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Frequency dampening mounting system

Abstract

A vibration isolating damper for securing a first structure to a second structure includes a primary isolator of elastomeric material configured to engage the first structure for securement thereto and including a tubular body and a shoulder adjacent to an axial end of the tubular body, the shoulder extending radially inwardly to partially close the axial end of the tubular body. The vibration isolating damper also includes a fastener having a rod portion extending through the tubular body of the primary isolator and configured for securement to the second structure; a rigid tube disposed about the rod portion of the fastener and extending through the tubular body of the primary isolator; and a coil spring disposed about the rigid tube and engaging the shoulder of the primary isolator within the tubular body.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATION (1) This patent application claims the benefit of priority to U.S. Provisional Patent Application Ser. No. 63/226,927, filed Jul. 29, 2021, the entire disclosure of which is incorporated by reference herein in its entirety.

FIELD OF THE INVENTION

(1) The present disclosure relates to a frequency dampening mounting system for vehicle systems and assemblies.

BACKGROUND

(2) Vehicle systems, assemblies and components result in noise and vibration during operation of the vehicle. Efforts to mitigate noise and vibration include frequency dampening and resonant frequency avoidance. The industry utilizes many different types of dampening components and techniques, the selection of which depends on the particular application. Efforts to improve dampening are continuously sought in the industry, as noise and vibration not only lead to more rapid and severe degradation of components, but are also associated with a negative perception of vehicle quality by consumers.

SUMMARY

(3) According to one aspect of the disclosure, a vibration isolating damper for securing a first structure to a second structure is provided. The vibration isolating damper includes a primary isolator of elastomeric material configured to engage the first structure for securement thereto and including a tubular body and a shoulder adjacent to an axial end of the tubular body, the shoulder extending radially inwardly to partially close the axial end of the tubular body. The vibration isolating damper also includes a fastener having a rod portion extending through the tubular body of the primary isolator and configured for securement to the second structure; a rigid tube disposed about the rod portion of the fastener and extending through the tubular body of the primary isolator; and a coil spring disposed about the rigid tube and engaging the shoulder of the primary isolator within the tubular body.

(4) According to another aspect of the disclosure, a mounting bracket assembly for attaching a component to a structural element in a vehicle is provided. The mounting bracket assembly includes at least one vibration isolating damper configured to couple the component to the structural element while limiting transmission of vibration therebetween. The vibration isolating damper includes a primary isolator of elastomeric material configured to engage a first structure for securement thereto and including a tubular body and a shoulder adjacent to an axial end of the tubular body, the shoulder extending radially inwardly to partially close the axial end of the tubular body. The vibration isolating damper also includes a fastener having a rod portion extending through the tubular body of the primary isolator and configured for securement to the second structure; a rigid tube disposed about the rod portion of the fastener and extending through the tubular body of the primary isolator; and a coil spring disposed about the rigid tube and engaging the shoulder of the primary isolator within the tubular body.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The subject matter that is regarded as the invention is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other features, and advantages of the invention are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

(2) FIG. **1**A shows a perspective view of a mounting bracket assembly in accordance with an aspect of the present disclosure;

(3) FIG. **1**B shows an end view of the mounting bracket assembly of FIG. **1**A;

(4) FIG. **1**C shows a side view of the mounting bracket assembly of FIG. **1**A;
(5) FIG. **2** shows an exploded diagram showing components of the vibration isolating damper in the mounting bracket assembly of FIG. **1**A;
(6) FIG. **3** shows exploded diagram showing components of the vibration isolating damper in accordance with an aspect of the present disclosure;
(7) FIG. **4** is fragmentary cut-away diagram showing internal details of the vibration isolating damper in the mounting bracket assembly of FIG. **1**A; and
(8) FIG. **5** shows a graph with plots showing dynamic transfer stiffness as a function of frequency for the vibration isolating damper with an uncoated coil spring and with a PVC coated coil spring.

