June 24, 1941. F. HYMANS 2,246,732

ELEVATOR CAB ISOLATION

Filed Nov. 7, 1939 2 Sheets-Sheet 1

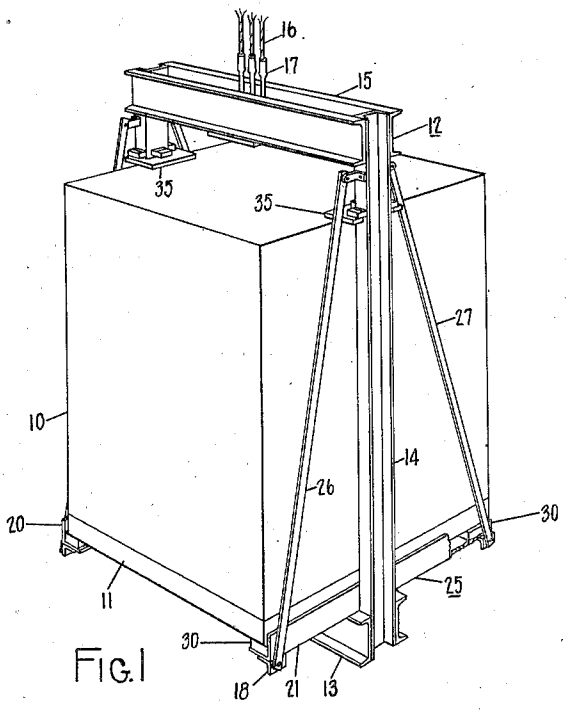


FIG. 1

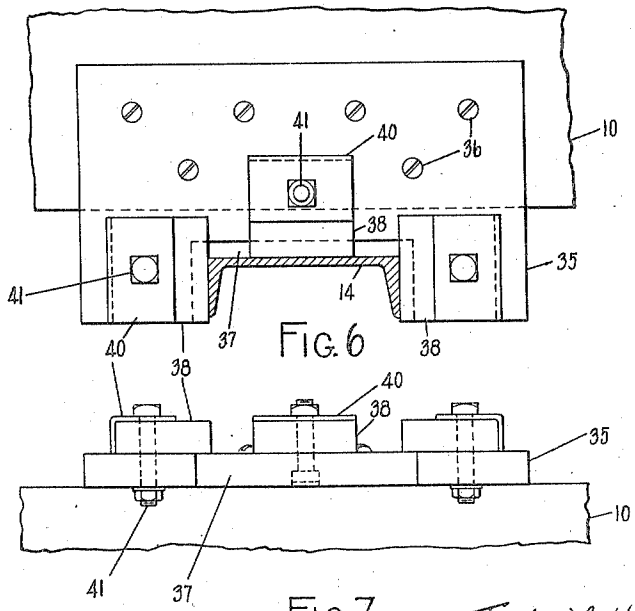


FIG. 6

FIG. 7

Frederick Hymans INVENTOR

BY Walter T. Bradley ATTORNEY

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ELEVATOR CAB ISOLATION

Filed Nov. 7, 1939 2 Sheets-Sheet 2

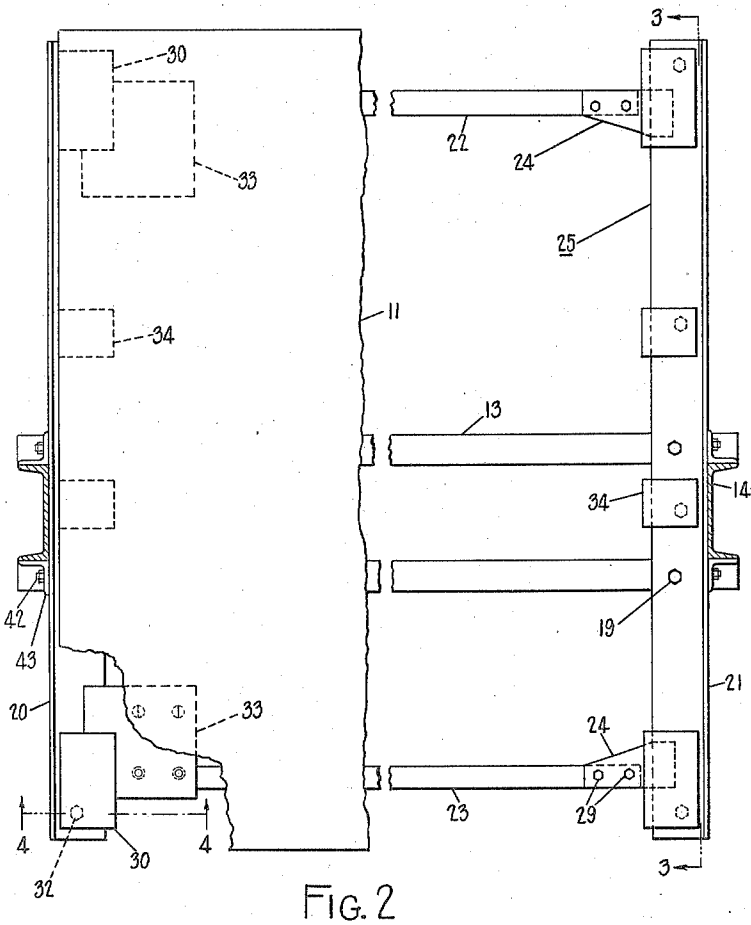


FIG. 2

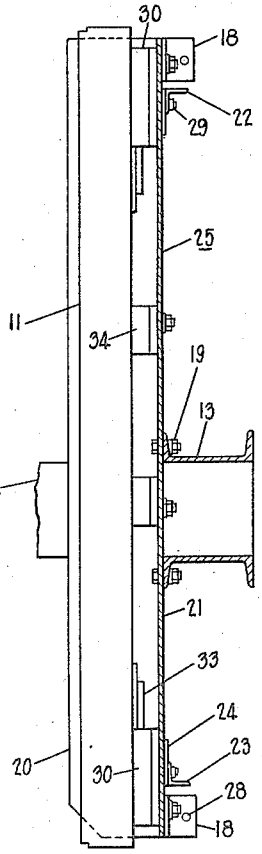


FIG. 3

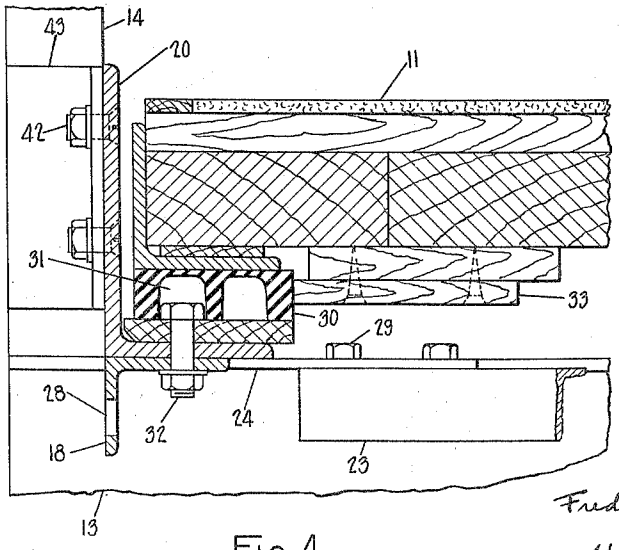


FIG. 4

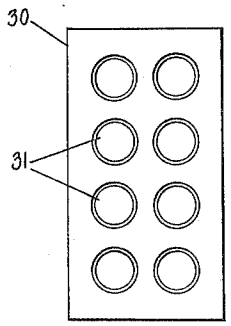


FIG. 5

Frederick Hymans INVENTOR

BY Walter C. Bradley ATTORNEY

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2,246,732

ELEVATOR CAB ISOLATION

Frederick Hymans, Larchmont, N. Y., assignor to Otis Elevator Company, New York, N. Y., a corporation of New Jersey

Application November 7, 1939, Serial No. 303,194

6 Claims. (Cl. 187—1)

The invention relates to elevators and especially to the suspension of the elevator cab.

