United States Patent

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[33] Japan
[31] Nos. 42/3613 and 42/75070

[54] **ELEVATOR GUIDING DEVICE**
9 Claims, 9 Drawing Figs.

[52] U.S. Cl. 181/95, 308/6, 308/26, 188/83
[51] Int. Cl. B66b 17/22
[50] Field of Search 187/95, 1; 308/6, 6B, 26, 176; 74/574; 267/1E, 1F; 226/1FC, 194; 188/83

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Attorneys—Robert E. Burns and Emmanuel J. Lobato

ABSTRACT: An elevator car is provided with supporters by which individual holders for holding guide shoes are supported in rolling contact relation for limited movement toward and away from the associated guide rails and also rotational movement respectively. A friction member resiliently engages the shoe holder to apply a controlled frictional force to it.

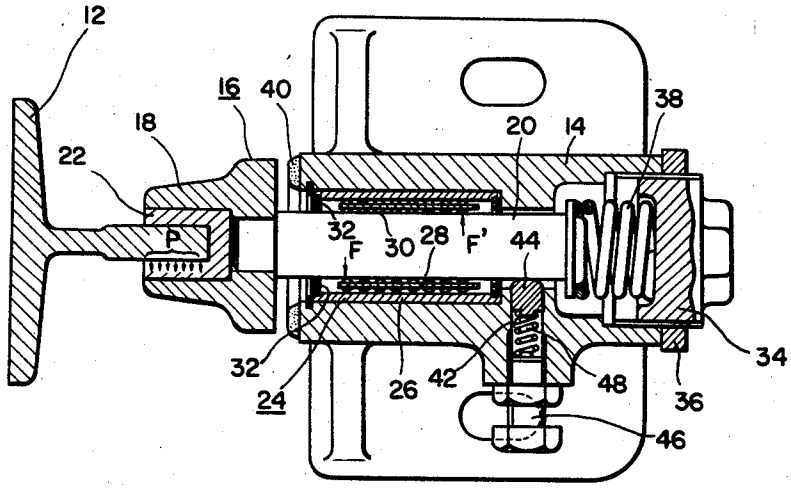


Fig. 1.

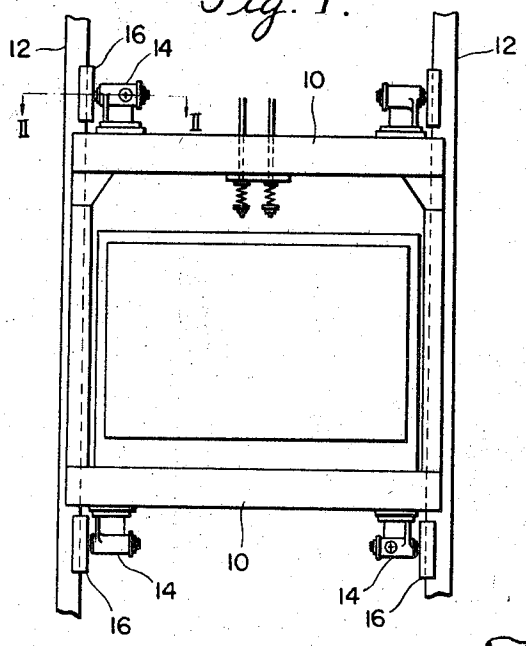


Fig. 2A.

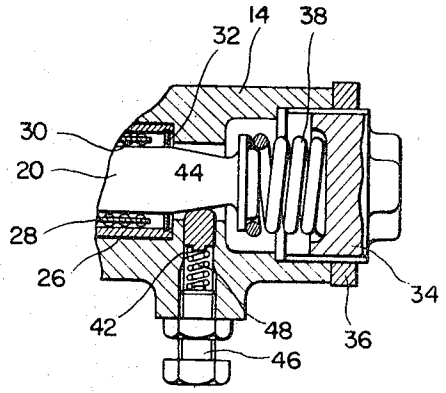


Fig. 2.

