readily installed, and savings can be realized in the cost of the car weight sensing mechanism. Since the plurality of cable anchors 2 are engaged with the single cable anchor plate 11, no inclination arises in the cable anchors 2, which would otherwise be caused by the weight of the car. Hence, there can be prevented occurrence of a drop in the accuracy of detection of weight of the car, which would otherwise be caused by inclinations of the cable anchors 2. Hence, an operation for vertically moving the car can be controlled normally.

[0018] In order to describe the present invention in more detail, another embodiment of the present invention will be described by reference to Fig. 2. Fig. 2 is a diagram showing a second embodiment of the present invention; that is, a front view conceptually showing joints of the main cables supporting a vertically-movable member.

[0019] In Fig. 2, those reference numerals which are identical with those provided in Fig. 1 correspond to the same elements. Reference numeral 14 designates a detector which is composed of a potentiometer, is provided on a stationary member, and operates through pivotal displacement. An operating section of the detector is engaged with the cable anchor plate 11 via a transmission line 9 (e.g., wire). By means of such a construction, straight displacement of the cable anchor plate 11 is converted into a rotational angle by means of taking up the transmission line 9, and the detector 14 constituted of a potentiometer detects the angular displacement.

[0020] Even in the elevator car load sensor constructed in the manner set forth, the plurality of cable anchors 2 are engaged with the cable anchor plate 11 supported by the plurality of elastic members 12. Displacement of the cable anchor plate 11 due to the weight of the car is detected by the detector 14. Consequently, although detailed descriptions are omitted, the embodiment shown in Fig. 2 also yields the same advantage as that yielded in the embodiment shown in Fig. 1.

[0021] In order to describe the present invention in more detail, yet another embodiment of the present invention will be described by reference to Fig. 3. Fig. 3 is a diagram showing a third embodiment of the present invention; that is, a front view conceptually showing joints of main cables supporting a vertically-movable member.

[0022] In Fig. 3, those reference numerals which are identical with those provided in Fig. 1 correspond to the same elements. Reference numeral 15 designates a pivotal transmission mechanism which is provided on a stationary member and equipped with the transmission line 9 engaged with the cable anchor plate 11. Reference numeral 8 designates a detector constituted of an acceleration sensor which operates while being connected to the pivotal transmission mechanism 15. By means of such a construction, straight displacement of the cable anchor plate 11 is converted into a rotational angle by means of taking up the transmission line 9, and the detector 8 constituted of an acceleration sensor detects the angular displacement.

[0023] Even in the elevator car load sensor constructed in the manner set forth, the plurality of cable anchors 2 are engaged with the cable anchor plate 11 supported by the plurality of elastic members 12. Displacement of the cable anchor plate 11 due to the weight of the car is detected by the detector 8. Consequently, although detailed descriptions are omitted, the embodiment shown in Fig. 3 also yields the same advantage as that yielded in the embodiment shown in Fig. 1.

[0024] In order to describe the present invention in more detail, still another embodiment of the present invention will be described by reference to Fig. 4. Fig. 4 is a diagram showing a fourth embodiment of the present invention; that is, a front view conceptually showing joints of main cables supporting a vertically-movable member.

[0025] In Fig. 4, those reference numerals which are identical with those provided in Figs. 1 and 2 correspond to the same elements. Reference numeral 16 designates an enlargement transmission mechanism provided. The enlargement transmission mechanism 16 comprises a pillar-like member 17 provided on the stationary member in an upright position; an arm member 18 whose longitudinally-intermediate point is pivotally attached to the pillar-like member 17; a first transmission line 9 which is connected to one end of the arm member 18 and engaged with the cable anchor plate 11; and a second transmission line 19 connected to the other end of the arm member 18 and to a detector 14, wherein the second transmission line 19 is spaced a much longer distance from the pivotally-attachment point of the arm member 18 than is the first transmission line 9 is. By means of such a structure, displacement of the cable anchor plate 11 is enlarged by the enlargement transmission mechanism 16, and the detector 14 constituted of a potentiometer detects the thus-enlarged displacement.

