ABSTRACT OF THE DISCLOSURE

A cushioned mounting arrangement for supporting vertical loads against generally horizontally longitudinally applied impacts, said mounting arrangement comprising a plurality of superposed elastomeric pads, a plate member fixed on top of the uppermost of said pads, plate means being fixed between adjacent ones of said pads, a supporting member, means fixing the bottom of said lowermost of said pads to said supporting member, and means extending between the members and the plate means and providing vertical support for the load in compression on said pads and frictionally engageable with surfaces facing between said plate means and the members during movement of said pads in shear upon the application of a longitudinally applied impact on said support means.

The present invention relates to a cushioned mounting structure for supporting vertical loads thereon and protecting the load against longitudinally applied impacts and, more particularly, to a new and improved cushioned mounting structure having an elastomeric means which is compressed upon application of a vertical load and is elongated in shear upon the application of a longitudinal impact to the base structure on which the mounting structure is supported.

Cushioned mounting structures of the general type to which the present invention relates have generally been constructed with a columnar block of an elastomeric material disposed between a pair of metallic plates of which one of the plates is fixed to a support structure and of which the other plate has fixed thereon a suitable load or latching attachment means. The columnar block is unsupported so that when a vertical load is applied thereon the blocks are placed under compression. Upon the application of a longitudinal impact to the support structure, the compressed elastomeric blocks are elongated between the upper and lower plates and stressed in shear. Such stresses in shear result in the absorption by the blocks of a portion of the longitudinally applied impact to the extent of travel of the elastomeric block from an erect to elongated position.

These prior arrangements are limited to a travel of about 8" in shear, particularly, when loaded in compression. Such limitation of the travel is caused by such factors as column stability and the hysteresis characteristic of the elastomeric material forming the block. Upon the application of a longitudinally applied impact the upper plate or face of the elastomeric block is displaced lengthwise of the lower face so that the full height of the block or column is not available at the displaced portion. Under this extended condition of the elastomeric block the load may cause the displaced or unsupported portion to be collapsed so that the load is tilted on the cushioned mounting structure. This creates a problem in returning the block from its elongated to normal upright position after the longitudinal impact has been dissipated.

Moreover, the hysteresis characteristic of the elastomeric block under compression is such that the elasticity of the material when extended to its full length of travel in shear is incapable of returning the load supported on the mounting structure to its original position. Thus upon further impact the full length of travel is not available for further cushioning.

Hereinafter, as mentioned above, these factors have limited elastomeric cushioned mounting structures of the foregoing general type to travel about eight inches in shear. Such travel under many conditions may be inadequate to protect the load mounted thereon from damage because of the inability to absorb and dissipate a sufficient quantity of impact energy.

It is a principal object of the present invention to provide a new and improved cushioned mounting structure which is constructed and arranged to materially increase the cushioned travel of the structure in shear beyond the eight inch limitation imposed heretofore.

It is a further object to provide a cushioned mounting structure which is constructed and arranged to provide a plurality of stacked rubber cushions which are movable in shear and connected in series so that the total travel of each of the cushions is additive.

It is another object of the invention to provide a cushioned container mounting structure which is constructed and arranged to include a plurality of elastomeric cushioning members connected in stacked and series relationship and each being movable and in shear and having means disposed between said series connected cushioned members for controlling the compression forces imposed on the elastomeric pads in a manner resulting in sufficient elasticity at the end of travel of each of the cushioning devices so that the elastomeric members are capable of returning to the erect position.

It is still another object taken in conjunction with the immediately foregoing object to provide means for imparting a friction resisting force as the elastomeric cushion means extend in shear.

Further objects and features will hereinafter appear.

In the drawings:

FIG. 1 is a fragmentary top plan view of a plurality of the cushion pads embodying the principles of the present invention mounted on a railroad car for accommodating the latter to support containers thereon;

FIG. 2 is a side elevational view of the cushioned mounting structure of the present invention showing in phantom lines the position of the structure in its extended position;

FIG. 3 is an end elevational view of the cushioned mounting structure showing the relative positions of the components thereof in the absence of a vertical load imposed thereon; and

FIG. 4 is a view similar to FIG. 3 but showing the conditions of the components of the cushioned mounting structure when a load such as a container is supported thereon.

