

Description

Technical Field

This invention relates to an elevator car weighing assembly having improved load weighing capabilities, said assembly comprising :

- a) a car assembly frame ;
- b) an occupant-carrying cab ;
- c) a plurality of pendulum support rods connecting said car to said frame, said rods being disposed one at each corner of said cab and having one end connected to said frame and an opposite end connected to said cab, whereby said rods are tensioned in proportion with the weight of said cab and a load weighing transducer assembly mounted on at least one rod and operable to measure cab and occupant load at said one of said rods.

Such an elevator car assembly is known from US-A-4 899 852. EP-A-0 367 621 shows a similar assembly.

Background Art

An important input for an elevator controller relates to the load, or number of passengers, in the elevator car. U.S. Patent No. 4,330,836 granted May 18, 1982 to A.J. Donofrio, and al., relates to elevator cab load measuring, and contains a discussion of the desirability of monitoring car load, and the enhancement of elevator control derived therefrom. In the system disclosed in this patent, the elevator car is mounted on the frame by means of a plurality of elastomeric damped mount assemblies. There are, for example, six of the mount assemblies, and two of them will be equipped with force transducers which measure the car load.

U.S.-A- 4,899,852, granted February 13, 1990, discloses an elevator car mounting assembly wherein the car is suspended on the frame by a plurality of pendulum rods, one at each corner of the car. This patent briefly alludes to a load weighing assembly which is included in the mounting assembly.

This invention relates to the preferred embodiment of the load weighing assembly generally disclosed in U.S. Patent No. 4,899,852. The car is suspended in the frame by four pendulum rods, one at each corner of the car. One diagonally opposed pair of the pendulum rods may be equipped with the load weighing assembly according to this invention. This allows for more accurate monitoring of the car load since there are only four load paths and 50% of them will be monitored. In the prior art, only 33% or less of the load bearing paths were monitored. The load weighing assembly permits a single capacity transducer to be used

over a wide range of elevator car weights. In general, the assembly includes a lever which presses on the transducer so that the length of the lever arm acts as a multiplier of the operating range of the load cell transducer.

It is therefore an object of this invention to provide an improved load weighing capability for an elevator car.

It is a further object of this invention to provide an elevator car load weighing assembly which can be used on a suspended car.

It is another object of this invention to provide an elevator car load weighing assembly of the character described which can utilize a common load transducer or load cell on elevator cars of different weights.

According to the invention, in the elevator car weighing assembly previously mentioned the load weighing transducer assembly comprises a lever member with a preselected mechanical advantage which presses on the transducer so that it acts as a multiplier of the operating range of the transducer and is operable to limit the load imposed upon said transducer to the preselected fraction of actual load at said one of said rods.

The objects and advantages of the invention will become more readily apparent from the following detailed description of a preferred embodiment thereof, when taken in conjunction with the accompanying drawings, in which :

Brief Description of The Drawings

FIGURE 1 is a perspective view of an elevator car which is suspended in a car frame by means of pendulum rods located at each corner of the car; and

FIGURE 2 is a side elevational view of one of the load sensing assemblies.

Best Mode For Carrying Out The Invention

Referring now to FIGURE 1, there is shown the elevator car assembly comprising the car 2 and the frame 4. The frame 4 has an upper cross beam 6, upper side beams 8 secured to the cross beam 6, and side vertical stiles 10 (only one set of which is shown) secured to the cross beam 4 and to the upper side beams 8. The floor of the car 2 includes floor beams 12 and 14. Four rods 16 (two of which are shown) suspend the car 2 in the frame 4 in the pendulum style. The rods 16 are fixed to the upper side beams 8 on the frame 4, and pass through the car floor beams 12 and 14. Support feet 18 are fixed to the lower end of each rod 16 thereby bearing the weight of the car 2 at each corner of the latter. The load sensing assemblies, denoted generally by the numeral 20 are mounted on two

diametrically opposed rods 16. In FIGURE 1, the load weighing assemblies 20 are shown at the bottom of the rods 16, but they can just as easily be mounted at the top of the rods 16.