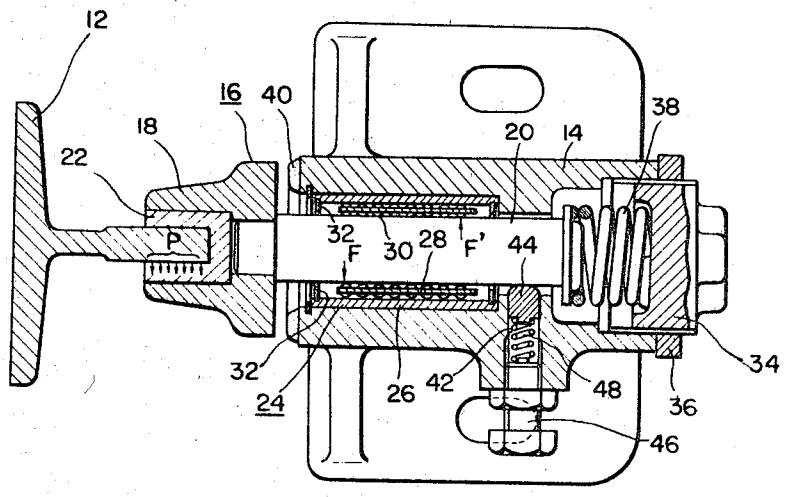


Fig. 3.

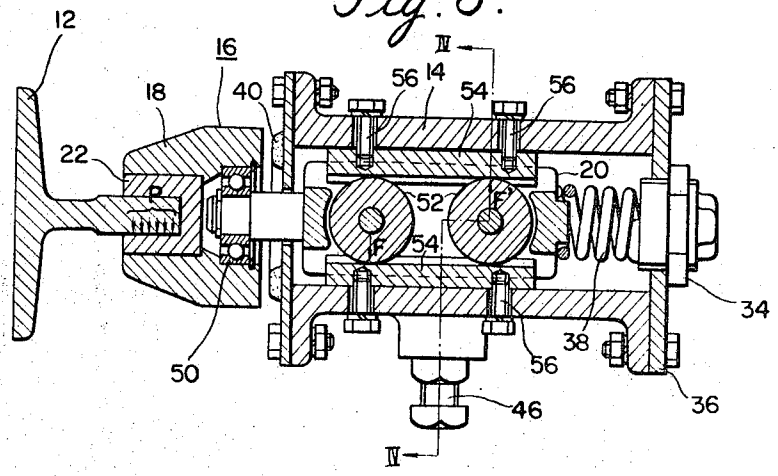


Fig. 4.

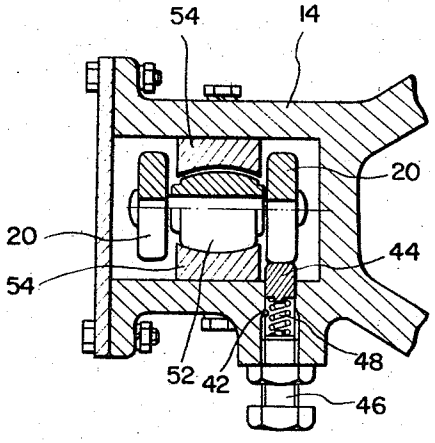


Fig. 6.

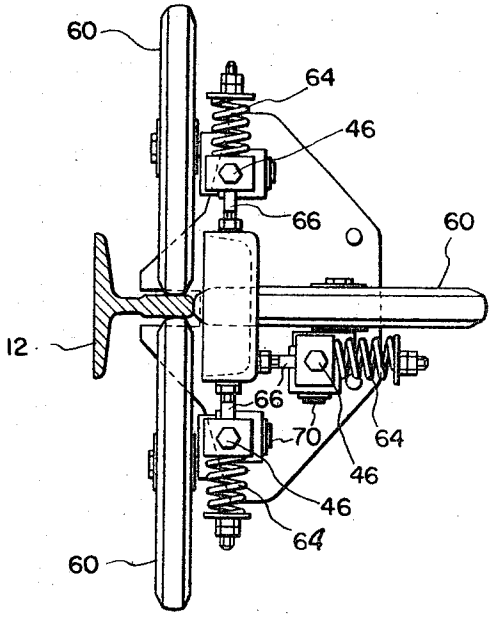


Fig. 5.