Referring now to FIG. 1, there is shown a plurality of cushioned mounting structures 10 embodying the principles of the present invention. The cushioned mounting structures 10 are shown mounted on a flat deck railroad car 11 which includes the usual 5th wheel stanchions 12 mounted thereon. The cushioned mounting structures 10 are arranged to support and mount a container on the car by way of an engagement with respective ones of four corners of the typical container C. The containers C are of normal conventional structure of the general type having a substantially frameless construction so that the container body must be protected against undue stresses imposed thereon by impacts. The cushioned mounting structures 10 of the present invention are particularly suitable to provide a cushion travel which reduces the stresses imposed on the container structure and reduces the damage to the lading carried in the container.

Referring now to FIGS. 2 to 4, the cushioned mounting container structures 10 each comprises a base plate 13 and
to which there is fastened as by rivets 20 a lower plate 14 of an elastomeric block assembly 16. The plate 14 is suitably bonded to an elastomeric block 17 preferably formed of rubber or the like. The elastomeric block is formed as a substantially rectangular column having a horizontal cross section adequate to resiliently support the vertical static load. The vertical cross section is selected to provide the longitudinal or shear loading as more fully to be described. The block 17 is further characterized by a durometer rating which is selective to provide optimum travel in shear with a maximum energy under compression and shear loading. Bonded to the upper surface of the elastomeric block 17 is a top plate 18 which is suitably fastened to an intermediate plate 19 which extends beyond the side periphery of the elastomeric block 17.

The intermediate plate 19 lies over the upper ends of a pair of transversely spaced upstanding plates 21—21 which are fixed at their lower end as by welding to the base plate 13. In the absence of a load on the cushioned mounting structure 10 as shown in FIG. 3, the intermediate plate 19 is spaced above the upstanding plates 21—21 so as to provide clearance therebetween. However, upon the application of a vertical load thereon, the rubber pad is placed under compression so that plate 19 is displaced toward the lower end of the upstanding members 21 as shown in FIG. 4. As more fully to be explained hereafter, to achieve controlled friction between the contacting surfaces of the plate 19 and the upper ends of the upstanding plates 21, the contacting surfaces are formed with a suitable finish.

Fixed to the upper surface of the intermediate plate 19 by rivets 22 connecting the top plate of the elastomeric block 17 to the latter is a bottom plate 23 of a second elastomeric block 24 of a block assembly 25. The elastomeric block 24 is selected so as to have substantially the same characteristics as the elastomeric block 17 hereinafter described. Bonded to the upper surface of the block 24 is a plate 26 which is fixed as by rivets 27 to a top plate 28. The top plate 28 extends beyond the periphery of the elastomeric block 24 and overlies in vertically spaced relationship a pair of transversely spaced upstanding supports 29 which are fixed as by welding to the intermediate plate 19. Upon the application of a vertical load on the top plate 28 causing compression of the elastomeric block 24, the former is displaced toward the upper ends of the upstanding supports 29 in the same manner as described in connection with the displacement of the intermediate plate 19 toward the upstanding supports 21.

The contacting surfaces of the upstanding plates 29 and top plate 28 are also finished to provide controlled friction.

Mounted on the upper side of the top plate 28 is a container mounting structure which in the form shown comprises a base block 31 from which there extends a circular column 32 which is received within an opening O of a standard corner fitting on each of the corners of a container C. It should be clearly understood that in the event that the cushioned mounting structure is employed for other purposes than mounting a container on a railway car, various other types of suitable fastening structures may be employed for structure shown.

To impart lateral stability to the cushion unit and thereby prevent lateral deflection of the elastomeric blocks 17 and 24, there extends downwardly from the top plate a pair of transversely spaced guide plates 33, which are each disposed outwardly of respective ones of the upstanding plates 29. Additional lateral stability guides 34 are fixed to the respective upstanding plates 21 and extending upwardly of the intermediate plate 19 and are spaced from the upstanding plates 29 as shown in FIGS. 3 and 4.