FIGURE 2 shows details of a load weighing assembly 20. The assembly 20 includes upper and lower support plates 22 and 24, respectively, through which the rod 16 passes. A sound isolation pad 26 is disposed below the plate 24, and an end plate 28 is disposed below the pad 26. Lock nuts 30 are threaded onto the lower end of the rod 16 to hold the aforesaid components on the rod 16. As seen in Figure 1, the upper plate 22 supports the lower car beams 12 and 14. A cylindrical roller 32 is disposed on one side of the rod 16 between the plates 22 and 24, and the load sensing transducer 34 is disposed between the plates 22 and 24 on the other side of the rod 16. The roller 32 may be welded to the plate 22 whereby its axis will be fixed relative to the axis of the rod 16 and it sits in a groove 25 in the plate 24. The load sensing transducer 34 is a conventional device, such as is made by Sensotec Corporation of Columbus, Ohio. With the arrangement shown in Figure 2, the roller 32 bears some of the load of the car, and the load cell 34 also bears some of the load of the car. The roller 32 can be thought of as a hinge for the plate 22. When the distance a^1 between the axis of the load cell 34 and the axis of the rod 16 equals the distance a^2 between the axis of the rod 16 and the axis of the roller 32, then the roller 32 and load cell 34 will each bear one half of the tension in the rod 16 resulting from the car 2. In this manner, the force on the load cell can be held within the range in which the load cell is designed to operate. For example, a cell designed for a 4 449,8 N (1,000 lbs.) upper working limit can be used to measure tensions up to 8 899,6 N (2,000 lbs.). By moving the load cell 34 farther away from the rod 16 while keeping the roller 32 the same distance from the rod 16, the percentage of rod tension borne by the load cell decreases. For example, a geometry can be selected wherein the roller 32 bears two-thirds of the rod tension, while the load cell 34 bears only one-third of the rod tension. With the latter arrangement, a 4 449,8 N (1,000 lbs.) maximum load cell can measure tensions of up to 13 349,4 N (3,000 lbs.).

It will be readily appreciated that the load weighing assembly of this invention can result in allowing one to use a single maximum capacity load cell in load weighing assemblies for a wide range of elevator car weights. By cutting down the load bearing paths in the system, one can accurately monitor car loading with a minimum number of load cells.

Since many changes and variations of the disclosed embodiment of the invention may be made

without departing from the inventive concept, it is not intended to limit the invention otherwise than as required by the appended claims.

5 Claims

1. An elevator car weighing assembly having improved load weighing capabilities, said assembly comprising :
 - a) a car assembly frame (4) ;
 - b) an occupant-carrying cab (2) ;
 - c) a plurality of pendulum support rods (16) connecting said car to said frame (4), said rods (16) being disposed one at each corner of said cab and having one end connected to said frame and an opposite end connected to said cab (2), whereby said rods (16) are tensioned in proportion with the weight of said cab (2) and a load weighing transducer assembly mounted on at least one rod and operable to measure cab and occupant load at said one of said rods (16), characterized in that said load weighing transducer assembly comprises a lever member (32, 22, 24) with a preselected mechanical advantage which presses on the transducer (34) so that it acts as a multiplier of the operating range of the transducer (34) and is operable to limit the load imposed upon said transducer (34) to the preselected fraction of actual load at said one of said rods (16).
2. The elevator car weighing assembly of Claim 1, wherein said transducer (34) and said lever member (32, 22, 24) are each spaced predetermined distances from the axis of said one of said rods (16) on opposite sides thereof, and are disposed on a component of said assembly which is fixed relative to said one of said rods (16).
3. The elevator car weighing assembly of claim 2, wherein said transducer (34) and said lever member (32, 22, 24) are spaced from the axis of said one of said rods (16) respective distances operable to impose one-half of said actual load on each of said transducer (34) and said lever member (32, 22, 24).
4. The elevator car weighing assembly of Claim 1, wherein there are equivalent load weighing assemblies (20) associated with more than one of said support rods (16).
5. The elevator car weighing assembly of Claim 4, wherein there are four support rods (16), two of which are associated with load weighing cell



diametrically opposed rods 16. In FIGURE 1, the load weighing assemblies 20 are shown at the bottom of the rods 16, but they can just as easily be mounted at the top of the rods 16.

FIGURE 2 shows details of a load weighing assembly 20. The assembly 20 includes upper and lower support plates 22 and 24, respectively, through which the rod 16 passes. A sound isolation pad 26 is disposed below the plate 24, and an end plate 28 is disposed below the pad 26. Lock nuts 30 are threaded onto the lower end of the rod 16 to hold the aforesaid components on the rod 16. As seen in Figure 1, the upper plate 22 supports the lower car beams 12 and 14. A cylindrical roller 32 is disposed on one side of the rod 16 between the plates 22 and 24, and the load sensing transducer 34 is disposed between the plates 22 and 24 on the other side of the rod 16. The roller 32 may be welded to the plate 22 whereby its axis will be fixed relative to the axis of the rod 16 and it sits in a groove 25 in the plate 24. The load sensing transducer 34 is a conventional device, such as is made by Sensotec Corporation of Columbus, Ohio. With the arrangement shown in Figure 2, the roller 32 bears some of the load of the car, and the load cell 34 also bears some of the load of the car. The roller 32 can be thought of as a hinge for the plate 22. When the distance a^1 between the axis of the load cell 34 and the axis of the rod 16 equals the distance a^2 between the axis of the rod 16 and the axis of the roller 32, then the roller 32 and load cell 34 will each bear one half of the tension in the rod 16 resulting from the car 2. In this manner, the force on the load cell can be held within the range in which the load cell is designed to operate. For example, a cell designed for a 4 449,8N (1,000 lbs.) upper working limit can be used to measure tensions up to 8 899,6 N (2,000 lbs.). By moving the load cell 34 farther away from the rod 16 while keeping the roller 32 the same distance from the rod 16, the percentage of rod tension borne by the load cell decreases. For example, a geometry can be selected wherein the roller 32 bears two-thirds of the rod tension, while the load cell 34 bears only one-third of the rod tension. With the latter arrangement, a 4 449,8 N (1,000 lbs.) maximum load cell can measure tensions of up to 13 349,4 N (3,000 lbs.).