DETAILED DESCRIPTION

(9) Referring now to the Figures, where the invention will be described with reference to specific embodiments, without limiting same, various embodiments of the invention are illustrated and disclosed herein.

(10) FIGS. **1**A-**1**C show several views of a mounting bracket assembly **20** of the present disclosure. The mounting bracket assembly **20** may be used to attach a component, such as a compressor to a larger structure, such as a chassis of a vehicle, and to limit transfer of vibration therebetween. The mounting bracket assembly **20** of the present disclosure may reduce noise, vibration, and harshness (NVH) that may otherwise be generated as a result of vibrations from the compressor being transmitted to other structures of the vehicle.

(11) As shown in FIG. **1**A, the mounting bracket assembly **20** includes a first structure **22** connected to a second structure **24**. Each of the first structure **22** and the second structure **24** are shown as brackets. However, either or both of the structures **22**, **24**, may be another type of structural element, such as a housing of a motor or a compressor and/or a structural member of a larger assembly, such as a motor vehicle. A set of vibration isolating dampers **50** couple the first structure **22** to the second structure **24**. The mounting bracket assembly **20** includes two of the vibration isolating dampers **50**. However, an alternative mounting bracket may include any number of the vibration isolating dampers **50**. For example, a mounting bracket may include only one of the vibration isolating damper. The number and configuration of the vibration isolating dampers **50** may depend on several design considerations, such as the weight and positioning of an object to be mounted thereto.

(12) The first structure **22**, which may also be called a lower bracket, may be formed of a rigid material, such as aluminum or steel and which may be molded, cast, and/or machined. In one embodiment, the first structure **22** may be formed in a high-pressure die cast (HPDC) process. However, other materials may be used, such as a fiber-reinforced polymer (FRP). The first structure **22** includes a body portion **26** with two mounting lugs **28** extending therefrom. The mounting lugs **28** each have a generally tubular shape and are spaced-apart and substantially parallel to one another. Each of the mounting lugs **28** defines a mounting flange **30** facing away from the body portion **26**, with a mounting hole **32** defined therein and coaxial with the tubular shape. The mounting holes **32** may have an internal thread for receiving a bolt or other fastener (not shown) for mounting an object (not shown). The first structure **22** also defines two damper cups **34**, with each of the damper cups **34** configured to hold a corresponding one of the vibration isolating dampers **50**. The damper cups **34** each have a generally tubular shape that are spaced apart and substantially parallel to one another. Each of the damper cups **34** extend substantially perpendicular to the mounting lugs **28**.

(13) The first structure **22** also includes an extension portion **36** that extends from an end of the body portion **26**, with a stud **38** attached thereto and extending substantially parallel to and spaced apart from the damper cups **34**. The stud **34** may be used to attach other equipment, such as a wiring harness and/or an air duct.

(14) The second structure **24**, which may also be called an upper bracket, has a Z-shaped cross-section, best shown in FIG. **1**B. The second structure **24** may be formed of a rigid material, such as

plastic, which may include a fiber-reinforced polymer (FRP). However, the second structure **24** may be made of metal, such as aluminum. The second structure **24** defines a lower flange portion **40** configured to attach to the vibration isolating dampers **50**. The lower flange portion **40** includes reinforced sections adjacent to the vibration isolating dampers **50** to withstand forces applied thereto from the vibration isolating dampers **50**. The second structure **24** also includes a vertical portion **42** attached to the lower flange portion **40** and extending generally perpendicularly thereto and away from the first structure **22**. The second structure **24** also includes an upper flange portion **44** attached to the vertical portion **42** opposite from the lower flange portion **40**. Together, the lower flange portion **40**, the vertical portion **42**, and the upper flange portion **44**, define the Z-shaped cross-section of the second structure **24**. Alternative arrangements for the second structure **24** may be provided, such as ones with a C-shape or an L-shape cross-section.

