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(54) **SKID STEER LOADERS WITH VARIABLE ISOLATION ON VIBRATORY ROLLER**

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(75) Inventors: **Ahmet Kartal**, Villa Rica, GA (US); **Carl James Wieland**, Spicer, MN (US)

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Correspondence Address:
WESTMAN CHAMPLIN & KELLY, P.A.
SUITE 1400, 900 SECOND AVENUE SOUTH
MINNEAPOLIS, MN 55402 (US)

(57) **ABSTRACT**

Disclosed are skids steer loaders and vibratory roller attachments embodiments in which an improved variable isolator is provided to isolate the skid steer loader, and thus the operator of the loader, from the severity of the vibrations in the vibratory roller. The vibratory roller attachment includes a frame configured to be mounted to the skid steer loader. A drum is supported by the frame, and an eccentric weight is positioned within the drum. A plurality of variable isolators couple the drum to the frame to provide isolation of the skid steer loader from vibrations of the vibratory roller. The plurality of variable isolators each have a non-cylindrical exterior shape. The non-cylindrical shape can include an exterior surface having curved end portions separated by a substantially linear middle portion to allow for improved deflection of the variable isolators, and thus improved vibration isolation between the attachment and the skid steer loader.

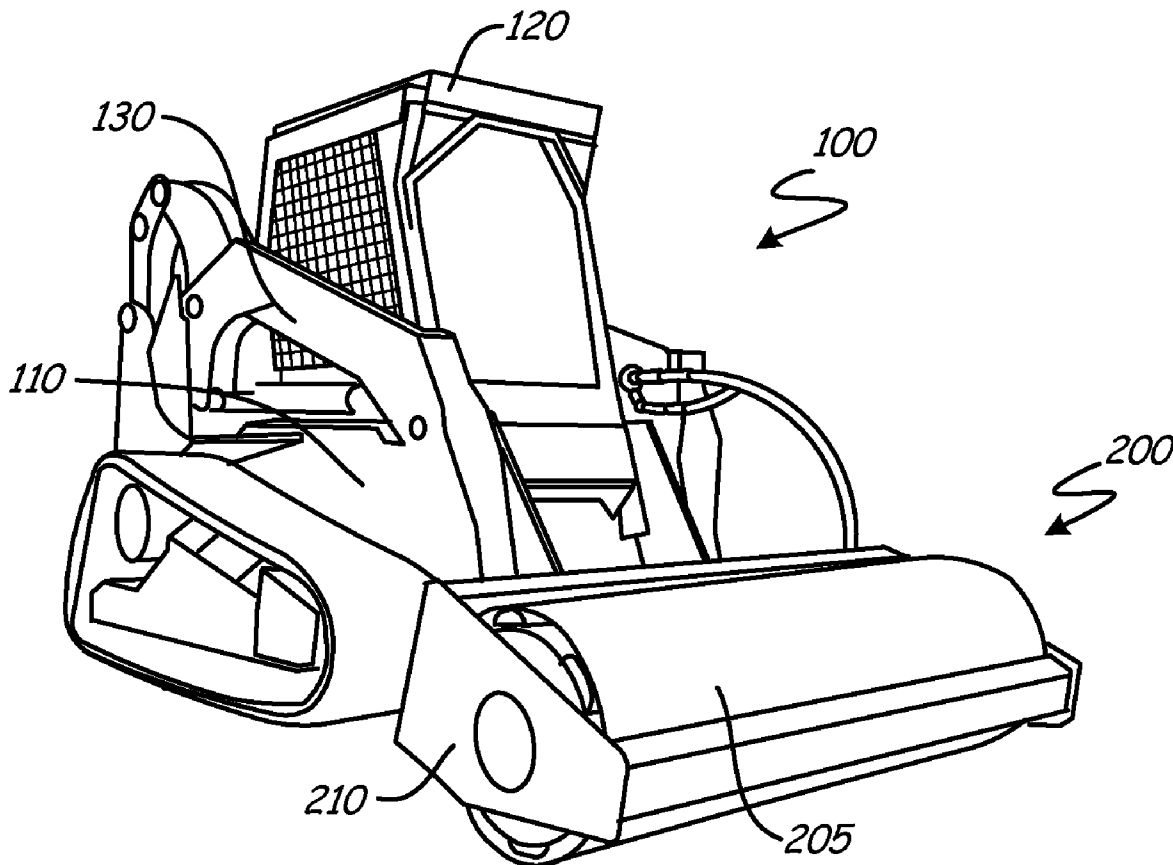
(73) Assignee: **CLARK EQUIPMENT COMPANY**, West Fargo, ND (US)

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Related U.S. Application Data

(60) Provisional application No. 61/105,183, filed on Oct. 14, 2008.



