

A VIBRATION REDUCING ASSEMBLY

Field of the invention

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The present invention relates to an assembly used for reducing vibration in vehicles so as to reduce the discomfort caused to passengers. It is particularly useful for tracked vehicles, wherein vibration levels are higher, although the invention is also suitable for use in other types of vehicles.

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Therefore, it will be convenient to hereinafter describe the invention in relation to this particular application to tracked vehicles. However it should be appreciated that the assembly may be used in other types of vehicles.

Background of the invention

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Vehicles tend to vibrate during movement because of contact with the ground. The level of vibration generally depends on the type of terrain. Vehicle suspension systems are typically used to reduce vibration and increase comfort to passengers. Nevertheless, it is felt that the level of vibration can be further reduced.

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Tracked vehicles are known to have higher noise and vibration levels as compared to wheeled vehicles. Studies have shown that the increased vibration is attributable to the inherent design of metal track links. The impact forces arriving from the metal track links hitting the idler wheel or sprocket excite the hull plates of the vehicles, which in turn set them in vibration.

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In the case of tracked vehicles, reduction of vibration at these sources would call for radical changes in the hull structure and suspension system,

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which are likely to involve compromises in the weight and size of the vehicles, as well as a trade-off in vehicle performance.

5 The problem is that excessive vibration of hull structures, especially those on the belly plate and seat structure of the tracked vehicle cause discomfort and physical fatigue to the passengers in the passenger compartment.

10 It is particularly important to overcome this problem in relation to tracked vehicles used to carry combat troops, where the troopers' physical discomfort and fatigue are crucial factors in land combat operations. After all, it is the ability of the soldiers to operate the combat machines which often influences the outcome of a battle. Hence, further vibration attenuation measures in the trooper compartment would be desirable.

15 Summary of the invention

It is therefore an object of the current invention to more effectively attenuate vibration levels attributed to resonance associated with moving vehicles that is transmitted to passengers' bodies, especially their legs when they are
20 seated.

In the event, the invention also seeks to raise the comfort level of passengers travelling on board the vehicles, especially in tracked vehicles.

25 According to the present invention, there is provided an assembly for reducing vibration felt by passengers in a compartment of a moving vehicle including foundation means attached to a relatively fixed surface of the compartment, a seat assembly attached to the foundation means, a floorboard assembly attached to the seat assembly, and a resilient means
30 mounted between the floorboard assembly and the seat assembly to reduce vibration of the floorboard assembly relative to the seat assembly,

wherein in use, the floorboard assembly is spaced from each surface of the compartment.

5 Preferably, a second resilient means is mounted between the seat assembly and the foundation means to reduce vibration of the seat assembly relative to the foundation means.

The foundation means preferably include a fastener means for attaching the foundation means to the relatively fixed surface of the compartment.

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The floorboard assembly may consist of a floorboard and a floorboard-connecting arm extending from the floorboard for connection with the seat assembly. Further, the seat assembly may consist of seating means and a seat-connecting arm extending from the seating means for connection with
15 the floorboard assembly. Thus, the resilient means may be mounted between the floorboard-connecting arm and the seat-connecting arm and may control relative movement between the floorboard-connecting arm and the seat-connecting arm.

20 It is preferable that the resilient means bias the floorboard assembly towards the seat assembly such that the floorboard assembly is spaced from each surface of the compartment.

The resilient means preferably comprises a spring, whereas the second
25 resilient means preferably comprises one or more rubber isolators. The second resilient means may further include one or more rubber isolators mounted horizontally relative to the seating means as well as one or more rubber isolators mounted vertically relative to the seating means.

It is preferable that the floorboard is in contact with at least one surface of the compartment when the weight acting on the floorboard assembly is greater than the biasing resistance provided by the resilient means.

- 5 According to another aspect of the invention, there is provided a vehicle comprising a passenger compartment which contains assembly as described above. It is preferable that the vehicle is a tracked vehicle.

- 10 According to yet another aspect of the invention, there is provided an assembly for reducing vibration felt by passengers in a compartment of a moving vehicle including foundation means adapted to be attached to a relatively fixed surface of the compartment, a seat assembly attached to the foundation means, floorboard assembly attached to the seat assembly and
15 a resilient means mounted between the seat assembly and the foundation means to reduce vibration of the seat assembly relative to the foundation means, wherein in use, the floorboard assembly is spaced from each surface of the compartment.