[0026] Even in the elevator car load sensor having the foregoing construction, the plurality of anchor cables 2 are engaged with the cable anchor plate 11 by means of the plurality of elastic members 12. The displacement of the cable anchor plate 11 due to the weight of the car is detected by the detector 14 by way of the enlargement transmission mechanism 16. Consequently, although detailed descriptions are omitted, the embodiment shown in Fig. 4 also yields the same advantage as that yielded in the embodiment shown in Fig. 1.

[0027] In order to describe the present invention in more detail, another embodiment of the present invention will be described by reference to Fig. 5. Fig. 5 is a diagram showing a fifth embodiment of the present invention; that is, a front view conceptually showing joints of main cables supporting a vertically-movable member.

[0028] In Fig. 5, those reference numerals which are identical with those provided in Figs. 1 and 4 correspond to the same elements. Reference numeral 20 designates a rotary enlargement transmission mechanism. The rotary enlargement transmission mechanism 20 comprises a pillar-like member 17 provided on the stationary member in an upright position; a smaller pulley 21 pivotally attached to the pillar-like member 17; a larger pulley 22 fixed to the smaller pulley 21; a first transmission line 9 (e.g., a wire) which is at one end coupled to the smaller pulley 21 and at the other end engaged with the cable anchor plate 11; and a second transmission line 19 (e.g., a wire) which is at one end coupled to the larger pulley 22 and at the other end connected to the detector 14. By means of such a structure, displacement of the cable anchor plate 11 is enlarged by way of the wires and the two pulleys 21, 22 which are of different diameters, and the detector 14 detects the thus-enlarged displacement, thereby enabling accurate detection of minute displacement.

[0029] Even in the elevator car load sensor constructed in the manner as mentioned above, the plurality of anchor cables 2 are engaged with the cable anchor plate 11 by means of the plurality of elastic members 12. The displacement of the cable anchor plate 11 due to the weight of the car is enlarged by way of the rotation enlargement mechanism 20, and the thus-enlarged displacement is detected by the detector 14. Consequently, although detailed descriptions are omitted, the embodiment shown in Fig. 5 also yields the same advantage as that yielded in the embodiment shown in Fig. 1.

[0030] In order to describe the present invention in more detail, another embodiment of the present invention will be described by reference to Fig. 6. Fig. 6 is a diagram showing a sixth embodiment of the present invention; that is, a front view conceptually showing joints of the main cables supporting a vertically-movable member.

[0031] In Fig. 6, those reference numerals which are identical with those provided in Fig. 2 correspond to the same elements. Reference numeral 23 designates elastic members which are each constituted of a compression coil spring, are fitted around the cable anchors 2 disposed on respective ends of the cable anchor plate 11, are interposed between the cable anchor engagement member 1 and the cable anchor plate 11, are disposed symmetrically with reference to the positions of the cable anchors 2 when viewed in horizontal direction, and are compressed in accordance with the load of the car. In other words, the elastic members 23 are provided in the same positions as those of the cable anchors 2. As a result, the entirety of the elevator car load sensor is made compact, thereby realizing space savings. Further, the moment exerted on the cable anchor plate 11 is diminished, and hence the structure member can be made thin, thereby realizing weight reduction and saving of raw materials.

[0032] Even in the elevator car load sensor constructed in the manner as mentioned above, the plurality of anchor cables 2 are engaged with the cable anchor plate 11 supported by the elastic members 12. The displacement of the cable anchor plate 11 due to the weight of the car is detected by the detector 14. Consequently, although detailed descriptions are omitted, the embodiment shown in Fig. 6 also yields the same advantage as that yielded in the embodiment shown in Fig. 1. The elastic members 23 are fitted around the cable anchors 2 disposed at the respective ends of the cable anchor plate 11. For this reason, the space for setting up the load sensor can be saved with reference to the horizontal direction, and installation of the load sensor can be simplified.

[0033] In order to describe the present invention in more detail, another embodiment of the present invention will be described by reference to Fig. 7. Fig. 7 is a diagram showing a seventh embodiment of the present invention; that is, conceptually showing extension of main cables in the hoistway of an elevator system. In other respects, the elevator car load sensor shown in Fig. 7 is constructed in the same manner as that described in connection with the embodiment shown in Fig. 1.