Assuming that an impact is applied to the car 11 on which cushioned mounting structures 10 are mounted, the container C and the car body move relatively to each other. During this relative movement the lower elastomeric block 17 is elongated in shear as shown in the phantom line position of FIG. 2. Such elongation occurs because of the displacement of the intermediate plate 19 relative to the base plate 13 and the elastomeric block 17 is extended in shear to the full extent of its travel. At the same time, the elastomeric pad 24 which is fixed at its bottom face for movement with the intermediate plate 19 is displaced therewith. Also, the upper plate 28 is displaced to the extent of the elongation of the elastomeric pad 24. Thus, the elastomeric pads 17 and 24 are each elongated in shear. As is readily apparent, the total travel of the upper plate 28 relative to the lower plate 13 is the sum of the elongation of the elastomeric pads 24 and 27 so that the container mounted thereon travels a total length T. During this travel the shear stresses imposed on the elastomeric pads 17 and 24 are operative to absorb a portion of the impact energy applied.

It is to be noted that as the elastomeric blocks 17 and 24 are each elongated, the upper plate 28 and the upstanding supports 29 and the intermediate plate 19 and the upstanding supports 21 are in sliding contact. Thus, there is created a frictional intermediate plate 19 and the supports 19, 21 and 28 of the block 17 absorbs a portion of the impact energy. At the same time the upstanding supports 29 and 21, in sliding contact with the plates 28 and 29, prevent further compression of the elastomeric pads 17 and 24 under the force of the vertical load imparted thereto. Moreover, the supports 21 and 29 further maintain the upper and lower surface of each of the blocks in substantial parallelism along the length thereof so that the elongated ends are not collapsed. Thus, the elastomeric blocks 17 and 24 each retain sufficient elasticity to return the vertically supported load from the elongated or extended position or maximum travel position to the neutral position of the mounting structure after the force of impact has been dissipated.

The elastic block of the elastomeric blocks 17 and 24 after elongation in shear will vary with the hysteresis characteristic of the elastomeric material being used, the vertical and horizontal cross sections, and the maximum vertical load to be supported on the mounting structure 10. These factors will to some extent determine the vertical spacings d between intermediate plate 19 and the upper ends of the upstanding supports 21 and the top plate 28 and the upper ends of the upstanding supports 29, respectively. Should the elastomeric material of the blocks 17 and 24 have considerable elasticity at the end of the travel T under a selective maximum load adequate to return the load to the neutral position and overcome the frictions forces between the contacting surfaces of the upstanding support posts 21 and intermediate plate 19 and support posts 29 and top plate 28, the distance d may be held to a minimum to obtain as much frictional contact and energy absorption therefrom during the travel T.

However, if the elastomeric material has a minimum elasticity at the end of the travel T, it may be necessary to maintain the frictional forces at a minimum by increasing the vertical spacings d. Under the latter condition there may be vertical spacing between the respective upper ends of the upright supports 21 and intermediate plate 19 and upright supports 29 and top plate 28 when the vertical load is applied on the mounting structure in the normal or neutral position thereof. Accordingly, upon the application of a longitudinal impact causing an elongation of the elastomeric blocks 17 and 24 in shear, the plates 19 and 28 slidable contact the upstanding supports 21 and 29 for a portion of the travel T. Such sliding contact is, however, preferably maintained at a maximum to absorb by friction as much as possible of the impact energy.

The foregoing description and drawings are given merely to explain and illustrate the invention, and the invention is not to be limited thereto. For example, the appended claims are so limited, since those skilled in the art who have the disclosure before them will be able to make modifications and variations therein without departing from the scope of the invention. For instance, the use of such terms as "base" or "base plate" is not in...
tended to limit the construction to a thin plate material but may be a block or a housing or the like.

What is claimed is:

1. A cushioned mounting arrangement for supporting vertical loads against generally horizontally longitudinally applied impacts, said mounting arrangement comprising a plurality of superposed elastomeric pads, a plate member fixed on top of the uppermost of said pads, plate means being fixed between adjacent ones of said pads, a supporting member, means fixing the bottom of said lowermost of said pads to said supporting member, and means extending between said plate means and providing vertical support for the load in compression on said pads and frictionally engageable with surfaces facing between said plate means and the members during movement of said pads in shear upon the application of a longitudinally applied impact on said support means.

2. The invention according to claim 1, and in which said plate member is a hollow plate member of thin sheet metal material and wherein said plate member is attached to the top of said uppermost plate member.