(15) The upper flange portion **44** defines a pair of mounting holes **46** extending therethrough in a spaced and substantially parallel configuration. The mounting holes **46** may include rigid inserts, such as metal sleeves, to receive corresponding bolts or screws (not shown) for securing the upper flange portion **44** to a structural element, such as a chassis of a vehicle. The upper flange **44** of the second structure **24** also includes an archway **48** defining a hole **49** extending therethrough. The archway **48** may function as a lifting lug for receiving a hook to lift the mounting bracket assembly **20** and any equipment attached thereto. The archway may be used during a vehicle assembly process for positioning the mounting bracket assembly **20** and corresponding equipment within a vehicle assembly prior to securement, such as before bolts are secured through the mounting holes **46**.

(16) The lower flange portion **40** of the second structure **24** may also include similar rigid inserts, such as metal sleeves, each configured to receive a fastener **52**, such as a bolt or screw, of a corresponding vibration isolating dampers **50**. A nut **54** is threaded on each of the fasteners **52** of the vibration isolating dampers **50** for securement to the lower flange portion **40** of the second structure **24**. The fasteners **52** may be made of steel and may be, for example, a class 8.8 bolt. The fasteners **52** may include an M8 thread. However, the fasteners **52** may have a different materials, classification, and/or size.

(17) Each of the vibration isolating dampers **50** includes a fastener **52** that extends through an assembly of another component, holding them together and securing the first structure **22** connected to the second structure **24** of the mounting bracket assembly **20**. Each of the vibration isolating dampers **50** also includes an upper retainer washer **56**, a primary isolator **58**, an isolator ring **60**, and a lower retainer washer **62**. The upper retainer washer **56** and the lower retainer washer **62** may have an identical construction and may, therefore, be interchangeable. However, an alternative design may use different components for the upper retainer washer **56** and the lower retainer washer **62**. The primary isolator **58** may be made of an elastomeric material, such as rubber. The isolator ring **60** may be made of an elastomeric material, such as rubber. There materials are merely illustrative and not intended to be limiting.

(18) FIGS. **2-3** show various details of the vibration isolating dampers **50** and their attachment to the first structure **22**. FIG. **2** shows the first structure **22** with each of the damper cups **34** defining a tubular wall **100** with an upper rim **102** to receive and engage a corresponding one of the vibration isolating dampers **50**.

(19) The primary isolator **58** includes a tubular body **70** that receives and surrounds a coil spring **64** and a rigid tube **66**. The tubular body **70** may have a taper or a frustoconical shape, which may aid in installing the primary isolator **70** within the tubular wall **100** of the first structure **22**. The rigid tube **66** configured to receive the fastener **52** therethrough, with the coil spring **64** wound thereabout. The rigid tube **66** may be made of steel or another rigid and durable material. The primary isolator **58** includes a shoulder **72** adjacent to an upper axial end thereof and having an annular shape that extends radially inwardly to partially close the upper axial end thereof, proximate to the upper retainer washer **56**.

