

Aug. 29, 1967

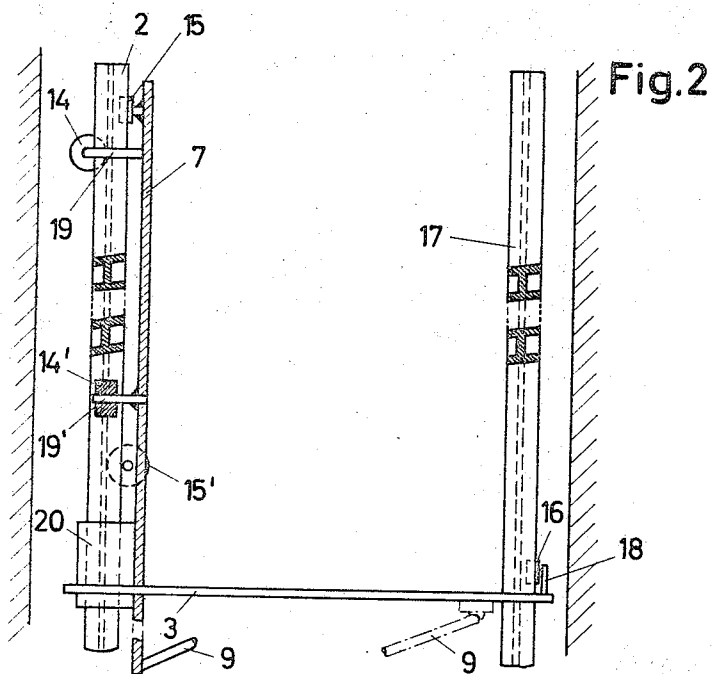
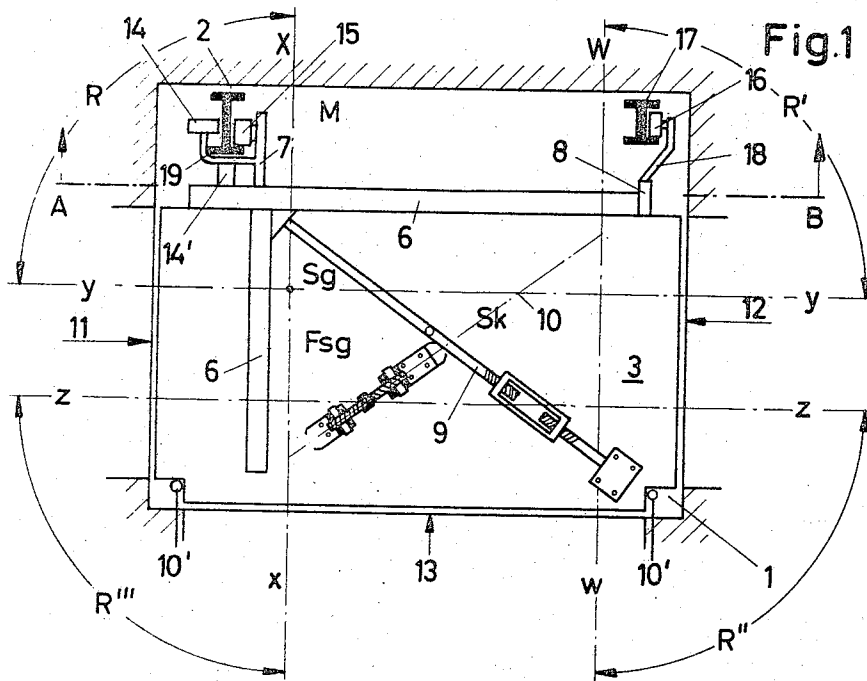
A. LÖDIGE