In many elevator installations there are vibrations in the hoisting mechanism which are transmitted to the cab through the hoisting ropes and the framework within which the cab is mounted. This is more prevalent in the case of geared machines where vibrations are set up due to the gearing itself as a result of slight inaccuracies in manufacture. Vibrations may be due to other causes, for example, those set up by the ropes running over the hoisting sheave or those set up in the hoisting motor itself. Vibrations of the latter nature are possible with gearless as well as geared machines. Transmission of vibrations to the elevator cab is objectionable because it is felt by the passengers. Also, if the frequency of any of the vibrations is in the audible range, an objectional hum is set up in the cab.

It is the object of the invention to provide a suspension for the elevator cab which reduces the vibrations transmitted thereto to a negligible value.

The invention involves supporting the elevator cab upon elastic means arranged between the cab and the framework. The elastic means are so chosen that, for a cab of a given weight plus the weight of the maximum load to which the cab may be subjected, the natural frequency of vibrations of this mass suspended by the elastic means is considerably less than the frequency of vibrations transmitted to the framework. This renders the vibrations transmitted from the framework to the cab of negligible value.

Features and advantages of the invention will become apparent from the following description and appended claims.

In the drawings:

Figure 1 is a schematic view in perspective of an elevator cab and framework therefor, embodying the invention;

Figure 2 is a plan view showing the manner in which the platform of the arrangement in Figure 1 is supported by the framework;

Figure 3 is a view in section taken along the line 3—3 of Figure 2;

Figure 4 is an enlarged sectional detail of the same, taken along the line 4—4 of Figure 2;

Figure 5 is a bottom view of a supporting pad;

Figure 6 is an enlarged sectional plan view, showing an arrangement for isolating the top of the cab; and

Figure 7 is a front view of the same.

Referring to the drawings, the elevator cab comprises an enclosure 10 mounted on a platform 11. The cab is arranged within a framework 12 comprising the safety plank 13, uprights 14 and crosshead 15. The uprights are in the form of channels and the safety plank and the crosshead comprise a pair of channels secured to the sides of the uprights. Hoisting ropes 16 are secured to the crosshead through thumblerods 17.

A pair of angle members 20 and 21 are secured as by bolts 19 to the top of the safety plank, one at each end of the plank. The angle members extend crosswise of the plank inside the uprights, to which they are secured by countersunk screws 42, to angle members 43 welded to the uprights. These members are of a length equal to the depth of the car and are connected at their ends by additional angle members 22 and 23 running parallel to the safety plank. These latter angle members are secured to plates 24 by bolts 29, plates 24 in turn being welded to members 20 and 21. This forms a frame 25 for supporting the platform. On each side of the cab are two angle braces 26 and 27. These braces are secured at their upper ends to the upright 14 and at their lower ends to the angle pieces 18 welded to the ends of members 20 and 21, apertures 28 being provided in each angle piece to receive securing bolts. This provides a rigid support for the frame 25, thus obviating any tendency for the frame to tilt. In certain installations these braces may be omitted.

The cab is supported on elastic means arranged between the cab platform and the frame 25. In the embodiment illustrated, a plurality of rubber pads 30 are utilized for this purpose. Each pad is provided with a plurality of apertures 31 (see Figure 5). These apertures are illustrated as closed at their tops, for convenience of molding, but the apertures may extend through the pads. These pads are located one at each end of each of the angle members 20 and 21. Each pad is positioned with respect to frame 25 by means of a bolt 32 secured to the angle member with its head extending upwardly into one of the apertures 31 in the pad. An angle member 33 is secured to the bottom of the platform at each corner thereof to fit against the inner sides of the pad at the corresponding corner of the frame 25. In this way the platform is located with respect to the framework in such position that the cab is supported entirely on the rubber pads without touching the framework.