(20) In some embodiments, the coil spring **64** is coated with a resilient material configured to generate a specific damping characteristic at a given range of frequencies. For example, the composition and/or characteristics such as thickness of the resilient material may be configured to cause the vibration isolating damper to have a dynamic transfer stiffness below a given value for the given range of frequencies. In some embodiments, the resilient material includes polyvinyl chloride (PVC). However, other materials may be used for coating the coil spring.
(21) Still referring to FIG. **3**, the primary isolator **58** also includes a tubular extension **76** that extends axially upwardly from the shoulder **72**, away from the tubular body **70**. The primary isolator **58** also includes an annular extension **78** that extends radially outwardly from the tubular extension **76** at an end thereof spaced apart from the shoulder **72**. The annular extension **78** best shown in FIG. **3** with a solid ring shape. However, the annular extension **78** may have a different configuration, such as an annular arrangement of several different sections. Together, the shoulder **72**, the tubular extension **76**, and the annular extension **78** define an annular pocket that receives a corresponding upper rim **102** of the first structure **22**. A bumper extension **80** having a trapezoidal cross section extends upwardly from the annular extension **78** for engaging the upper retainer washer **56** and for damping any vibration therebetween. A plurality of upper recesses **82** are defined in the bumper extension **80** at regular angular intervals to provide a castellated structure. The bumper extension **80** may function as an end-of-travel feature to engage the upper retainer washer **56** to limit travel between the first structure **22** and the second structure **24** in a compression direction with the first structure **22** and the second structure **24** coming together, i.e. when the vibration isolating damper **50** is in a full-extended position.
(22) The primary isolator **58** also includes a lower skirt **84** that extends annularly about and radially outwardly from a lower end of the tubular body **70** opposite from the shoulder **72**. A plurality of protrusions **86** extending from a lower surface of the lower skirt **84**, away from the shoulder **72**. The protrusions **86** may function as an end-of-travel feature to engage the lower retainer washer **62** to limit travel between the first structure **22** and the second structure **24** in a tension direction with the first structure **22** and the second structure **24** pulling apart, i.e. when the vibration isolating damper **50** is in a full-compressed position.
(23) FIG. **3** also shows each of the upper retainer washer **56** and the lower retainer washer **62** including a flat plate **88** with a circular shape and a central hole for the fastener **52** to pass through. Each of the upper retainer washer **56** and the lower retainer washer **62** also include a locating feature **89** adjacent to the central hole and which extends substantially perpendicularly to the flat plate **88** to engage the rigid tube **66** therebetween. In some embodiments, the locating feature **89** of each of the upper retainer washer **56** and the lower retainer washer **62** may include a tubular-shaped protrusion that may be press-fit into a central bore of the rigid tube **66**. However, the locating feature **89** of either or both of the upper retainer washer **56** and/or the lower retainer washer **62** may have a different configuration.
(24) FIG. **3** also shows the isolator ring **60**, which includes a flange portion **90** that is disposed adjacent to the lower retainer washer **62**. The isolator ring **60** also includes a narrowed portion **92** protruding upward from the flange portion **90** and having a shared central bore configured to tightly surround the rigid tube **66** adjacent to the lower retainer washer **62**. The isolator ring **60** may engage the coil spring **64**, with the flange portion **90** extending between the coil spring **64** and the flat plate **88** of the lower retainer washer **62**. The narrowed portion **92** is configured to fit within the coil spring, with an end of the coil spring **64** disposed around the narrowed portion **92** to locate the coil spring **64** coaxial with and spaced apart from the rigid tube **66**.
(25) FIG. **4** is fragmentary cut-away diagram showing internal details of the vibration isolating damper **50** and its attachment to the first structure **22** and the second structure **24**. FIG. **4** shows the fastener **52** in the form of a bolt, with a head contacting a lower surface of the lower retainer washer **62**, opposite the locating feature **89**. The fastener **52** also includes a rod portion **53** that extends through a center of the lower retainer washer **62**, the rigid tube **66**, the upper retainer

washer **56**, and the lower flange portion **40** of the second structure **24** for attachment thereto. As shown in FIG. **4**, the primary isolator **58** also includes an inner tubular portion **77** that extends axially from the shoulder **72** and away from the annular extension **78**, and located radially between the coil spring **64** and the rigid tube **66**. The inner tubular portion **77**, together with the shoulder **72** and the tubular body **70** define a pocket for receiving an upper end of the coil spring **64**, opposite from the isolator ring. This pocket in the primary isolator **58** to locate the coil spring **64** coaxial with and spaced apart from the rigid tube **66**.