[0034] In Fig. 7, those reference numerals which are identical with those provided in Fig. 1 correspond to the same elements. Reference numeral 1 designates a cable anchor engagement member; that is, a member for supporting the load of an elevator car, and the cable anchor engagement member 1 is formed from a cable anchor beam provided in the machinery room of the elevator system.

[0035] Reference numeral 24 designates a stationary pulley pivotally attached to a fixed section of the machinery room of the elevator system; 25 designates a car which moves vertically along a predetermined path in the hoistway of the elevator system; 26 designates a counterweight which moves vertically along another predetermined path in the hoistway of the elevator system; and 27 designates a main cable. One end of the main cable 27 is coupled to the cable anchor 2 inserted into the cable anchor plate 11, and the main cable 27 is coiled around pulleys provided on the car 25, the stationary pulley 24, and a pulley provided on the counterweight 26. The other end of the main cable 27 is coupled to the cable anchor 2 inserted into the cable anchor beam 1 provided in the machinery room.

[0036] Reference numeral 28 designates an elastic member for regulating tensile force, which is formed from a compression coil spring. The elastic member 28 is fitted around the cable anchor 2 inserted into the cable anchor plate 11, and interposed between the nut 3 fitted around and screwed to the insertion end of the cable anchor 2, and the cable anchor plate 11. The other elastic member 28 for regulating tensile force is fitted around the cable anchor 2 inserted into the cable anchor beam 1 provided in the machinery room. The elastic member 28 is interposed between the nut 3 fitted around and screwed to the insertion end of the cable anchor 2, and the cable anchor beam 1. Either or both the elastic members 28 may be provided.

[0037] Even in the elevator car load sensor constructed in the manner as mentioned above, the plurality of anchor cables 2 are engaged with the cable anchor plate 11 by means of the plurality of elastic members 12. The displacement of the cable anchor plate 11 due to the weight of the car is detected by the detector 14. Consequently, although detailed descriptions are omitted, the embodiment shown in Fig. 7 also yields the same advantage as that yielded in the embodiment shown in Fig. 1. Moreover, since the cable anchor 2 is engaged with the cable anchor plate 11 via the elastic member 28 for regulating tensile force, the tensile force of the main cable can be regulated readily.

[0038] In order to describe the present invention in more detail, another embodiment of the present invention will be described by reference to Fig. 8. Fig. 8 is a diagram showing a seventh embodiment of the present invention; that is, conceptually showing extension of main cables in the hoistway of an elevator system. In other respects, the elevator car load sensor shown in Fig. 8 is constructed in the same manner as that described in connection with the embodiment shown in Fig. 1. In Fig. 8, those reference numerals which are identical with those provided in Fig. 7 correspond to the same elements.

[0039] Reference numeral 1 designates a cable anchor engagement member; that is, a member for supporting the load of the elevator car 25, and the cable anchor engagement member 1 is formed from an upper frame of the car 25. Reference numeral 29 designates a traction machine disposed in an elevator machine room; and 30 designates a main cable. One end of the main cable 30 is coupled to the cable anchor 2 inserted into the cable anchor plate 11, and the main cable 30 is coiled around a sheave of the traction machine 29. The other end of the main cable 30 is connected to the cable anchor 2 inserted into an upper frame of the counterweight 26.

[0040] Reference numeral 28 designates an elastic member for regulating tensile force, which is formed from a compression coil spring. The elastic member is fitted around the cable anchor 2 inserted into the cable anchor plate 11, and interposed between the nut 3 fitted around and screwed to the insertion end of the cable anchor 2, and the cable anchor plate 11. The other elastic member 28 for regulating tensile force is fitted around the cable anchor 2 inserted into an upper frame of the counterweight 26 and interposed between the nut 3 fitted around and screwed to the insertion end of the cable anchor 2, and the upper frame of the counterweight 26. Either or both of the elastic members 28 may be provided.

[0041] Even in the elevator car load sensor constructed in the manner as mentioned above, the plurality of anchor cables 2 are engaged with the cable anchor plate 11 by means of the plurality of elastic members 12. The displacement of the cable anchor plate 11 due to the weight of the car is detected by the detector 14. Further, the elastic members 28 are provided. Consequently, although detailed descriptions are omitted, the embodiment shown in Fig. 8 also yields the same advantage as that yielded in the embodiments shown in Figs. 1 and 7.