The rubber pads have an elasticity such that with a given total mass to be supported thereby an elastic system is provided having a natural

frequency of vibration which is considerably less than the frequency of the vibrations transmitted to the framework. To provide such a system, not only must the weight of the cab and the weight of the accessories and passengers which may be carried thereby be considered but also the construction and properties of the rubber pads which determine their elasticity. The elasticity of the pads is dependent on their effective supporting area, their bulge area, and the properties of the rubber.

For example, in one installation in which the hoisting motor drives the hoisting sheave through the intermediary of a worm gear, the full running speed of the hoisting motor is 1000 R. P. M., this being an alternating current machine operating on 50 cycles. The motor drives the hoisting sheave through a triple thread worm. Due to some slight imperfection in manufacture of the worm, vibrations of a frequency of 3000 cycles per minute were transmitted to the sheave shaft. These vibrations were taken up by the hoisting ropes which in turn transmitted them to the framework. From the framework these vibrations were transmitted to the cab. This was effectively reduced to a negligible value by providing elastic supporting means for the elevator cab in accordance with the invention. The weight of the cab and accessories plus the maximum load to which it was subjected was in the neighborhood of 3600 lbs. Six pads were provided between the car platform and the supporting framework. Each of these pads was 6 inches long, 3¼ inches wide and 1 inch thick and was provided with apertures to give an effective area of each pad of 13 square inches with a bulge area of 45 square inches. Rubber of the following composition was used: non-cold-flow rubber of a tensile strength of 300 lbs. per square inch minimum, an elongation at 3000 lbs. of 600% minimum, 12% maximum cold flow at 600 lbs. per square inch, and a durometer hardness of 35 to 45. This provided a natural frequency vibration of the cab on the pads in the neighborhood of 540 vibrations per minute or about one-sixth of the frequency of the transmitted vibrations. This natural frequency of vibration increased as the load decreased but was still sufficiently small as compared with the transmitted vibrations to render the effect of the transmitted vibrations substantially negligible.

It often happens that there are present several harmonics of the main frequency of vibration. Elastic means which are of the proper elasticity to effectively dampen vibrations of the main frequency are also effective to dampen the harmonics as their natural frequency is a smaller fraction of the harmonics than of the main frequency. Inasmuch as the framework for the cab is not a solid mass, vibrations transmitted thereto from the hoisting ropes exist in different directions. The elastic supporting means for the cab effectively dampens all these vibrations, those in a sidewise direction being taken up by the sheer elasticity of the supports.

Utilizing pads of the same character, isolation against the transmission of vibrations of other frequencies or in installations of other loads on the elastic supporting means may be effectively accomplished by varying the supporting area of the pads. In the construction illustrated in Figure 2 two additional pads have been illustrated, these pads being split crosswise and the halves **34** positioned at intermediate points along angle members **20** and **21**. These pads are kept in position by means of bolts extending into apertures as previously described. Pads may also be provided on the top of the channels of the safety plank where additional supporting area is desired.

While rubber pads have been described as used to support the cab, it is to be understood that other elastic means may be utilized, as for example coil springs. Also certain variations in construction may be made, as well as variations in the manner in which the cab is supported by the elastic means. The elasticity of the supporting means is chosen so that the natural frequency of vibration of the mass on the elastic means is a small percentage of the impressed frequency, without making it so small as to give a feeling of insecurity to passengers in the car.