(26) FIG. **5** shows a graph with plots **120**, **122** showing dynamic transfer stiffness as a function of frequency for the vibration isolating damper **50** of the present disclosure. A first plot **120** shows the dynamic transfer stiffness of the vibration isolating damper **50** with the coil spring **64** being uncoated. A second plot **122** shows the dynamic transfer stiffness of the vibration isolating damper **50** with the coil spring **64** having a PVC coating. As shown, the first plot **120** has a large peak in dynamic stiffness at around 700 Hz, and a smaller peak at around 1,300 Hz. The second plot **122** shows the dynamic transfer stiffness for the coil spring **64** with the PVC coating and which does not include any large peaks in dynamic stiffness. However, the dynamic transfer stiffness of the vibration isolating damper **50** with the PVC-coated coil spring **64** with the PVC coating has a generally higher transfer stiffness, especially at frequencies greater than about 800 Hz.

(27) According to an aspect of the present disclosure, a vibration isolating damper for securing a first structure to a second structure is provided. The vibration isolating damper includes: a primary isolator of elastomeric material configured to engage the first structure for securement thereto and including a tubular body and a shoulder adjacent to an axial end of the tubular body, the shoulder extending radially inwardly to partially close the axial end of the tubular body a fastener having a rod portion extending through the tubular body of the primary isolator and configured for securement to the second structure; a rigid tube disposed about the rod portion of the fastener and extending through the tubular body of the primary isolator; and a coil spring disposed about the rigid tube and engaging the shoulder of the primary isolator within the tubular body.

(28) In some embodiments, the coil spring is coated with a resilient material configured to generate a specific damping characteristic at a given range of frequencies.

(29) In some embodiments, the resilient material includes polyvinyl chloride (PVC).

(30) In some embodiments, the vibration isolating damper further includes at least one retainer washer having a flat plate defining a hole for the fastener to pass through, the at least one retainer washer further including a locating feature adjacent to the hole and configured to engage the rigid tube.

(31) In some embodiments, the at least one retainer washer includes two retainer washers, each configured to engage an opposite end of the rigid tube.

(32) In some embodiments, the locating feature includes a tubular-shaped protrusion configured to press-fit into a central bore of the rigid tube for securement thereto.

(33) In some embodiments, the vibration isolating damper further includes an isolator ring of elastomeric material configured to engage the coil spring, with the coil spring extending between the isolator ring and the shoulder of the primary isolator.

(34) In some embodiments, the isolator ring defines a narrowed portion configured to fit within the coil spring, with an end of the coil spring disposed around the narrowed portion to locate the coil spring coaxial with and spaced apart from the rigid tube.

(35) In some embodiments, the primary isolator further includes a bumper extension located beyond the shoulder away from the tubular body and configured to limit travel between the first structure and the second structure in a compressive direction.

(36) In some embodiments, the primary isolator further includes a tubular extension that extends beyond the shoulder away from the tubular body, and an annular extension that extends radially outwardly from an end of the tubular extension spaced apart from the shoulder, and the shoulder, the tubular extension, and the annular extension together define an annular pocket that receives a