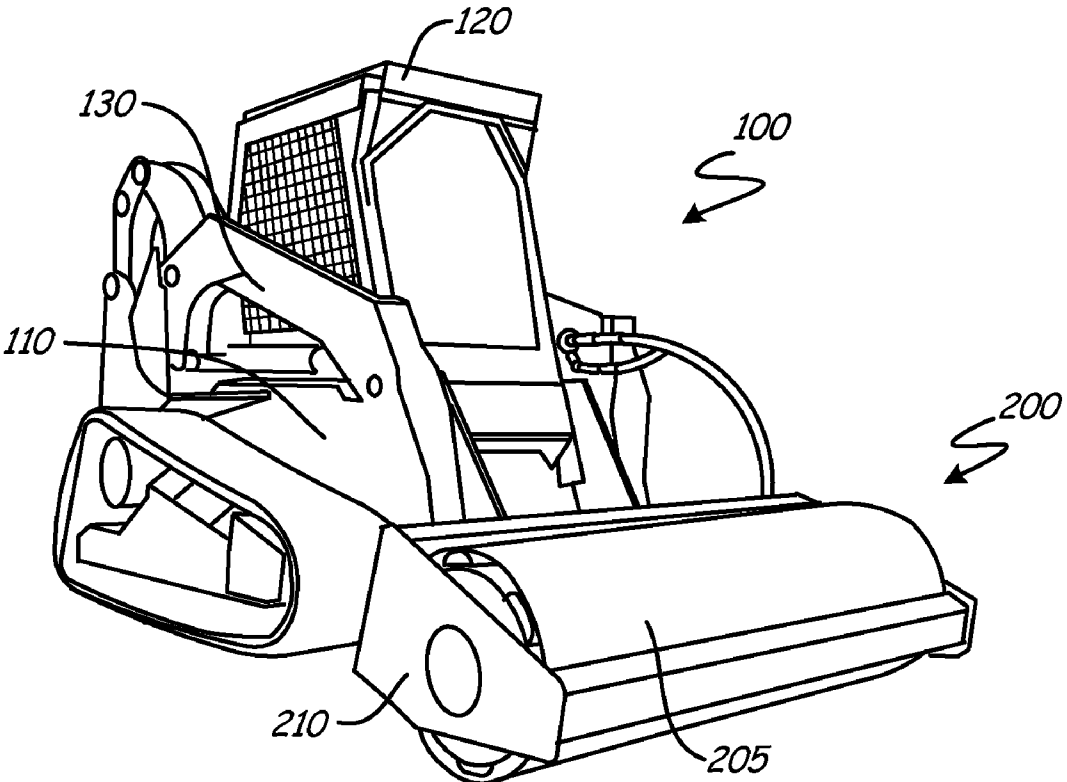


Fig. 1

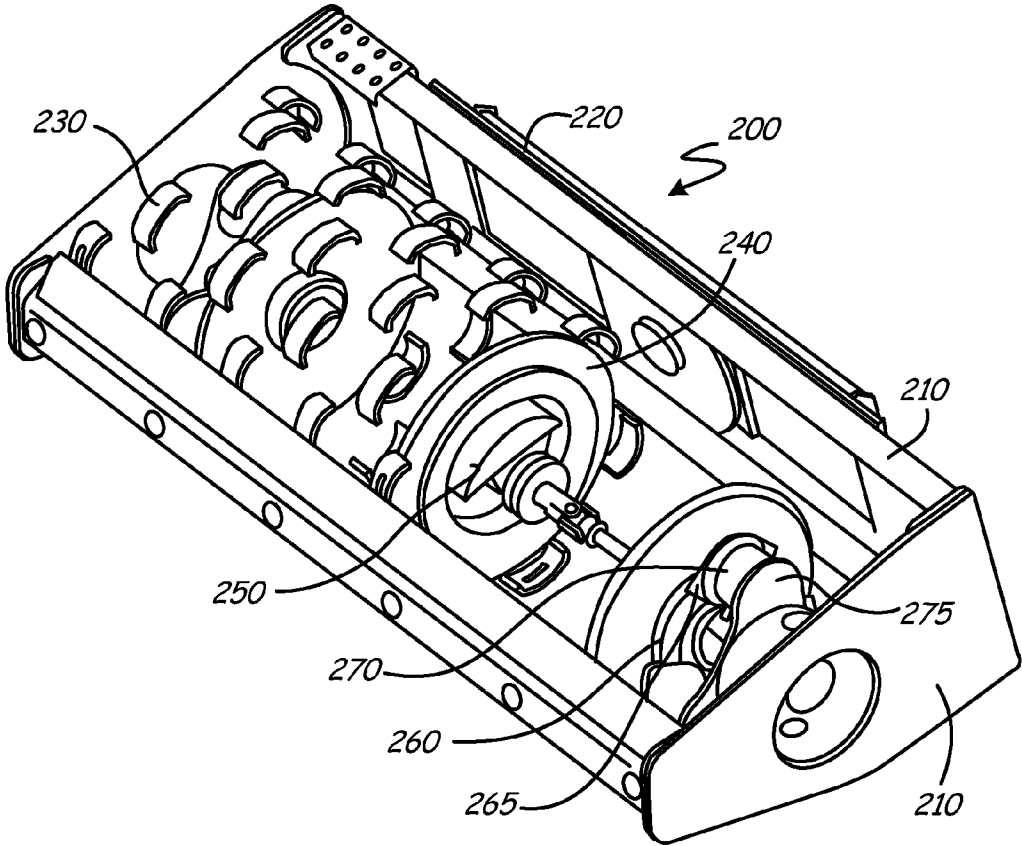