3,338,336

SUSPENSION OF LIFTS

Filed Oct. 29, 1965

2 Sheets-Sheet 1



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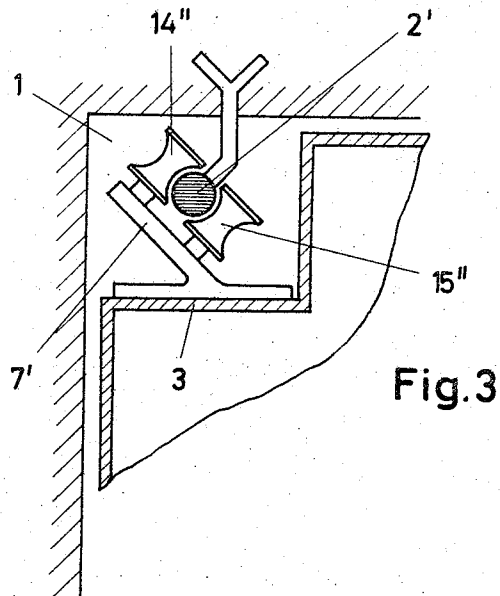
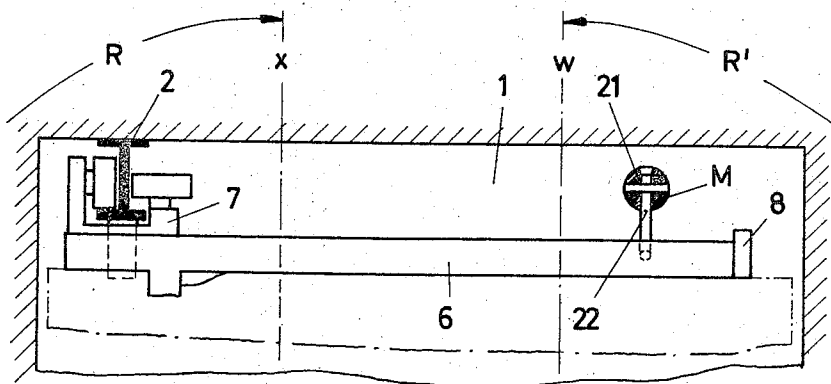


Fig. 4



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SUSPENSION OF LIFTS

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Filed Oct. 29, 1965, Ser. No. 505,616

Claims priority, application Germany, Nov. 2, 1964,

L 49,173

3 Claims. (Cl. 187—95)

ABSTRACT OF THE DISCLOSURE

An elevator which eliminates tilting motions by having the elevator platform supported at one corner on a series of vertically spaced, opposing rollers engaging a fixed vertical supporting rail in a manner that prevents the elevator platform from tilting or jolting as the load is shifted. The elevator platform is suspended against vertical motion at the corner adjacent the guide rail to further stabilize the elevator and its contents.

This invention relates to a passenger and goods lift, in which the point of suspension of the car lies off centre.

The car of a lift, the same as any other body, has a fixed centre of gravity; and the load, which changes its position within the car, also has its own centre of gravity. What is of concern in the present invention is the position of the centre of gravity in the horizontal plane of projection. The centre of gravity of the lift car is a fixed point. In the most troublesome case, the maximum permissible load in the lift may wander round with its centre of gravity at the edge of the car floor. A slab of lead, for example, may be standing right against the car wall, in which case the centre of gravity of the load lies at the edge of the car floor. In the course of loading or load changing, therefore, the centre of gravity of the carried load may be situated at any point on the floor of the car. The position and weight of the carried load, in conjunction with the fixed centre of gravity of the car itself, determines the combined centre of gravity at any moment. This combined centre of gravity may migrate within a certain area, determined by the movement of the carried load. The perimeter of this area of possible migration of the combined centre of gravity is defined as the maximum carried load moves round the side edges of the car floor.

The area of possible migration of the combined centre of gravity contains only one combined centre of gravity where the loaded lift car produces no turning moment. That is to say, no turning moment is produced when the combined centre of gravity lies directly above or below the point of suspension of the car. All other points in this area, which may lie round about the point of suspension, produce moments in various directions, according to the position to which the carried load has moved. For this reason, any lift car, whenever the load moves within it, will tilt to the extent allowed by the play between it and the guides. This tilting or jolting of the car induces a feeling of insecurity in the passengers, especially in passenger lifts. The area of possible migration of the combined centre of gravity may be round or rectangular, according to the shape of the lift floor.

To eliminate the drawbacks which arise with lifts guided as hitherto, the inventor proposes that the point of suspension of the lift car be arranged to lie within geometrical figures such that no change arises in the direction of the turning moment, however the carried load may move, namely in or near a corner quadrant and outside the area of possible migration of the combined centre of gravity of the car. In this way, the car with its gravity moment can be guided by one rail or round guide fitted

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in any desired position in the lift shaft, even within the same quadrant as the point of suspension. With such an arrangement, any form of power can be used to drive the lift. Thus, for example, the car can be driven by pulley transmission or hydraulically.

As every item of the carried load is of a certain size, its centre of gravity can migrate only at a distance from the sides of the car and not over the floor edges, so that the area within which the combined centre of gravity (that is to say the centre of gravity of the car itself and the centre of gravity of the wandering carried load) can be located is reduced to that extent. This means that the geometrical figure—a quadrant, for example—within which the point of suspension may be positioned is in practice the greater.

One great advantage of the arrangement here proposed, whereby the point of suspension lies in or near a corner quadrant, is that the car cannot jolt, however the carried load wanders. Thus, the car may run either between two guides or on a single rail or round guide.