3. A cushioned mounting arrangement for supporting vertical loads against longitudinal applied impacts, said cushioned mounting arrangement comprising a first elastomeric pad having a bottom surface fixed to a base plate, an intermediate plate fixed to the upper surface of said first elastomeric pad in substantially parallel relationship with said base plate, a second elastomeric pad having a bottom surface fixed to the upper surface of said intermediate plate, a top plate fixed to the upper surface of said second elastomeric pad, means on said top plate for mounting a vertical load thereon, a pair of laterally spaced support means disposed on opposite sides of said first and second elastomeric pads and mounted at one end thereof on one of said pads, said laterally spaced support means each including a surface in frictional sliding relationship engaged with the remaining of said plates to support the vertical load as said first and second elastomeric pads are elongated in shear upon the application of impact force to said mounting structure.

4. The invention as defined in claim 3 wherein said upstanding support means comprises a pair of laterally spaced support means disposed between said base and said intermediate plate, said first upstanding means being mounted at one end thereof to one of said intermediate and base plates, and having a surface engageable in frictional sliding relationship with the other of said intermediate and base plates; and a second pair of upstanding support means mounted at one end thereof to one of said intermediate and top plates, said second upstanding support means each including a surface engageable in frictional sliding relationship with the other of said intermediate and top plates.

5. The invention as defined in claim 4 wherein said first upstanding support means are mounted on said base, and said second upstanding means are mounted on said intermediate plate.

6. A cushioned mounting arrangement for supporting vertical loads against generally horizontally longitudinally applied impacts, said mounting arrangement comprising generally horizontally extending vertically spaced upper, intermediate and lower load bearing members, first elastomeric pad means between the upper and intermediate members and second elastomeric pad means between the intermediate and lower pad members, upright support means extending between the intermediate and lower members and cooperating with one of the intermediate and lower members, said intermediate and lower load bearing members presenting a load bearing surface for the second elastomeric pad means extending between them, said load bearing surface having frictional engagement with said support means for horizontal translation of the intermediate member relative to the lower member, said load bearing surfaces, and for support of the second pad means against collapse with said first and second pad means being placed in shear to increase longitudinal travel of the cushioned mounting arrangement upon the application of a generally horizontally longitudinally applied impact on said lower load bearing member.

7. A cushioned mounting arrangement for supporting vertical loads against generally horizontally longitudinally applied impacts, said mounting arrangement comprising a pair of elastomeric pad means stacked in vertical series and means supporting each of the pad means against collapse upon horizontal translation of one pad means relative to the other and including a pad separator between each of the pad means, said means supporting said pad means further including a load bearing member on the top of the upper pad means and a load bearing member for the bottom of the lower pad means, said upper and lower load bearing members being provided with support means cooperatively with the pad separator for vertically supporting the both pad means while permitting relative horizontal frictional movement of the upper member relative to the lower member and placing each of the pad means in shear to extend the length of travel of the cushioned mounting arrangement the cumulative amount of the movement of each of the pad means.

8. A cushioned mounting arrangement for supporting vertical loads against generally horizontally longitudinally applied impacts, said mounting arrangement comprising horizontally extending vertically spaced upper, intermediate and lower load bearing members, first elastomeric pad means between the upper and intermediate members and second elastomeric pad means between the intermediate and lower pad members, upright support means extending between the intermediate and lower members and between the intermediate and upper members, said upright support means having frictional engagement with one of the intermediate and lower members and with one of the intermediate and upper members for horizontal translation of the upper load bearing member relative to the intermediate and lower load bearing members with the first pad means being shifted horizontally of the second pad means attendant to lengthening cushion travel with each of the pad means being placed in shear upon the application of a generally horizontally longitudinally applied impact on said lower load bearing member.

9. The invention according to claim 8, and said upright support means comprising a pair of laterally spaced apart support means on either side of the elastomeric pad means.

10. The invention according to claim 8, and said upright support means comprising a first pair of laterally spaced supports on opposite sides of said first elastomeric member and between the upper and intermediate members and a second set of laterally spaced support members on either side of said second elastomeric pad means between the intermediate and the lower pad members.

11. The invention according to claim 8, and means cooperative with said support means and load bearing members to limit lateral movement of one pad means relative to the other.

12. The invention according to claim 8, and wherein said upright support means is spaced vertically away from one of the intermediate and lower members and one of the intermediate and upper members until such time as a vertical load is applied to the member whereupon the elastomeric pads are compressed to provide for engagement between the upright support means and the members.

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