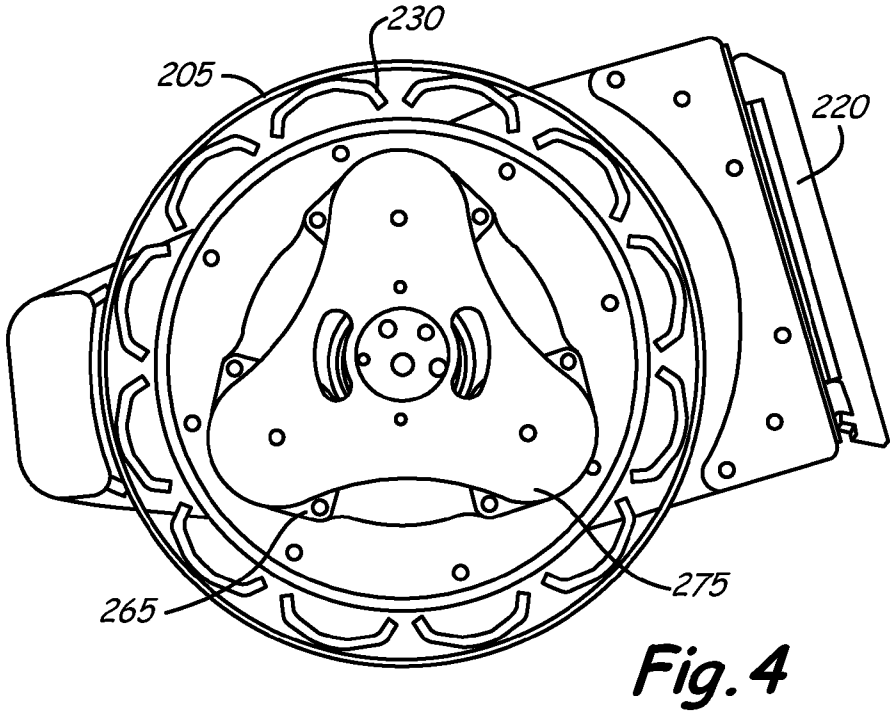
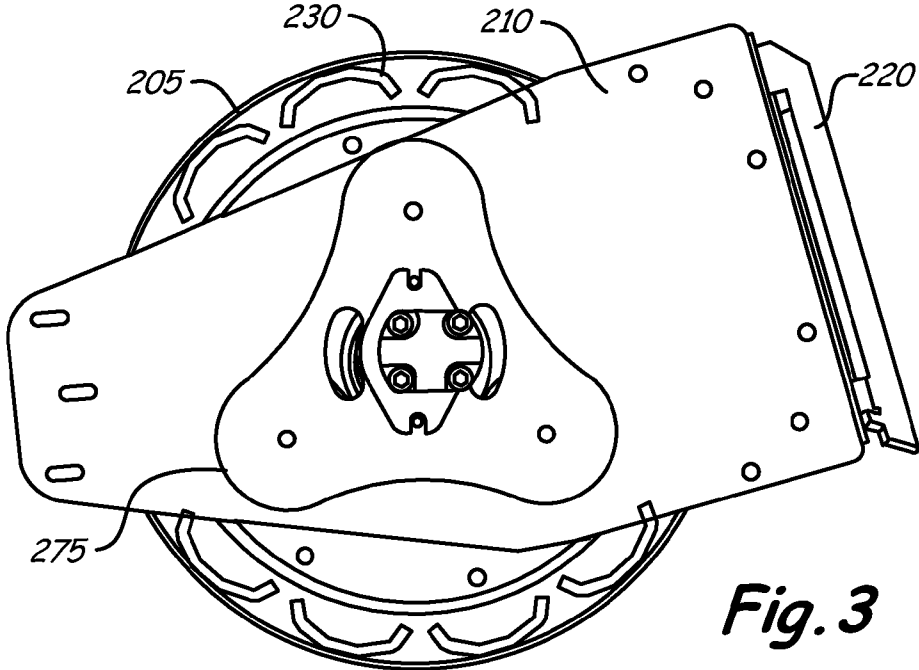