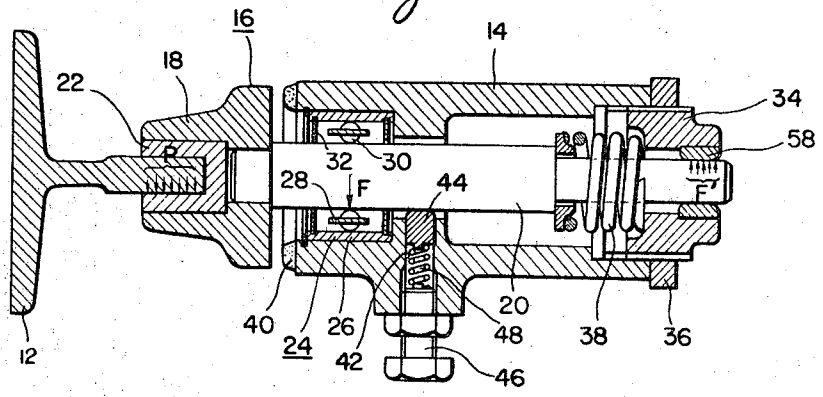


Fig. 7.

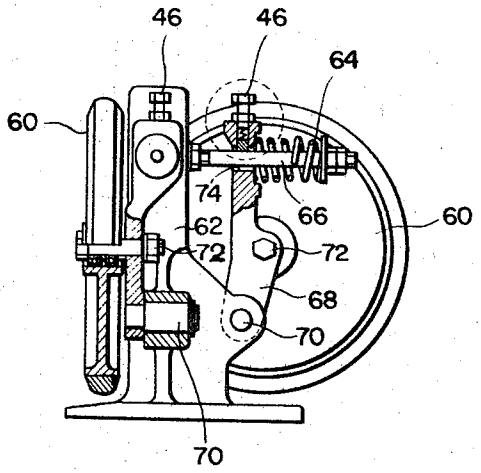
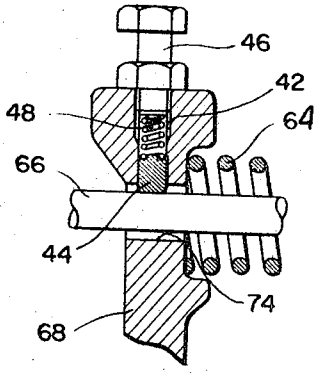


Fig. 7A.



ELEVATOR GUIDING DEVICE

This invention relates in general to an elevator guiding device and more particularly to improvements in a holder device for holding a guide movable along a guide rail.

Inevitably, elevator apparatus have previously encountered and are presently encountering the problems of surface irregularities staggered junctions of guide rails due to the guide rails being erroneously mounted in the associated hoistway, eccentric loading on an elevator car and the like. Therefore elevator cars are normally operated while relatively high pressures are applied to the associated guide shoes thereby to impose a moment of loads on each of the holder's rods connected to the guide shoes. In order to provide a comfortable ride in an elevator car, it is essential that even under these operating conditions, the shoe holders instantaneously respond to minute curvatures, irregularities and staggered junctions of guide rails to very smoothly effect both axial reciprocating movement and rotational movement about their axes such that the elevator car is always smoothly carried under the control of the associated spring means.

It has been heretofore practiced to use a slide bearing for journaling a shoe holder. It has been found that under the operating conditions as above described, such a slide bearing could cause a frictional resistance which, in turn, substantially inhibits the associated shoe holder from being finely and smoothly moved with respect to a guide rail coupled to the holder and that any movement of the shoe holder might sometimes result in nonsmooth slippage thereof to impulsively rock the car. Thus the use of such a slide bearing has very impeded a comfortable ride in the associated elevator car.