- It will be convenient to hereinafter describe an embodiment of the present
20 invention with reference to the accompanying drawings which illustrate one form of a tracked vehicle incorporating the invention. It is to be understood that the particularity of the drawings and the related description is not to be understood as superseding the generality of the broad description of the invention as defined in the claims.

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Brief description of the drawings

The drawings illustrate a preferred embodiment of the present invention relating to the use of the invention in a tracked vehicle.

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Figure 1 is a perspective view of a passenger compartment in a tracked vehicle incorporating one embodiment of the present invention.

Figure 2 is a front elevational view illustrating the present invention implemented in a passenger compartment of a tracked vehicle.

Figure 3 is a side view of a spring assembly mounted between the floorboard assembly and seat assembly according to the said embodiment of the present invention.

Detailed description of the preferred embodiment of the invention

Referring to Figure 1, the compartment 10 of a tracked vehicle has relatively fixed side walls 12 to which are attached cantilevered seat bench structures 14. The cantilevered seat bench structures 14 may be attached to the side walls either by bolts or other fastener means. Seat assemblies 16 are connected to the cantilevered seat bench structures 14. A floorboard assembly 18 is further connected to the seat assembly 16.

Figure 2 is a front elevational view illustrating the present invention implemented in a passenger compartment 10 of a tracked vehicle. The seat assembly 16 consists essentially of a cushion seat 20 and seat-connecting arms 22. The floorboard assembly 18 consists essentially of a floorboard 24 and floorboard-connecting arms 26. The floorboard-connecting arms 26 and seat-connecting arms 22 are separated by resilient means, in this case a spring assembly 28, such that the floorboard assembly 18 is suspended from the seat assembly 16. In turn, the seat assembly 16 is isolated from the cantilevered seat bench structures 14 by second resilient means such as rubber isolators 30,32.

One way in which vibration is reduced is that the cantilevered seat bench structures 14 are mounted to the side walls 12 so that vibration from the belly plate 34 is not transmitted directly to the cushion seat 20.

- 5 In addition, the cushion seat 20 is isolated from the cantilevered seat assembly 14 by employing the vertically mounted 30 and horizontally mounted 32 rubber isolators. These isolators not only provide vibration isolation at higher frequencies for the cushion seats 20, but also act as first stage isolation for the suspended floorboard assembly 18.

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- The floorboard assembly 18, where the foot of the passengers will be resting, is mounted to the isolated seat assembly 16 and suspended above the belly floor 34 of the tracked vehicle. The spring assembly 28 provides the second stage vibration isolation at lower frequencies for the suspended floorboard assembly 18.

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- During normal operation, when the passengers occupy the compartment 18 of the vehicle, they will sit on the cushion seats 20 and their feet will rest on the floorboard 24 of the floorboard assembly 18. As a result, the floorboard 24 will be suspended above the belly floor 34 since more of the passengers' weight rests on the seat assembly 16 relative to the floorboard 24.

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- During mounting and dismounting, when for example, more than two passengers are standing on the floorboard 24, the spring assemblies 28 will be compressed as the total stiffness of the springs is less than the total stiffness of the horizontally 32 and the vertically 30 mounted rubber isolators. Therefore, the suspended floorboard 24 will rest on the belly floor 34 thus preventing the rubber isolators 30,32 from being over-loaded.

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- Thus, the spring assemblies 28 not only provide second-stage isolation for the suspended floorboard 24, but also doubles up as a load release

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mechanism to prevent over-loading of the rubber isolators 30,32. These spring assemblies 28 are preferably adjustable vertically to provide sufficient clearance as well as the desirable stiffness between the suspended floorboard 24 and the belly plate 34.

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It should be noted that the horizontally mounted rubber isolators 32 also act as a fail-safe device to prevent the vertically mounted rubber isolators 30 from shear when the floorboard assembly 18 is loaded. These horizontally mounted rubber isolators 32 also provide horizontal restraint during vehicle

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Figure 3 is a side view of a spring assembly 28 mounted between the floorboard assembly 18 and seat assembly 16 according to the said embodiment of the present invention. The spring assembly 28 includes a platform 40 for supporting a helical spring 42. A pair of height adjustment nuts 44 are used to connect the platform 40 to the seat assembly arms 22, and to adjust the height of the platform 40 along the seat assembly arms 22. The end of the helical spring 42 supports an end-plate 48 located at the top end of the floorboard-connecting arm 26 such that the floorboard assembly 18 is biased towards the seat assembly 16. A spring stiffness adjustment nut 46 is located just below the platform 40 and along the length of the floorboard-connecting arm 26 to adjust the stiffness of the helical spring 42. The greater the distance between the spring stiffness adjustment nut 46 and the end-plate 48, the lighter will be the resistance provided by the helical spring 42.