[0042] The first through sixth embodiments have exemplified the case of three main cables 2A. However, the main cables 2A may number ??two or ??more than three. Moreover, there have been exemplified cases where the elastic members (coil springs) 12 are provided at respective ends of the cable anchor 2. In a case where the number of main cables 2A has increased, the elastic members 12 may be provided at the respective corners of a rectangle.

[0043] Although, for the sake of brevity, the seventh and eighth embodiments have illustrated one main cable, a plurality of main cables may be provided.

Industrial Applicability

[0044] As has been described, in an elevator car load sensor according to the present invention, the weight of a car acting on respective cable anchors is collectively supported by elastic members by way of a cable anchor plate. Even when the number of cable anchors is increased, there is no necessity of increasing the number of elastic members and the number of detectors. Consequently, a mechanism of detecting the weight of the car can be simplified and readily set up. Further, expenses to be incurred by a car weight detection mechanism can be saved. For these reasons, the present invention is useful as an elevator car load sensor for detecting the weight of a car relevant to load which is to change during the course of operation of the car.

[0045] Since a plurality of cable anchors are engaged with a single cable anchor plate, there is prevented occurrence of inclination of cable anchors, which would otherwise be caused by the weight of the car. Further, there can be prevented occurrence of a drop in the accuracy of detection of weight of the car, which would otherwise be caused by inclination of the cable anchors. Thus, the elevator car load sensor is suitable for normalizing operation control of the car.

Claims

1. An elevator car load sensor comprising:

a plurality of cable anchors coupled with main cables supporting a car;
a cable anchor engagement member which is constituted of a member for supporting the load of the car and in which are inserted the cable anchors, which are arranged side by side;
a cable anchor plate coupled with insertion ends of the respective cable anchors;
elastic members which are interposed between the cable anchor engagement member and the cable anchor plate, which are arranged symmetrically with reference to the cable anchors when viewed in a horizontal direction and which are compressed in accordance with the load of the car; and
a detector whose operating section is engaged with the cable anchor plate and which produces

an output corresponding to the amount of displacement of the cable anchor plate.

2. The elevator car load sensor according to claim 1, wherein the detector is constituted of a differential transformer, and an operating section of the differential transformer is engaged with the cable anchor plate and operates through forward and backward displacement action.

3. The elevator car load sensor according to claim 1, wherein the detector is constituted of a potentiometer, and an operating section of the potentiometer is engaged with the cable anchor plate via a transmission line and operates through pivotal displacement action.

4. The elevator car load sensor according to claim 1, wherein the detector is constituted of an acceleration sensor, and an operating section of the acceleration sensor is engaged with the cable anchor plate via a pivotal transmission mechanism and operates through pivotal displacement.

5. The elevator car load sensor according to any one of claims 2 through 4, further comprising an enlargement transmission mechanism which is constituted of: a pillar-like member provided on a stationary member in an upright position; an arm member whose longitudinal intermediate point is pivotally attached to the pillar-like member; a first transmission line coupled to one end of the arm member and engaged with the cable anchor plate; and a second transmission line coupled to the other end of the arm member and connected to the detector such that an interval between the second transmission line and the pivotally-attached portion of the arm member is longer than an interval between the first transmission line and the same.

6. The elevator car load sensor according to any one of claims 2 through 4, further comprising an enlargement transmission mechanism which is constituted of: a pillar-like member provided on a stationary member in an upright position; a smaller pulley pivotally attached to the pillar-like member; a larger pulley pivotally fastened to the smaller pulley; a first transmission line coupled to one end of the smaller pulley and engaged with the cable anchor plate; and a second transmission line coupled to one end of the larger pulley and connected to the detector.

7. The elevator car load sensor according to any one of claims 1 through 4, wherein the elastic member is fitted to each of the cable anchors provided at respective ends of the cable anchor plate.

8. The elevator car load sensor according to any one of claims 1 through 4, further comprising an elastic member for regulating tensile force provided between the cable anchor plate and each of the insertion ends of the respective cable anchors inserted into the cable anchor plate.

9. The elevator car load sensor according to any one of claims 1 through 8, wherein the cable anchor engagement member is constituted of a member which constitutes a principal section of the car and supports the weight of the car.