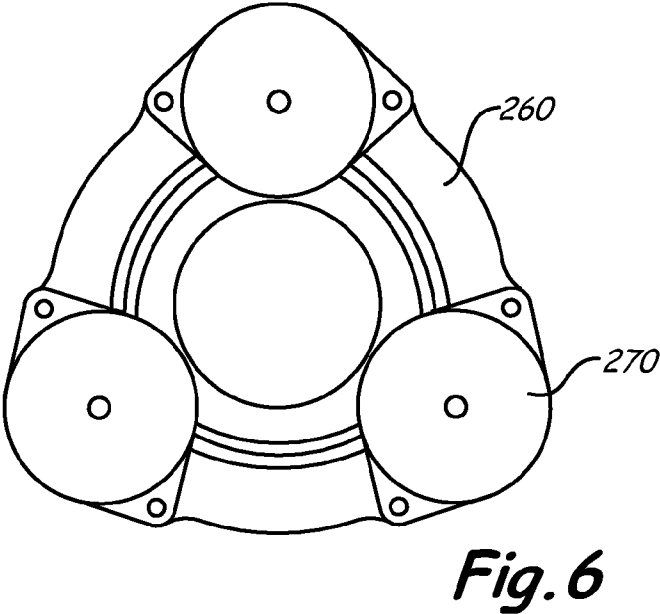
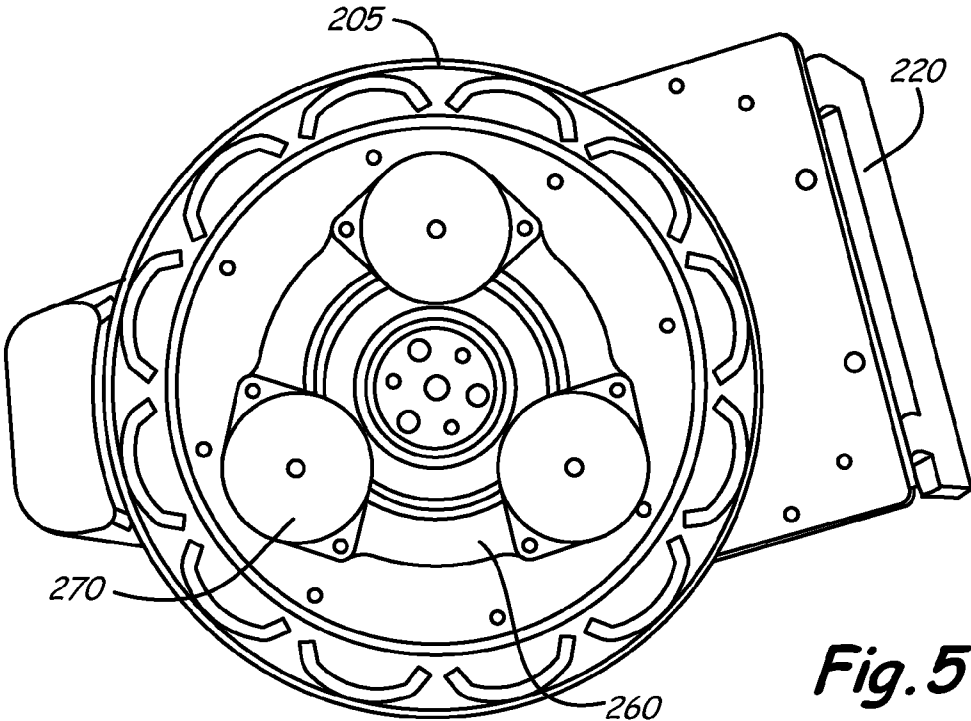