It will be readily appreciated that the load weighing assembly of this invention can result in allowing one to use a single maximum capacity load cell in load weighing assemblies for a wide range of elevator car weights. By cutting down the load bearing paths in the system, one can accurately monitor car loading with a minimum number of load cells.

Since many changes and variations of the disclosed embodiment of the invention may be made

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5 Claims

1. An elevator car weighing assembly having improved load weighing capabilities, said assembly comprising :
 - a) a car assembly frame (4) ;
 - b) an occupant-carrying cab (2) ;
 - c) a plurality of pendulum support rods (16) connecting said car to said frame (4), said rods (16) being disposed one at each corner of said cab and having one end connected to said frame and an opposite end connected to said cab (2), whereby said rods (16) are tensioned in proportion with the weight of said cab (2) and a load weighing transducer assembly mounted on at least one rod and operable to measure cab and occupant load at said one of said rods (16), characterized in that said load weighing transducer assembly comprises a lever member (32, 22, 24) with a preselected mechanical advantage which presses on the transducer (34) so that it acts as a multiplier of the operating range of the transducer (34) and is operable to limit the load imposed upon said transducer (34) to the preselected fraction of actual load at said one of said rods (16).
2. The elevator car weighing assembly of Claim 1, wherein said transducer (34) and said lever member (32, 22, 24) are each spaced predetermined distances from the axis of said one of said rods (16) on opposite sides thereof, and are disposed on a component of said assembly which is fixed relative to said one of said rods (16).
3. The elevator car weighing assembly of claim 2, wherein said transducer (34) and said lever member (32, 22, 24) are spaced from the axis of said one of said rods (16) respective distances operable to impose one-half of said actual load on each of said transducer (34) and said lever member (32, 22, 24).
4. The elevator car weighing assembly of Claim 1, wherein there are equivalent load weighing assemblies (20) associated with more than one of said support rods (16).
5. The elevator car weighing assembly of Claim 4, wherein there are four support rods (16), two of which are associated with load weighing cell



assemblies (20).

6. The elevator car weighing assembly of Claim 5, wherein each support rod (16) supports approximately one-quarter of the load of said car (2) and its occupants; and load weighing assemblies (20) are mounted on diagonally opposed support rods (16), so that the load imposed on each load transducer (34) is less than one-quarter of the actual prevailing cab and occupant load.
7. The elevator car weighing assembly of any preceding claim, wherein said transducer (34) consists in a load weighing cell.

Patentansprüche

1. Aufzugskabinen-Wiegevorrichtung mit verbesserten Lastwiegefähigkeiten, aufweisend:
 - a) einen Kabinen-Montagerahmen (4);
 - b) eine Kabine (2) zum Aufnehmen der Fahrgäste;
 - c) eine Mehrzahl von Pendel-Tragestäben (16), die die Kabine mit dem Rahmen (4) verbinden, wobei an jeder Ecke der Kabine ein Stab (16) angeordnet ist, der an einem Ende mit dem Rahmen und an dem entgegengesetzten Ende mit der Kabine (2) verbunden ist, wodurch die Stäbe (16) proportional zu dem Gewicht der Kabine (2) Zugbelastet sind, und eine Umsetzvorrichtung zum Wiegen der Last, die an mindestens einem Stab angebracht ist und Kabinen- und Fahrgastlast an diesem einen Stab (16) messen kann,

dadurch gekennzeichnet,

daß die Umsetzvorrichtung zum Wiegen der Last ein Hebelelement (32,22,24) mit einem festgelegten Hebelverhältnis aufweist, das auf den Umsetzer (34) drückt, so daß es als Multiplikator des Betriebsbereichs des Umsetzers (34) wirkt und die auf den Umsetzer (34) aufgebrachte Last auf den ausgewählten Bruchteil der tatsächlichen Last an dem einen Stab (16) begrenzen kann.