corresponding rim of the first structure for securement thereto.
(37) In some embodiments, the primary isolator further includes a lower skirt that extends annularly about and radially outwardly from a lower end of the tubular body opposite from the shoulder.
(38) In some embodiments, the primary isolator further includes plurality of protrusions extending from a lower surface of the lower skirt, away from the shoulder and configured to limit travel between the first structure and the second structure in a tension direction.
(39) According to an aspect of the present disclosure, mounting bracket assembly for attaching a component to a structural element in a vehicle provided. The mounting bracket assembly damper includes at least one vibration isolating damper configured to couple the component to the structural element while limiting transmission of vibration therebetween. The at least one vibration isolating damper includes: a primary isolator of elastomeric material configured to engage a first structure for securement thereto and including a tubular body and a shoulder adjacent to an axial end of the tubular body, the shoulder extending radially inwardly to partially close the axial end of the tubular body; a fastener having a rod portion extending through the tubular body of the primary isolator and configured for securement to a second structure; a rigid tube disposed about the rod portion of the fastener and extending through the tubular body of the primary isolator; and a coil spring disposed about the rigid tube and engaging the shoulder of the primary isolator within the tubular body.
(40) In some embodiments, the at least one vibration isolating damper includes two vibration isolating dampers.
(41) In some embodiments, the coil spring is coated with a resilient material configured to generate a specific damping characteristic at a given range of frequencies.
(42) In some embodiments, the resilient material includes polyvinyl chloride (PVC).
(43) In some embodiments, the mounting bracket further comprises an isolator ring of elastomeric material configured to engage the coil spring, with the coil spring extending between the isolator ring and the shoulder of the primary isolator.
(44) In some embodiments, the isolator ring defines a narrowed portion configured to fit within the coil spring, with an end of the coil spring disposed around the narrowed portion to locate the coil spring coaxial with and spaced apart from the rigid tube.
(45) In some embodiments, the primary isolator further includes a bumper extension located beyond the shoulder away from the tubular body and configured to limit travel between the first structure and the second structure in a compressive direction.
(46) In some embodiments, the primary isolator further includes a tubular extension that extends beyond the shoulder away from the tubular body, and an annular extension that extends radially outwardly from an end of the tubular extension spaced apart from the shoulder, and the shoulder, the tubular extension, and the annular extension together define an annular pocket that receives a corresponding rim of the first structure for securement thereto.
(47) While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Additionally, while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description.

Claims

1. A vibration isolating damper for securing a first structure to a second structure, and comprising: a primary isolator of elastomeric material configured to engage the first structure for securement thereto and including a tubular body and a shoulder adjacent to an axial end of the tubular body, the shoulder extending radially inwardly to partially close the axial end of the tubular body, wherein the primary isolator further includes a lower skirt that extends annularly about and radially outwardly from a lower end of the tubular body opposite from the shoulder, and wherein the primary isolator further includes plurality of protrusions extending from a lower surface of the lower skirt, away from the shoulder and configured to limit travel between the first structure and the second structure in a tension direction; a fastener having a rod portion extending through the tubular body of the primary isolator and configured for securement to the second structure; a rigid tube disposed about the rod portion of the fastener and extending through the tubular body of the primary isolator; and a coil spring disposed about the rigid tube and engaging the shoulder of the primary isolator within the tubular body.
2. The vibration isolating damper of claim 1, wherein the coil spring is coated with a resilient material configured to generate a specific damping characteristic at a given range of frequencies.
3. The vibration isolating damper of claim 2, wherein the resilient material includes polyvinyl chloride (PVC).
4. The vibration isolating damper of claim 1, further comprising at least one retainer washer having a flat plate defining a hole for the fastener to pass through, the at least one retainer washer further including a locating feature adjacent to the hole and configured to engage the rigid tube.
5. The vibration isolating damper of claim 4, wherein the at least one retainer washer includes two retainer washers, each configured to engage an opposite end of the rigid tube.
6. The vibration isolating damper of claim 4, wherein the locating feature includes a tubular-shaped protrusion configured to press-fit into a central bore of the rigid tube for securement thereto.
7. The vibration isolating damper of claim 1, further comprising an isolator ring of elastomeric material configured to engage the coil spring, with the coil spring extending between the isolator ring and the shoulder of the primary isolator.
8. The vibration isolating damper of claim 7, wherein the isolator ring defines a narrowed portion configured to fit within the coil spring, with an end of the coil spring disposed around the narrowed portion to locate the coil spring coaxial with and spaced apart from the rigid tube.
9. The vibration isolating damper of claim 1, wherein the primary isolator further includes a bumper extension located beyond the shoulder away from the tubular body and configured to limit travel between the first structure and the second structure in a compressive direction.
10. The vibration isolating damper of claim 1, wherein the primary isolator further includes a tubular extension that extends beyond the shoulder away from the tubular body, and an annular extension that extends radially outwardly from an end of the tubular extension spaced apart from the shoulder, and wherein the shoulder, the tubular extension, and the annular extension together define an annular pocket that receives a corresponding rim of the first structure for securement thereto.
11. A mounting bracket assembly for attaching a component to a structural element in a vehicle, comprising: at least one of the vibration isolating damper of claim 1.
12. The mounting bracket assembly of claim 11, wherein the at one of the vibration isolating damper of claim 1 includes two of the vibration isolating dampers of claim 1.
13. The vibration isolating damper of claim 1, wherein the primary isolator further includes: a tubular extension that extends beyond the shoulder away from the tubular body, an annular extension that extends radially outwardly from an end of the tubular extension spaced apart from the shoulder, and a bumper extension extending from the annular extension away from the tubular body, and wherein the bumper extension defines a plurality of upper recesses at regular angular intervals.