Fig. 2





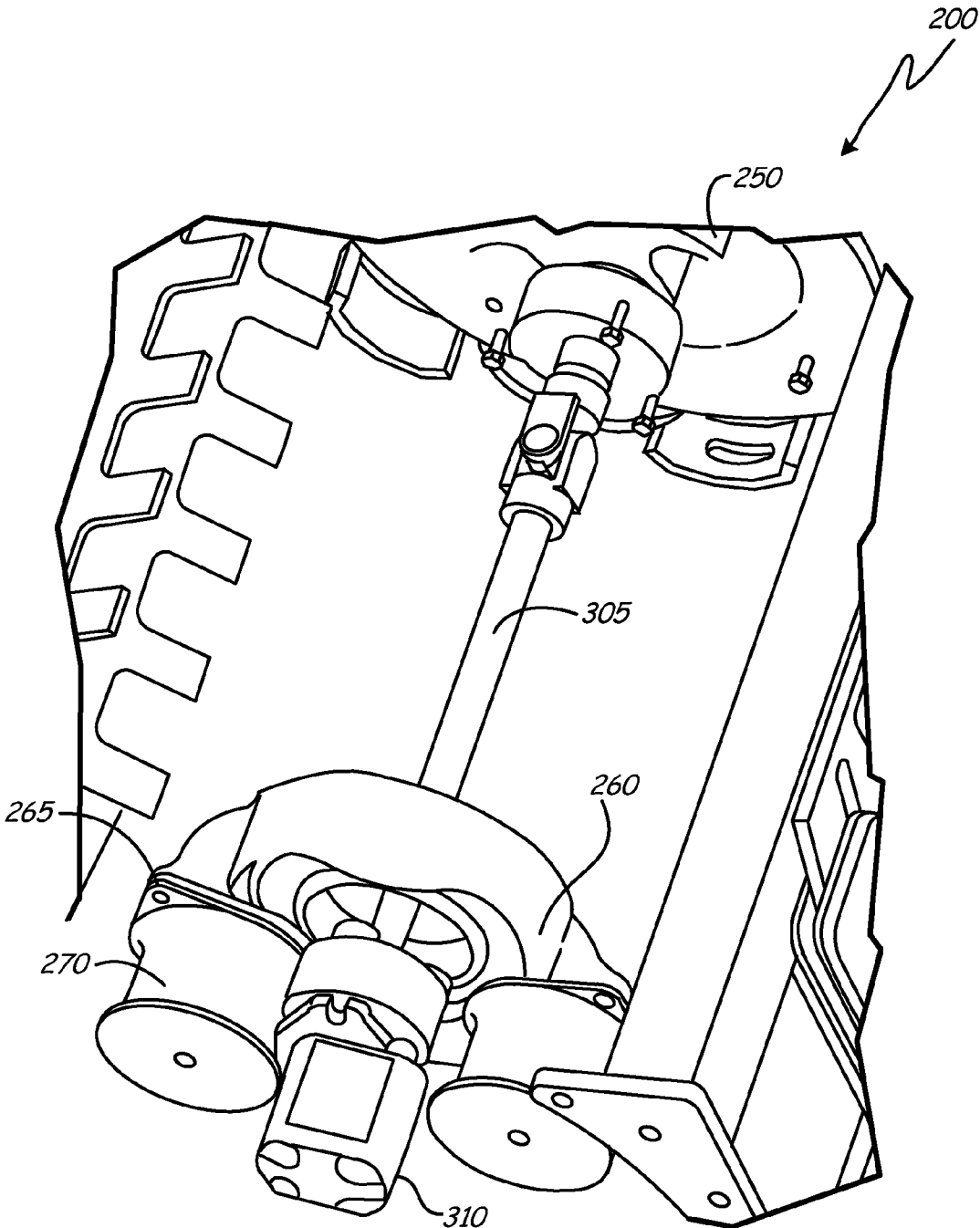


Fig. 7