Accordingly it is a general object of the invention to improve the vibrational characteristics of a guide shoe associated with a moving member such as an elevator car guided along guide rails so that its vibration due to any external force applied thereto is rapidly attenuated to provide a comfortable ride in the car even in the case the guide shoes engage the guide rails having a low accuracy of rectilinearity.

It is an object of the invention to effect smooth movement of a shoe holder connected to an elevator car with respect to the associated guide rail to provide a comfortable ride in the car by the provision of a bearing including low friction rolling members and disposed in a housing for the shoe holder.

The use of such low friction rolling members to support a shoe holder in rolling contact relationship in a housing causes a much decrease in shock given a person within an elevator car as traveling along curved or staggered portions of guide rails.

On the other hand, since the shoe holder can be smoothly moved with respect to its bearing, the elevator car tends to vibrate at a frequency corresponding to the natural frequency of the system determined by the weight of the car, and an elastic constant of a buffer resilient member or a spring operatively coupled to the shoe holder. This vibration will be long in duration resulting in a person or persons in the car being struck with uncomfortable feeling. In addition there are encountered a problem that upon opening and closing a door of an elevator car, the car is liable to effect rocking movement due to a reaction to a force caused through movement of a door operating mechanism, this rocking movement being slowly attenuated.

It is another object of the invention to rapidly attenuate the vibrational and rocking movements just described through a predetermined frictional force applied to the rod of the shoe holder in order to provide a much better comfortable ride in the associated elevator car.

It is still another object of the invention to provide a simple and inexpensive construction for attenuating the above-mentioned impulsively and persistently vibrational movements of an elevator car.

According to one aspect of the invention, there is provided an elevator guiding device comprising a moving member, guide rail means for guiding the moving member, a member movable along the guide rail means, a holder member for

movably the movable member, and support means mounted to the moving member to guide movement of the holder, characterized by rolling means within the support means to carry the holder member in rolling contact relationship to the support means.

According to another aspect of the invention, a friction mechanism is resiliently connected to the holder member to present a controlled frictional force to movement of the holder member relative to the support means in order to rapidly attenuate impulsive and persistent vibrations of the moving member.

In a preferred embodiment of the invention an elevator guiding device may comprise an elevator car, guide rails means for guiding the elevator car, a guide shoe slidable along the guide rail means, a holder member including a gib portion for holding the guide shoe and a rod, and a supporting housing mounted to the elevator car to movably support the rod of the holder member, characterized by an array of steel balls disposed in rolling contact with the rod of the holder within the supporting housing to permit the holder member to effect both limited movement toward and away from the guide rail means and rotational movement about the axis thereof.

Alternatively the gib portion of the holder member may be connected through a radial ball bearing within the same to the holder's rod which is, in turn, bifurcated and has a plurality of rollers rotatably secured thereto between the bifurcated potion. The rollers are adapted to be rollable within the supporting housing to permit the holder member to effect limited reciprocating movement with respect to the guide rail means.

The friction mechanism may preferably comprise a lateral hole extending through the supporting housing in the direction substantially perpendicular to the axis of the holder's rod, a friction member fitted into the hole to abut against the rod, and adjustable spring means for pushing the friction member against the rod of the holder member.

Advantageously the rod of the holder may have a tapered end portion while the friction member has an end surface complemental in shape to the tapered end portion of the rod to resiliently engage the latter.

In another preferred embodiment of the invention an elevator guiding device may comprise an elevator car, guide rail means for guiding the elevator car, a roller rollable along the guide rail means, support means mounted to the elevator car, a lever member pivotably secured to support means to rotatably hold the roller so as to permit the roller to be moved toward and away from the guide rail means, and a spring loaded friction mechanism operatively connected to the lever member to present a controlled frictional force to movement of the lever member relative to the support means.

The invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a front elevational view of an elevator apparatus in which the invention is interested;

FIG. 2 is a plan view partly in section of a sliding guide device according to the invention with the section taken along the line II–II of FIG. 1:

FIG. 2A is a fragmental sectional view of a modification of the device illustrated in FIG. 2;

FIG. 3 is a view similar to FIG. 2 but illustrating another modification of the invention:

FIG. 4 is a sectional view taken along the line IV–IV of FIG. 3;

FIG. 5 is a view similar to FIG. 2 but illustrating still another modification of the invention;

FIG. 6 is a plan view of a rolling guide device according to the invention;

FIG. 7 is a side elevational view partly in section of the device illustrated in FIG. 6; and

FIG. 7A is an enlarged view of a portion enclosed by dotted circle in FIG. 7.

Referring now to the drawings and FIG. 1 in particular, it is seen that an elevator apparatus illustrated comprises a frame

10 of an elevator car capable of traveling within a vertical hoistway of rectangular cross section (not shown), and a guide rail 12 of T-shaped cross section vertically disposed in each corner of the hoistway (only two of which are illustrated in FIG. 1). The car frame 10 has a pair of housings 14 rigidly secured on the upper and lower surfaces adjacent each of the guide rails 12. One guide holder 16 is movably coupled to each housing 14 and slidably engages the corresponding one of the guide rails 12.

As shown in FIG. 2, the guide holder 16 comprises a gib portion 18 and a rod 20. The gib portion 18 holds a guide shoe 22 of U-shaped cross section slidably engaging the associated guide rail 12 and the rod 20 is carried in a housing 14 of circular cross section through ball bearing means generally designated by the reference numeral 24 for both limited movement toward and away from the guide rail 12 and rotational movement about its axis. The ball bearing means 24 comprise an outer cylindrical sleeve 26 fitted into the housing 14, a cylindrical ball holder 28 shorter than the sleeve 26 and inserted into the outer sleeve 26 to hold a plurality of axial rows of spaced steel balls 30 or rolling members and an annular stopper 32 disposed on each end portion of the outer sleeve 26 to prevent the ball holder 28 from projecting beyond each end of the outer sleeve in response to axial movement caused by impulsive forces applied to the guide shoe. The rod 20 of the shoe holder 16 is put in rolling contact with the rows of steel balls 30. A gap formed between either end of the ball holder 28 and the opposite stopper 32 determines a distance by which the rod 20 of the shoe holder 18 and therefore the guide shoe 22 can be moved toward and away from the associated guide rail 12.

The housing 14 has an adjust screw 34 screwthreaded into that end portion thereof facing the free end of the rod 20 of the shoe holder 16 and a lock nut 36 engaging the screw 34. Disposed between the free end of the holder's rod 20 and the inner recessed end face of the adjust screw 34 is a helical spring 38 serving to push the shoe holder 16 and accordingly the guide shoe 22 against the associated guide rail 12 under a predetermined pressure. The adjust screw and lock nut 34 and 36 can be adjusted to control a pressure exerted on the rod 20 of the shoe holder 16 by the spring 38 to such a magnitude that during travel of the car frame 10 now clearance occurs between the guide show 22 and the associated guide rail 12. The housing 14 further has an annular buffer member 40 secured at that end facing the gib portion 18 of the shoe holder 16 to prevent the shoe holder 16 from directly striking against the housing 14.

As previously described minute curvature and staggered junction of the guide rails, any eccentric loading on an elevator car etc. can cause a relatively high pressure P to be applied to the associated guide shoe to impose a moment of loads F, F' on its holder (see FIG 2) with the result that the car impulsively rocks. Under these circumstances, the ball bearing means 24 are effective for moving the shoe holder with respect to the associated guide rail thereby to prevent the car from impulsively rocking.