The use of two guides is less desirable, however, because when there are two of them, the force produced by the wedging action of the frame corners bearing against them leads to unnecessary pressure of the shoes on the guides, so that forces arise which tend to curve the guides apart.

If, nevertheless, two guides have to be used, because of particularly heavy loads or through space considerations, the guides should be placed as close together as possible, so that the wedge effect by which the turning moments are absorbed and which is nil when a single guide is used, may be kept small. Any static unbalance in two-guide systems should be eliminated by means of resilient damping rollers.

However, it is better to take up the turning moments at two points on one rail or round guide. While a second guide may be provided, this should serve the sole purpose of guarding against any tendency of the car to swing round. It may therefore be a very light rail, as it need only take the stresses of horizontal acceleration in the lift car. If there are no forces of horizontal acceleration, the forces acting on the second rail will be nil. It is also possible for the place of the second rail to be taken by hydraulically driven ram, connected by an arm to the floor frame of the car. This hydraulic ram will then serve at the same time to support the car.

Compared to the guide systems used hitherto for the cars of lift installations, the single-guide system is not only better technically, but is far cheaper.

Further features of the lift installation here proposed are described in detail hereunder, in conjunction with the accompanying drawings, in which:

FIGURE 1 is a diagrammatic plan, partly in section, of a lift installation conforming to the invention, showing how the point of suspension is determined, and of the lift guide system;

FIGURE 2 is a diagrammatic section along the line A-B in FIGURE 1; and

FIGURES 3 and 4 are diagrammatic plans of other possible types of guide systems, showing only the guide arrangement and part of the car.

As can be seen from FIGURE 1, a guide 2, along which the car 3 of the lift moves up and down, driven for example by ropes (not shown) which passes over a driving pulley (not shown) is fitted in a normal lift shaft, 1. The chassis of the car 3 consists of a floor frame 6, which is provided with longitudinal and transverse beams; to the frame 6 are attached anchorage members, 7 and 8 which extend the same way as the lift shaft. Solid-wall or lattice reinforcements may be provided between these anchorages members. From the lower end of the anchorage member 7, which extends below the car floor to provide for

trussing, diagonal cross-braces 9 run to the ends of the car floor. These cross-braces may incorporate adjusters. Other tension members 10 brace the roof of the lift car in relation to vertical chassis anchorages 7 and 8. In addition, the side walls of the car between the car floor and the car roof are held together by struts 10'. Arrows 11, 12 and 13 indicate the possibilities for entrance gates on three sides. Rollers 14 and 15 are provided on the anchorage member 7, with the aid of which rollers the lift car moves along guide 2. The point of attachment M for the car suspension (in the form of a rope, for example) may also be located upon the anchorage 7.

As described hereunder, rollers 14 and 15 absorb the turning moment produced by the total weight of the car through four force-transmission components, the car guide being located, in the example shown in FIGURE 1, in the corner quadrant R.

The lift car numbered 3 in FIGURE 1 may be regarded for the purposes of the following explanation, as identical with the plan of the car floor. For the example chosen, let the centre of gravity of the car alone be assumed to lie at S_k in the car floor. The position of this centre of gravity is unchangeable, being determined by the construction of the car.

The combined centre of gravity S_g of the car, and its load is, on the other hand, the resultant of the centre of gravity of the car itself and that of the load within the car. Since the load may change its position within the car, the combined centre of gravity is subject to migration. For instance, a heavy object may be standing right against the car wall, in which case the combined centre of gravity will lie close to the wall. However, continual migration of the combined centre of gravity may take place, caused by changes in position of the carried load on the car floor. In the present instance, let this combined centre of gravity be assumed to lie within the area F_{sg} which is bounded by the chain lines W, X, Y and Z (FIGURE 1). Thus, the combined centre of gravity S_g may (for example) lie in that portion of Y which falls between X and W, or at the point of intersection of X and Y (the position in which it is shown in FIGURE 1). The lines W, X, Y and Z may thus be produced to define the corner quadrants R, R', R'' and R'''. The car suspension point M is located in or near R, one of these corner quadrants.

The corner quadrant containing the point of suspension can be arrived at similarly for a lift having a car floor of any desired shape, such as circular or polygonal.

This location of the point of suspension, in conjunction with the use of a single guide, enables the main members to be disposed on one wall of the lift shaft in a particularly compact manner, occupying very little space, so that three sides remain available for entrance gates. The single-guide system also makes it possible for the lift car to be guided to rotate in a helix, so that the installation can be used, for example, as a hoist for supplying machinery staggered at different levels.