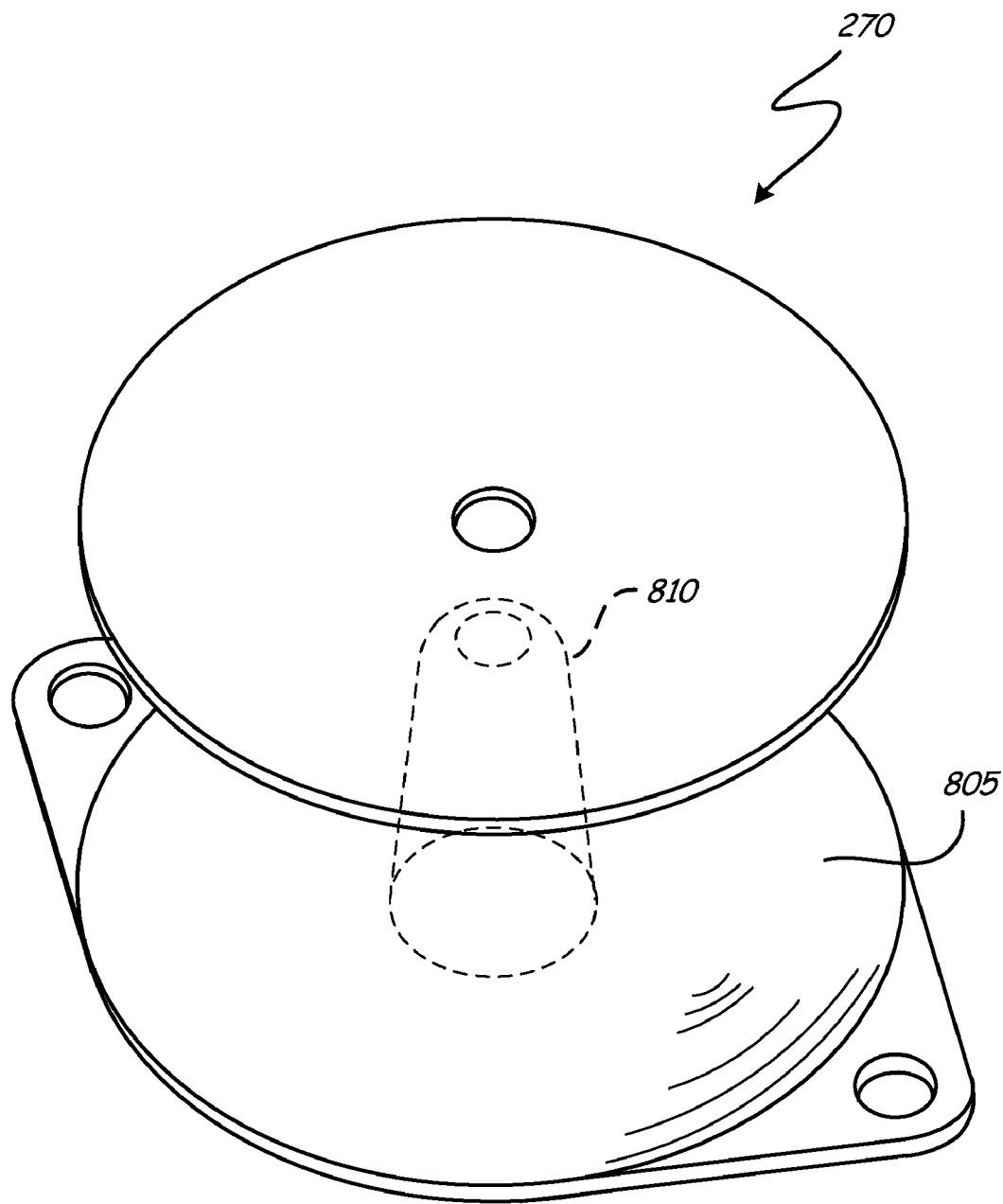


Fig. 8