Fig. 1

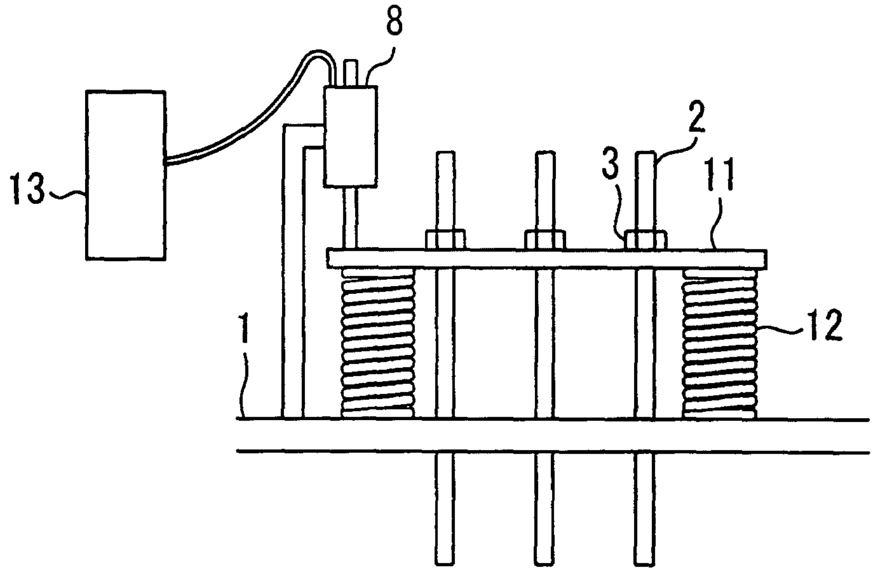


Fig. 2

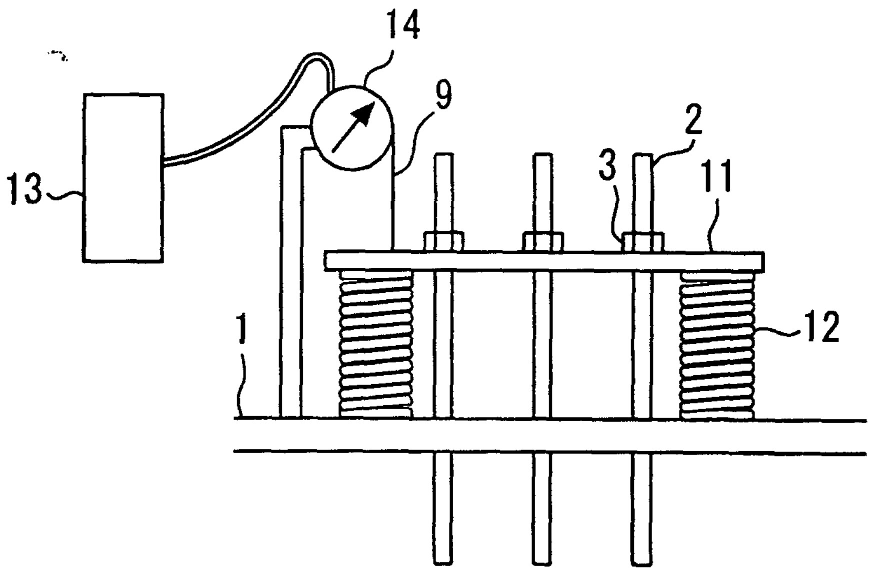


Fig. 3

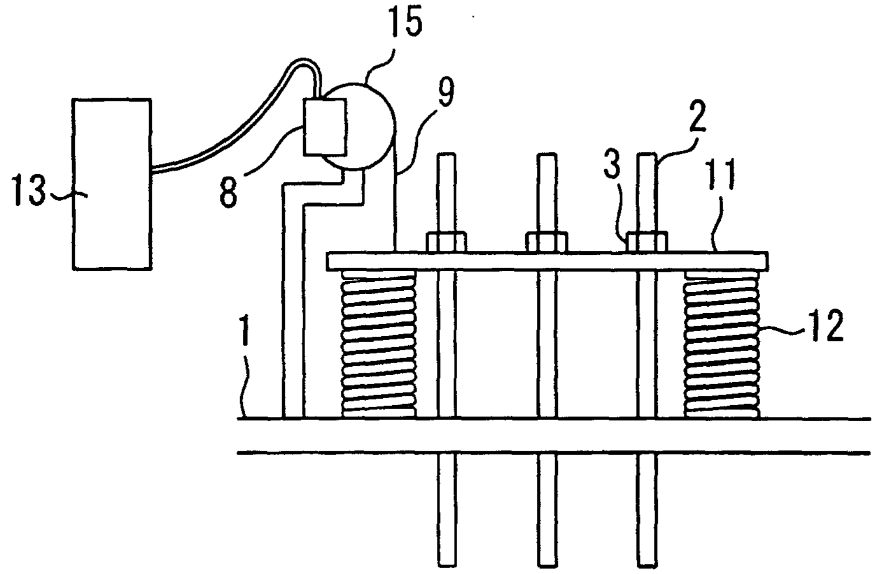


Fig. 4

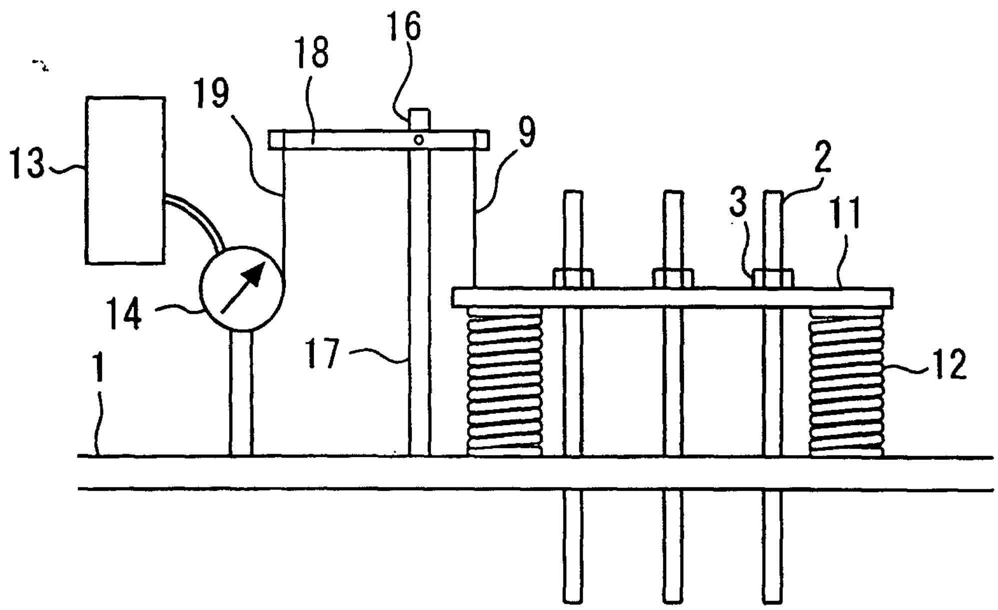


Fig. 5

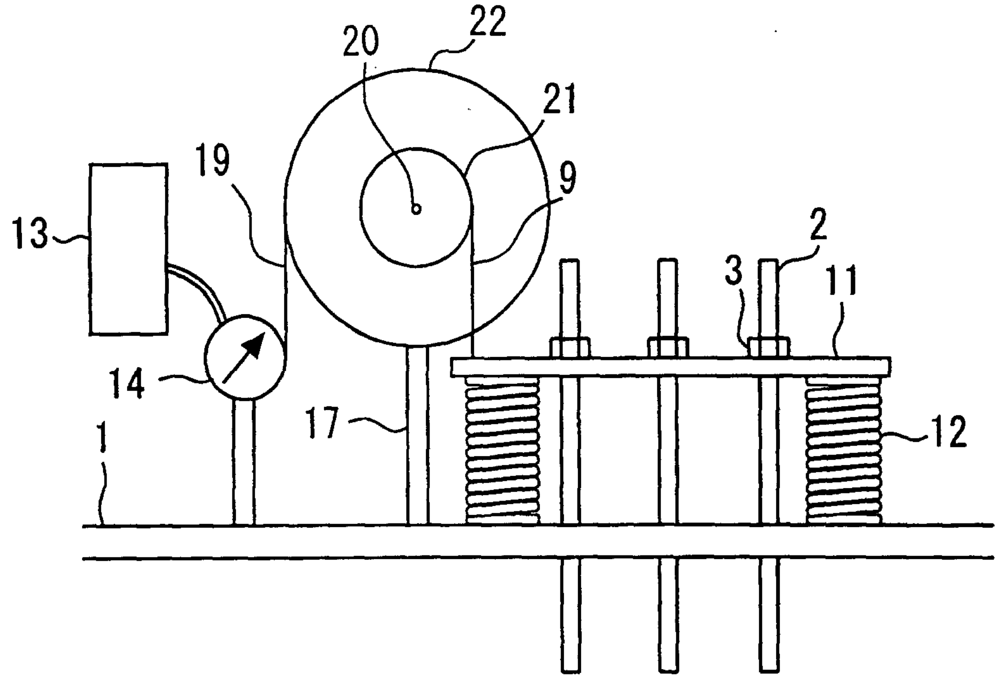


Fig. 6

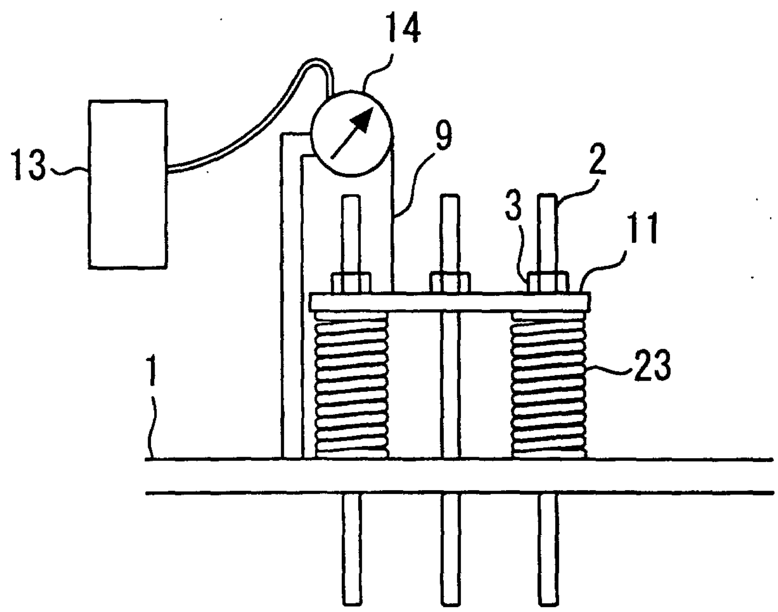


Fig. 7

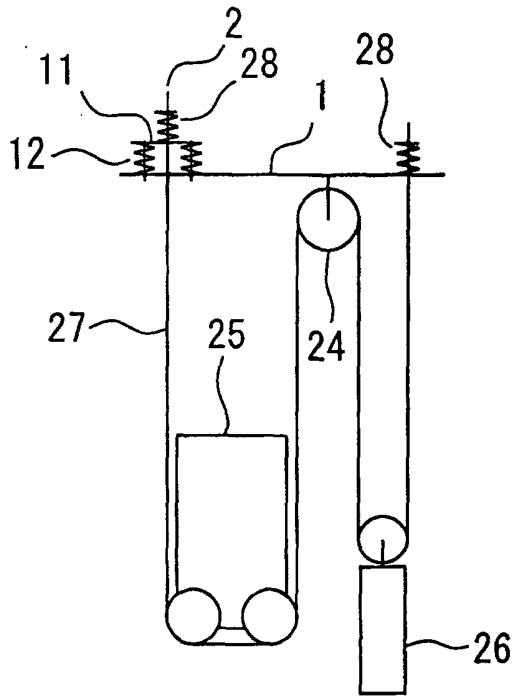


Fig. 8

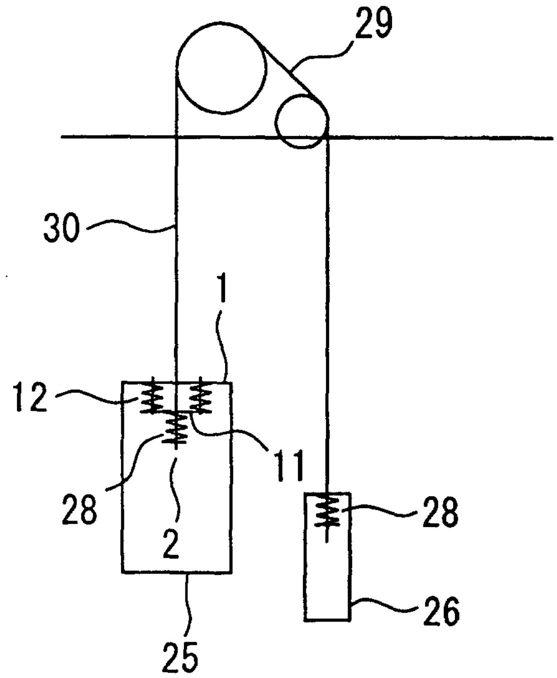
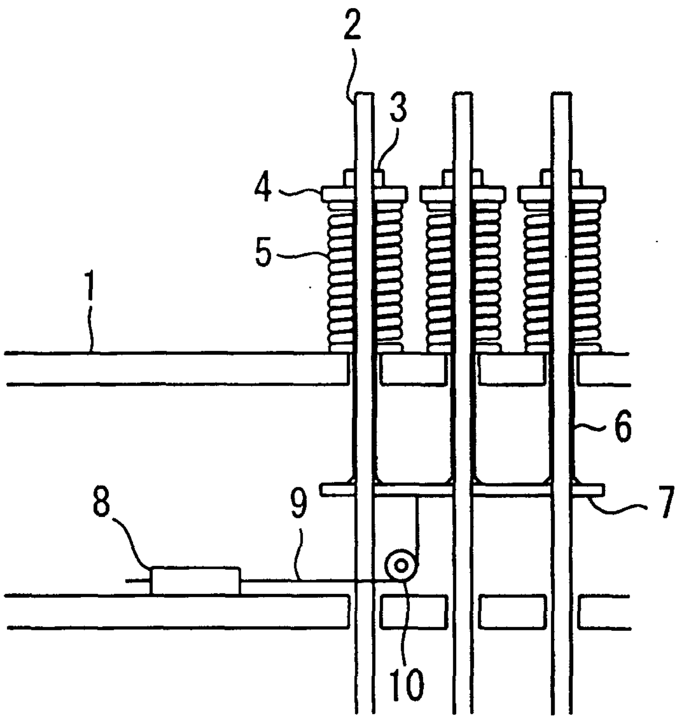


Fig. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/07828