2. Aufzugskabinen-Wiegevorrichtung nach Anspruch 1, bei der der Umsetzer (34) und das Hebelelement (32,22,24) je einen bestimmten Abstand von der Achse des einen Stabs (16) auf entgegengesetzte Seiten davon beabstandet sind und auf einem Bauteil der Vorrichtung angeordnet sind, das relativ zu dem einen Stab (16) fest ist.
3. Aufzugskabinen-Wiegevorrichtung nach Anspruch 2, bei der der Umsetzer (34) und das

Hebelelement (32,22,24) von der Achse des einen Stabs (16) je einen Abstand haben, um je eine Hälfte der tatsächlichen Last auf den Umsetzer (34) und das Hebelelement (32,22,24) aufzubringen.

4. Aufzugskabinen-Wiegevorrichtung nach Anspruch 1, bei der zu mehr als einem der Tragestäbe (16) äquivalente Vorrichtungen (20) zum Wiegen der Last gehören.
5. Aufzugskabinen-Wiegevorrichtung nach Anspruch 4, bei der vier Tragestäbe (16) vorhanden sind, von denen zu zweien Zellenvorrichtungen (20) zum Wiegen der Last gehören.
6. Aufzugskabinen-Wiegevorrichtung nach Anspruch 5, bei der jeder Tragestab (16) etwa ein Viertel der Last der Kabine (2) und ihrer Fahrgäste trägt und die Vorrichtungen (20) zum Wiegen der Last an diagonal entgegengesetzten Tragestäben (16) angebracht sind, so daß die auf jeden Lastumsetzer (34) aufgebrachte Last geringer ist als ein Viertel der tatsächlichen vorhandenen Last von Kabine und Fahrgästen.
7. Aufzugskabinen-Wiegevorrichtung nach einem vorhergehenden Anspruch, bei dem der Umsetzer (34) eine Lastwiegezelle ist.

Revendications

1. Ensemble de pesée pour cabine d'ascenseur possédant des capacités améliorées de pesée de la charge, ledit ensemble comprenant :
 - a) un châssis (4) d'ensemble de cabine ;
 - b) une cabine (2) de transport des occupants ;
 - c) une pluralité de barres de support pendulaires (16) qui relient ladite cabine audit châssis (4), lesdites barres (16) étant disposées à raison d'une à chaque angle de ladite cabine et ayant une extrémité fixée audit châssis et une extrémité opposée fixée à ladite cabine (2), de sorte que lesdites barres (16) sont soumises à une tension proportionnelle au poids de ladite cabine (2) et un ensemble transducteur de pesée de la charge monté sur au moins une barre (16) considérée et qui peut être mis en action pour mesurer la charge de la cabine et des occupants sur cette barre, caractérisé en ce que l'ensemble transducteur de pesée de la charge comprend un élément levier (32, 22, 24) ayant un effet multiplicateur d'effort présélectionné, qui presse sur le transducteur (34) de sorte qu'il se comporte comme un



- amplificateur de la plage de travail du transducteur (34) et qu'il est capable de limiter la charge appliquée au transducteur (34) à une fraction présélectionnée de la charge réelle qui s'exerce sur ladite barre (16) considérée. 5
2. Ensemble de pesée de cabine d'ascenseur selon la revendication 1, dans lequel ledit transducteur (34) et ledit élément levier (32, 22, 24) sont tous deux espacés de distances prédéterminées de l'axe de ladite barre (16) considérée de part et d'autre de cet axe, et sont disposés sur un composant dudit ensemble qui est fixe par rapport à ladite barre (16) considérée. 10 15
3. Ensemble de pesée de cabine d'ascenseur selon la revendication 2, dans lequel ledit transducteur (34) et ledit élément levier (32, 22, 24) sont espacés de l'axe de ladite barre (16) considérée de distances respectives telles que la moitié de ladite charge réelle soit appliquée à chacun des deux éléments, ledit transducteur (34) et ledit élément levier (32, 22, 24). 20 25
4. Ensemble de pesée de cabine d'ascenseur selon la revendication 1, dans lequel il est prévu plusieurs ensembles de pesée de la charge équivalents (20) associés à plusieurs desdites barres supports (16). 30
5. Ensemble de pesée de cabine d'ascenseur selon la revendication 4, dans lequel il y est prévu quatre barres supports (16), dont deux sont associées à des ensembles de cellules de pesée de charge (20). 35
6. Ensemble de pesée de cabine d'ascenseur selon la revendication 5, dans lequel chaque barre support (16) supporte approximativement un quart de la charge de ladite cabine (2) et de ses occupants ; et des ensembles de pesée de la charge (20) sont montés sur des barres supports (16) opposées en diagonale, de sorte que la charge appliquée à chaque transducteur de charge (34) est de moins d'un quart de la charge actuelle de la cabine et de ses occupants. 40 45 50
7. Ensemble de pesée de cabine d'ascenseur selon une quelconque des revendications précédentes, dans lequel ledit transducteur (34) est constitué par une cellule de pesée de la charge. 55