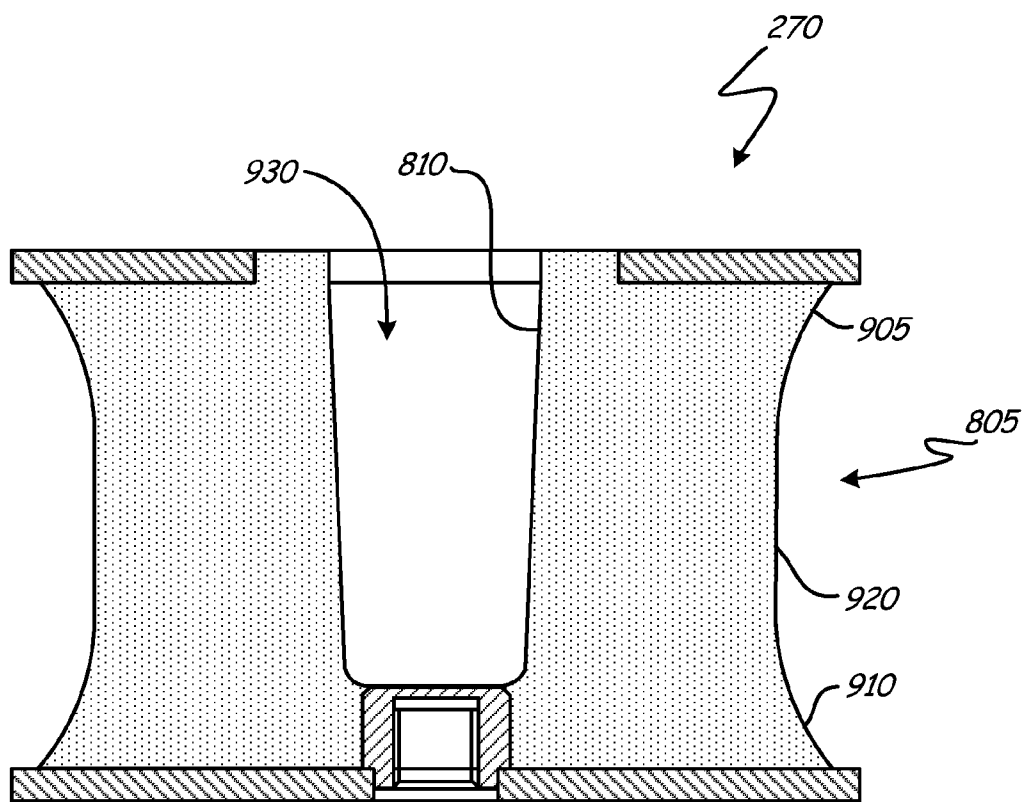


Fig. 9

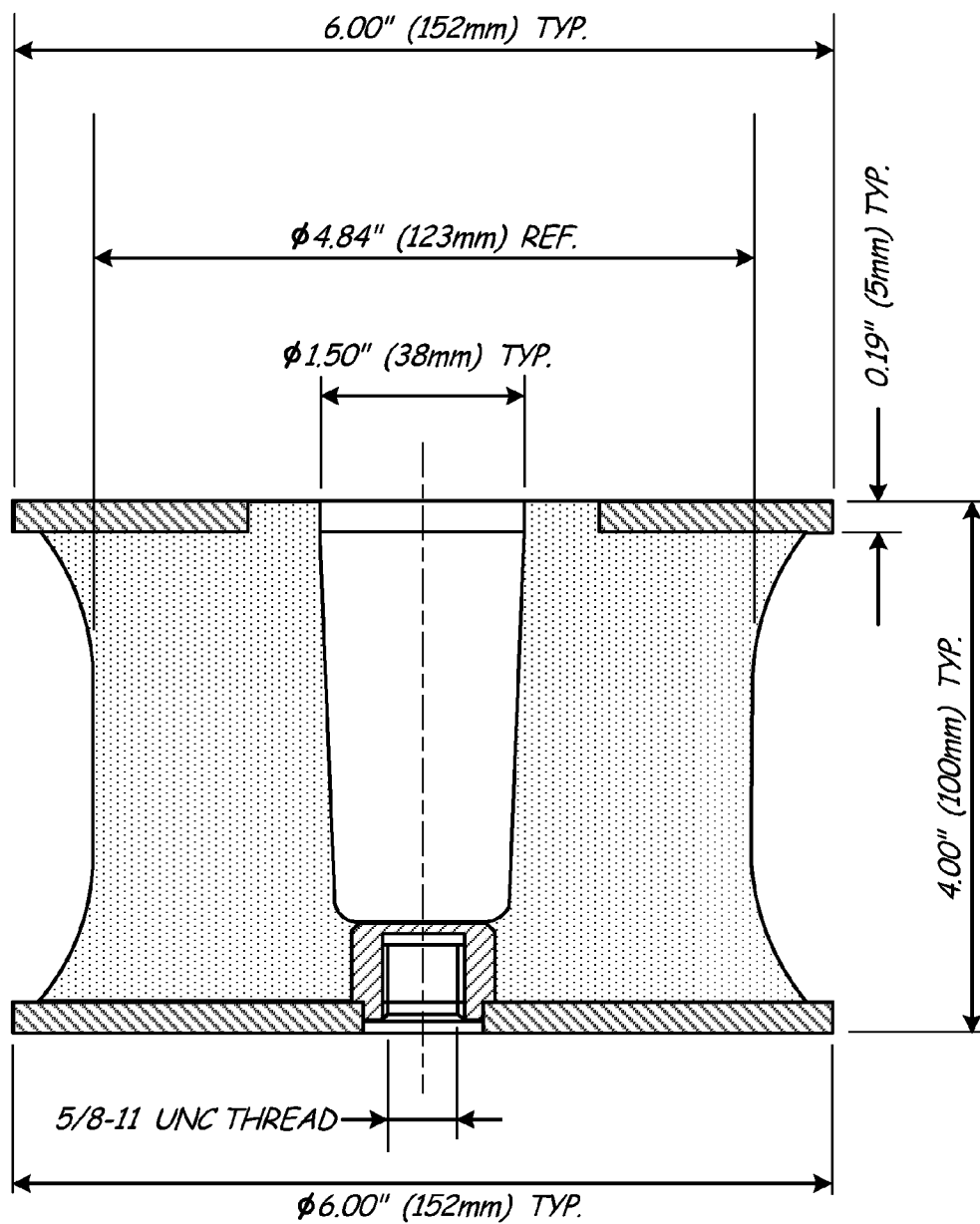