The housing 14 is also provided with a lateral through hole 42 adjacent the inner end of the ball bearing means 24 and in the direction substantially perpendicular to the axis of the rod 20. A friction member 44 is fitted into the hole 42 to resiliently abut against the rod 20 of the shoe holder 16 and adapted to exert on the holder's rod 20 a frictional force controlled by and adjust screw 46 screwthreaded into the hole 42 and a compression spring 48 positioned in the hole between the friction member and the adjust screw 44 and 46 respectively. The measure permits a suitable attenuation to be imparted to a vibration which may be caused in the associated elevator car and is difficult to be attenuated. Thus it cooperates with the roll ball bearing means 24 as above described to provide a comfortable ride in the car.

FIG. 2A shows a modification of the device illustrated in FIG. 2. A rod 20 of a shoe holder 16 has its free end portion tapered and a friction member 44 having a correspondingly tilted end face engages the tapered end portion of the rod 20. In the arrangement illustrated, the friction member 44 can automatically change its position where it contacts the rod 20 in accordance with a magnitude of a reaction due to the associated guide rail thereby to automatically control a frictional force exerted on the rod portion by the same. In another respect the device is substantially identical to that shown in FIG. 2 and the same reference numerals designate the corresponding components.

FIGS. 3 and 4 wherein the like reference numerals designate the components similar or corresponding to those illustrated in FIG. 2, show another modification of the invention. As shown, a shoe holder 16 comprises a rod 20 connected to a gib portion 18 through a radial ball bearing 50 disposed in the latter for rotational movement relative to the gib portion. That portion of the rod 20 disposed in a housing 14 of rectangular cross section is bifurcated and has a plurality, in this case two of aligned rollers 52 rotatably carried secured thereto between the bifurcated portions. Then the roller 52 rotatably contact a pair of opposite guide plates 54 complementary in shape to the rollers and rigidly secured to the opposite internal wall surfaces of the housing 14 by screws 56. A friction member 44 resiliently engages one of the bifurcated rod portion. In other respects the arrangement is substantially similar to that shown in FIG. 2.

With the arrangement illustrated in FIGS. 3 and 4 it will be appreciated that the shoe holder 16 is journaled by the radial bearing 50 for rotational movement about its axis while at the same time it is supported by the rollers 52 for its movement toward and away from the associated guide rail.

FIG. 5 wherein the like reference numerals designate the components similar or corresponding to those illustrated in FIG. 2 shows still another modification of the invention suitable to the case of a great distance between points at which a pair of like and opposite loads are applied to a rod portion of a shoe holder respectively. An arrangement illustrated comprises a shoe 16 including a relatively long rod 20 supported on that portion thereof adjacent its gib portion 18 by a ball bearing means 24 such as previously described and on the other end portion remote from the gib portion by a slide bearing 58 disposed in an adjust screw 34 for axial and rotational movements with a helical spring 38 disposed around the other end portion of the rod. In other respects the arrangement is substantially similar to that illustrated in FIG. 2.

In the arrangement illustrated in FIG. 5, it is noted that since that portion of the rod 20 supported by the ball bearing 24 is longer than that portion thereof disposed between the ball and slide bearings 24 and 58 respectively, a load P applied to the guide shoe 22 in response to the conditions of the associated guide rail and elevator car causes a higher load to to be applied to that portion of the holder's rod 20 near to the gib portion 18 while only a lower load is applied to that portion of the rod remote from the gib portion. Under these circumstances, the use the slide bearing 58 causes only a frictional force insufficient to actually impede a comfortable ride in the associated elevator car.

Referring now to FIGS. 6, 7 and 7A, there is illustrated a rolling guide device according to another aspect of the invention. An arrangement illustrated comprises three rollers 60 rollable along three surfaces of the associated guide rail 12, a support block 62 mounted to a frame of an elevator car, one buffer spring 64 operatively associated with each roller 60 and one support rod 66 secured to the support block 62 to support each of the buffer spring 64. As best shown in FIG. 7, a swingable lever 68 is pivotably mounted at one end to the support block 62 by a pivot pin 70 and rotatably carries the individual roller 60 by a bolt 72 extending through the intermediate portion thereof. The supporting rod 66 loosely extends through a hole 74 formed on the free end portion of the lever 68 and resiliently engages a friction mechanism 44-46-48 such as previously described in conjunction with FIG. 2 (see FIG. 7A). The buffer spring 64 normally bias the associated lever 68 and therefore the roller 60 carried thereby toward the guide rail 12.