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B 1/44, B66B 5/14, B66B 7/08

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)
Int.Cl[7] B66B 1/00-B66B 7/12

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2001
Kokai Jitsuyo Shinan Koho	1971-2001	Toroku Jitsuyo Shinan Koho	1994-2001

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 137726/1976 (Laid-open No. 56675/1978), (Tokyo Shibaura Denki K.K.), 15 May, 1978 (15.05.78), description, page 2, line 11 to page 3, line 4; page 3, line 16 to page 4, line 1; Figs. 1 to 3	
X		1-2,8-9
Y		3-4,7
A	description, page 4, lines 2 to 4; Fig. 4	5-6
	(Family: none)	
	JP 3-182485 A (Mitsubishi Electric Corporation), 08 August, 1991 (08.08.91), & JP 2502158 B2	
Y		3-4
A		5-5

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

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Date of the actual completion of the international search 24 July, 2001 (24.07.01)	Date of mailing of the international search report 07 August, 2001 (07.08.01)
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/07828

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 9-77410 A (Hitachi Ltd.), 25 March, 1997 (25.03.97), Par. No. [0012]; Fig. 1 (Family: none)	3
Y	JP 7-206278 A (Hitachi Ltd.), 08 August, 1995 (08.08.95), Par. No. [0012]; Fig. 1 (Family: none)	4
	JP 3-143890 A (Mitsubishi Electric Corporation), 19 June, 1991 (19.06.91), & JP 7-121795 B2	
Y		7
A		1-2
A	JP 2-8176 A (Mitsubishi Electric Corporation), 11 January, 1990 (11.01.90) (Family: none)	3-4

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