14. The vibration isolating damper of claim 1, wherein the primary isolator further includes an inner tubular portion extending in an axial direction from the shoulder and located between the coil spring and the rigid tube, and wherein the inner tubular portion, the shoulder, and the tubular together define a pocket that receives an upper end of the coil spring.
15. A vibration isolating damper for securing a first structure to a second structure, and comprising: a primary isolator of elastomeric material configured to engage the first structure for securement thereto and including a tubular body and a shoulder adjacent to an axial end of the tubular body, the shoulder extending radially inwardly to partially close the axial end of the tubular body; a fastener having a rod portion extending through the tubular body of the primary isolator and configured for securement to the second structure; a rigid tube disposed about the rod portion of the fastener and extending through the tubular body of the primary isolator; and a coil spring disposed about the rigid tube and engaging the shoulder of the primary isolator within the tubular body, wherein the primary isolator further includes: a tubular extension that extends beyond the shoulder away from the tubular body, an annular extension that extends radially outwardly from an end of the tubular extension spaced apart from the shoulder, and a bumper extension extending from the annular extension away from the tubular body, and wherein the bumper extension defines a plurality of upper recesses at regular angular intervals.
16. The vibration isolating damper of claim 15, wherein the bumper extension has a trapezoidal cross section.
17. The vibration isolating damper of claim 15, wherein the primary isolator further includes a lower skirt that extends annularly about and radially outwardly from a lower end of the tubular body opposite from the shoulder, and wherein the primary isolator further includes plurality of protrusions extending from a lower surface of the lower skirt, away from the shoulder and configured to limit travel between the first structure and the second structure in a tension direction.
18. A vibration isolating damper for securing a first structure to a second structure, and comprising: a primary isolator of elastomeric material configured to engage the first structure for securement thereto and including a tubular body and a shoulder adjacent to an axial end of the tubular body, the shoulder extending radially inwardly to partially close the axial end of the tubular body, a fastener having a rod portion extending through the tubular body of the primary isolator and configured for securement to the second structure; a rigid tube disposed about the rod portion of the fastener and extending through the tubular body of the primary isolator; and a coil spring disposed about the rigid tube and engaging the shoulder of the primary isolator within the tubular body, wherein the primary isolator further includes an inner tubular portion extending in an axial direction from the shoulder and located between the coil spring and the rigid tube, and wherein the inner tubular portion, the shoulder, and the tubular together define a pocket that receives an upper end of the coil spring.
19. The vibration isolating damper of claim 18, wherein the primary isolator further includes: a tubular extension that extends beyond the shoulder away from the tubular body, an annular extension that extends radially outwardly from an end of the tubular extension spaced apart from the shoulder, and a bumper extension extending from the annular extension away from the tubular body, and wherein the bumper extension defines a plurality of upper recesses at regular angular intervals.
20. The vibration isolating damper of claim 18, wherein the primary isolator further includes a lower skirt that extends annularly about and radially outwardly from a lower end of the tubular body opposite from the shoulder, and wherein the primary isolator further includes plurality of protrusions extending from a lower surface of the lower skirt, away from the shoulder and configured to limit travel between the first structure and the second structure in a tension direction.