This it will be appreciated that the roller **60** can instantaneously respond to any reaction due to the associated guide rail **12** to be moved about the axes of the pins **70** while rotating about the axes of their bolts **72**.

As in the arrangement shown in FIG. **2A**, that portion of the rod **66** engaging the friction member **44** may be tapered with the engaging end face of the friction member correspondingly tilted.

From the foregoing it will be appreciated that the objects of the invention have been accomplished by the provision of a guide shoe holder supported in rolling contact relationship by its supporter.

While the invention has been illustrated and described in conjunction with certain preferred embodiments thereof it is to be understood that various changes in the details of construction and the arrangement and combination of the parts may be resorted to without departing from the spirit and scope of the invention.

We claim:

1. A device for effectively distributing impulsive forces applied to a shaft comprising: a housing shaft slidably mounted in said housing resilient means acting between said housing and shaft responsive to the movement of said shaft in one axial direction for urging said shaft in the other axial direction; a sleeve roller bearing mounted on said shaft for both rotary and axial movement relative to said shaft; and means carried by said housing mounting said sleeve roller bearing in said housing or axial movement along said shaft in response to impulsive forces other than forces in said other axial direction applied to said shaft effective to distribute said impulsive forces to maximize the effectiveness of said resilient means.

2. A device according to claim **1**; including means rotatably mounting said slidably mounted shaft for assisting the operation of said sleeve roller bearing.

3. An elevator guiding device for effectively distributing impulsive forces applied to a guide shoe comprising a housing a shaft slidably mounted in said housing; a guide shoe connected to said shaft; resilient means acting between said housing and shaft responsive to the movement of said shaft in one axial direction for biasing said shaft in the other axial direction; a sleeve roller bearing mounted on said shaft for both rotary and axial movement relative to said shaft; and means carried by said housing mounting said sleeve roller bearing in said housing for axial movement along said shaft in response to impulsive forces other than forces in said other axial direction applied to said guide shoe effective to distribute said impulsive forces to maximize the effectiveness of said resilient means.

4. A device according to claim **3**; including means rotatably mounting said slidably mounted shaft for assisting the operation of said sleeve roller bearing.

5. A device according to claim **3**; further including means for applying a controlled frictional force to said slidably mounted shaft to inhibit movement thereof.

6. In combination: a longitudinally extending guide rail; a guide shoe mounted for movement along said guide rail; a housing shaft slidably mounted in said housing connected to said guide shoe; damping means acting between said housing and shaft responsive to the movement of said shaft in one axial direction for urging said shaft in the other axial direction; a sleeve roller bearing mounted on said shaft for both rotary and axial movement relative to said shaft; and means carried by said housing mounting said sleeve roller bearing in said housing for axial movement along said shaft in response to impulsive forces other than forces in said other axial direction applied to said guide shoe from said guide rail effective to distribute said impulsive forces to maximize the effectiveness of said damping means.

7. The combination according to claim **6**; further including means for applying a controlled frictional force to said slidably mounted shaft to attenuate vibrations of said shaft caused by the impulsively applied forces.

8. The combination according to claim **7**; wherein said last-mentioned means comprises a friction member engageable with a surface of said slidably mounted shaft; a compression spring normally urging said friction member into frictional contact with said surface; and means for adjusting the degree of compression of said spring.

9. The combination according to claim **8**; wherein said slidably mounted shaft has an inwardly tapered portion; and said friction member is shaped and positioned to frictionally contact said inwardly tapered portion.