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The seat assembly 16 including the floorboard assembly 18 are easily detachable for replacement of parts and for maintenance. The suspended floorboard assembly 18 can also be readily flipped up side-ways or removed from the vehicle for maintenance or routine cleaning.

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From the above description, it is apparent that the present invention provides a much more comfortable ride for passengers in moving vehicles and in particular, tracked vehicles.

- 5 Although the described embodiment of the invention relates to a tracked vehicle, it is apparent that the invention can also be applied to the compartments of other vehicles such as trains, buses or other vehicles, where high level of floorboard vibration is an annoyance to passengers. In fact, its application can be extended to any type of passenger transportation
- 10 means. Further, although the resilient means used herein are rubber isolators and helical spring respectively, it can be envisaged that other forms of resilient means can be applied.

- While a particular embodiment of the invention has been shown and
- 15 described, it will be appreciated by those skilled in the art that changes and modifications of the present invention may be made without departing from the invention in broadest aspects. As such, the scope of the invention should not be limited by the particular embodiment and specific construction described herein but should be defined by the appended claims and
- 20 equivalents thereof. Accordingly, the aim in the appended claims is to cover all such changes and modifications as fall within the spirit and scope of the invention.

CLAIMS:

1. An assembly for reducing vibration felt by passengers in a compartment of a moving vehicle including;
 - a foundation means adapted to be attached to a relatively fixed surface of the compartment,
 - a seat assembly including a seating means, attached to the foundation means,
 - a floorboard assembly attached to the seat assembly and disposed therefrom in a manner to allow a person sedentary on said seating means to naturally rest their feet on said floor board assembly, and
 - a resilient means mounted between the floorboard assembly and the seat assembly to reduce the transmission of vibration between the seat assembly and the floorboard assembly,wherein
in use, the floorboard assembly is spaced from each surface of the compartment.
2. An assembly according to claim 1, wherein a second resilient means is mounted between the seat assembly and the foundation means to reduce the transmission of vibration between the seat assembly and the foundation means.
3. An assembly according to claim 1 or 2, wherein the foundation means includes a fastener means for attaching the foundation means to the relatively fixed surface of the compartment.
4. An assembly according to any one of the preceding claims, wherein the floorboard assembly consists of a floorboard and a

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floorboard-connecting arm extending from the floorboard for connection with the seat assembly.

5. An assembly according to any one of the preceding claims, wherein the seat assembly consists of seating means and a seat-connecting arm extending from the seating means for connection with the floorboard assembly.
6. An assembly according to claim 5, wherein the resilient means is mounted between the floorboard-connecting arm and the seat-connecting arm and controls relative movement between the floorboard-connecting arm and the seat-connecting arm.
7. An assembly according to any one of the preceding claims, wherein in use the resilient means biases the floorboard assembly towards the seat assembly such that the floorboard assembly is spaced from each surface of the compartment.
8. An assembly according to any one of the preceding claims, wherein the resilient means comprises a spring.
9. An assembly according to any one of the preceding claims, wherein the second resilient means comprises one or more rubber isolators.
10. An assembly according to claim 9, wherein the second resilient means include one or more rubber isolators mounted horizontally relative to the seating means as well as one or more rubber isolators mounted vertically relative to the seating means.

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11. An assembly according to any one of the preceding claims, wherein the floorboard is in contact with at least one surface of the compartment when the weight acting on the floorboard assembly is greater than the biasing resistance provided by the resilient means.
12. A vehicle comprising a passenger compartment which contains an assembly according to any preceding claim.
13. A vehicle according to claim 12, wherein the vehicle is a tracked vehicle.
14. An assembly for reducing vibration felt by passengers in a compartment of a moving vehicle including
 - foundation means adapted to be attached to a relatively fixed surface of the compartment,
 - a seat assembly including a seating means, attached to the foundation means,
 - a floorboard assembly attached to the seat assembly and disposed therefrom in a manner to allow a person sedentary on said seating means to naturally rest their feet on said floor board assembly, and
 - a resilient means mounted between the seat assembly and the foundation means to reduce the transmission of vibration between the seat assembly and the foundation means,wherein
 - in use, the floorboard assembly is spaced from each surface of the compartment.