In some installations it is desirable to hold the cab in place at the top as by a locking plate **35**. Such arrangement has been illustrated. Referring to Figures 6 and 7, this plate, assuming a wood cab, is secured to the top of the cab as by screws **36**. This locking plate is provided with an opening **37** to permit the plate to straddle the upright, the opening being of a size to provide a clearance between the plate and the face and two sides of the upright. Rubber pads **38** are provided between the face and sides of the upright and the plate, being held in place respectively by clamps **40** secured to the locking plates as by bolts **41**. Rubber pads of the same character as those employed underneath the cab may be utilized for this purpose, thereby preventing the transmission of any vibrations or jars through the locking plate to the cab.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In an elevator system in which an elevator cab is arranged within a framework suspended by a plurality of hoisting ropes, supporting members secured to said framework, and a plurality of rubber pads arranged between said cab and said supporting members for supporting said cab out of contact with said supporting members and framework, the relationship between the thickness, bulge area, total effective supporting area and composition of the pads being such as to provide a natural frequency of vibration of said cab on said pads which is small as compared with the frequency of vibrations transmitted to said framework from said hoisting ropes.

2. In an elevator system in which the elevator cab is arranged within framework suspended by hoisting ropes and in which the cab has a platform, a supporting frame for said cab secured to said framework, elastic means arranged beneath said cab between the cab platform and said frame for supporting said cab, means for locating said elastic means with respect to said frame, and means for locating said cab platform with respect to said elastic means and thus said cab with respect to said frame to isolate said cab from said frame and framework.

3. In an elevator system in which the elevator cab is arranged within framework suspended by a plurality of hoisting ropes and in which said cab has a platform, a supporting frame for said

cab secured to said framework, a plurality of rubber pads arranged beneath said cab between said platform and said frame for supporting the cab, each pad having a plurality of vertical apertures, members extending from said frame into apertures in said pads for locating said pads on said frame, and means secured to said platform for locating said platform with respect to said pads and thus said cab with respect to said frame, to isolate said cab from said frame and framework.

4. In an elevator system in which the elevator cab is arranged within framework suspended by a plurality of hoisting ropes, said framework comprising a pair of uprights jointed at the top and bottom, supporting members secured to said framework, and elastic means arranged between said cab and said supporting members and between the top of the cab and said uprights to isolate said cab from said supporting members and said framework, said elastic means being of an elasticity such as to reduce to a negligible value the transmission of vibrations to said cab from said framework which have been transmitted to said framework from said hoisting ropes.

5. In an elevator system in which the elevator cab is arranged within framework suspended by a plurality of hoisting ropes and in which said framework comprises a pair of uprights joined at the top and bottom; supporting members secured to said framework; a plurality of rubber pads arranged between said cab and said supporting members for supporting said cab out of contact with said supporting members and framework, said pads having a thickness, a bulge area provided by a plurality of apertures in the pads, a total effective supporting area and composition, the relationship between said thickness, bulge area, supporting area and composition being such that the natural frequency of vibration of said cab on said pads is small as compared with the frequency of vibrations transmitted to said framework by said hoisting ropes; means cooperating with said pads for locating the bottom of the cab with respect to said framework; means for locating the top of the cab with respect to said framework; and similar rubber pads arranged between said top locating means and said uprights.

6. In an elevator system in which the elevator cab is arranged within framework suspended by a plurality of hoisting ropes and in which said cab comprises a platform and an enclosure on said platform and said framework comprises a pair of uprights joined at the top by a crosshead and at the bottom by a safety plank; a supporting frame for said platform secured to said framework; members connecting the corners of said frame to said uprights; a plurality of rubber pads arranged between said cab and said supporting members for supporting said cab out of contact with said supporting members and framework, said pads having a thickness, a bulge area provided by a plurality of apertures in the pads, a total effective supporting area and composition, the relationship between said thickness, bulge area, supporting area and composition being such that the natural frequency of vibration of said cab on said pads is small as compared with the frequency of vibrations transmitted to said framework by said hoisting ropes; means cooperating with said pads for locating said platform with respect to said framework; a pair of locking plates secured to the top of the cab and cooperating with said uprights to position the top of the cab, each plate having an opening straddling the upright for which it is provided; similar rubber pads arranged between the sides and face of each upright and its cooperating locking plate; and means securing said last named pads to said locking plates.

FREDERICK HYMANS.