From FIGURE 2, which is a cross-section along the line A-B in FIGURE 1, it can be seen that rollers 14 and 15, as one guide unit, are fitted as far as possible away from the lower guide units 14'/15' on anchorage member 7. Roller 15', which is near the lower end of anchorage member 7, lies on the opposite side of this with respect to upper roller 14. Roller 14' is similarly arranged with respect to upper roller 15, so that the turning moment about the X axis is taken up by rollers 14 and 15', and the turning moment about the Y axis is taken up by rollers 15 and 14'. A second rail, 17, of light construction, acts merely as a guard against swinging round. Roller 16, connected by anchorage 8 to the lift car, runs on guide 17. Anchorage 8, similarly to the anchorage 7, may extend for the height of the lift car, but guide roller 16 should preferably be attached only to an arm 18, which can be attached at any desired height to anchorage 8. In

FIGURE 2, arm 18, with guide roller 16, is fitted level with the floor of car 3.

Suitable attachments 19 and 19' are provided on anchorage member 7, for mounting rollers 14 and 14'. With the single-guide system here proposed, the lift car can naturally still be provided with an emergency brake, shown diagrammatically at 20. For additional safety, rack guides are provided, as is standard practice, these being brought into use only if the normal guides should be destroyed.

In the example shown in FIGURE 3, one round-sectioned guide 2' is used instead of the two H-sectioned guides 2 shown in FIGURES 1 and 2. On this guide 2', the turning moment in each direction is taken by one roller at the top 14'' and one roller below 15''. This construction is the simplest conceivable and well suited to small loads.

Instead of the anti-swing guide arrangement shown in FIGURES 1 and 2, consisting of roller 16 and a second guide 17 the same function can be discharged by, for example, a ram 21 (FIGURE 4), articulated by arm 22, to floor frame 6. Ram 21, in that case, both supports the car and prevents it from swinging round.

As the moment always exerts a turning force in one direction only, it is sufficient to supply two sets of guides diagonally from top to bottom, so that, compared to the usual elevator suspension arrangement, two sets of guides are saved.

The guide and suspension point of the lift car can be located at will. In FIGURE 1, for example, both the guide and the point of suspension lie in one and the same corner quadrant R.

In the layout shown in FIGURE 4, the car guide is situated within corner quadrant R, whereas suspension point M lies within corner quadrant R'.

Both forms of construction, with single and double guide systems, come within the scope of the invention, if the point of suspension M is located outside the area F_{sg} , wherein the combined centre of gravity of the lift car and of the wandering load carried can lie, preferably in or near a corner quadrant R.

Corner quadrant R is the geometrical locus for all points of suspension of the car for which, notwithstanding changes in the position of the load carried in the car, there is no change of direction in the turning moment.

The term "corner quadrant," in this connection, is used to mean not only a geometrical figure bounded by straight lines, but also one having a curved periphery (a circle, for example) but outside the area F_{sg} .

It is to be clearly understood that the rollers referred to in this specification (for example, the rollers 14, 15, 14', 15', 14'' and 15'') may be replaced by shoes of the well-known form.

I claim:

1. A lift installation for carrying a load upwards and downwards which comprises, in combination,
 - a single fixed vertical rail defining first and second pairs of guide surfaces, the planes of said first pair of guide surfaces being parallel and substantially perpendicular to the planes of said second pair of guide surfaces,
 - a substantially rectangular load-bearing platform, means for supporting said platform against free vertical movement at at least one point, said point being located adjacent one corner of said rectangular platform,
 - first and second pairs of vertically spaced roller surfaces affixed to said platform,
 - said first pair of roller surfaces being positioned to engage with said first pair of guide surfaces to prevent rotation of said platform about a first roll axis which is parallel to the planes of said first pair of guide surfaces and which passes through said rail,
 - said second pair of roller surfaces being positioned to engage with said second pair of guide surfaces to prevent rotation of said platform about a second roll

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axis which is parallel to the planes of said second pair of guide surfaces and which passes through said rail,

said vertical rail being positioned adjacent said one corner of said rectangular platform such that the combined center of gravity of said platform and said load lies on the same side of each of said roll axis regardless of where said load is placed on said platform.

2. A lift installation as set forth in claim 1 including means for preventing pivotal motion of said platform in a horizontal plane about said rail.

3. A lift installation as set forth in claim 1 including a vertical support member affixed to said corner of said platform adjacent said rail with said vertically spaced roller surfaces being attached to said vertical support

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member and said means for supporting said platform being attached to said vertical support member.

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