Fig. 10

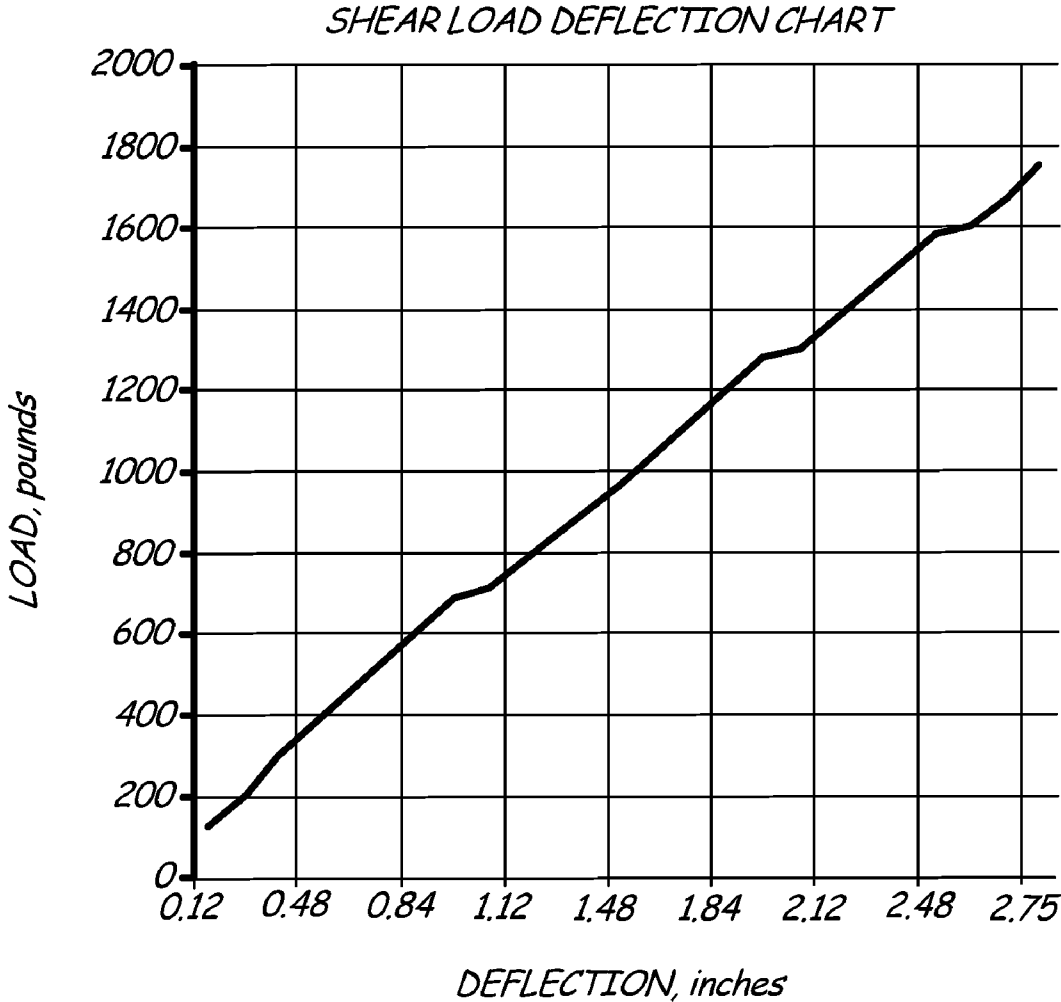


Fig. 11

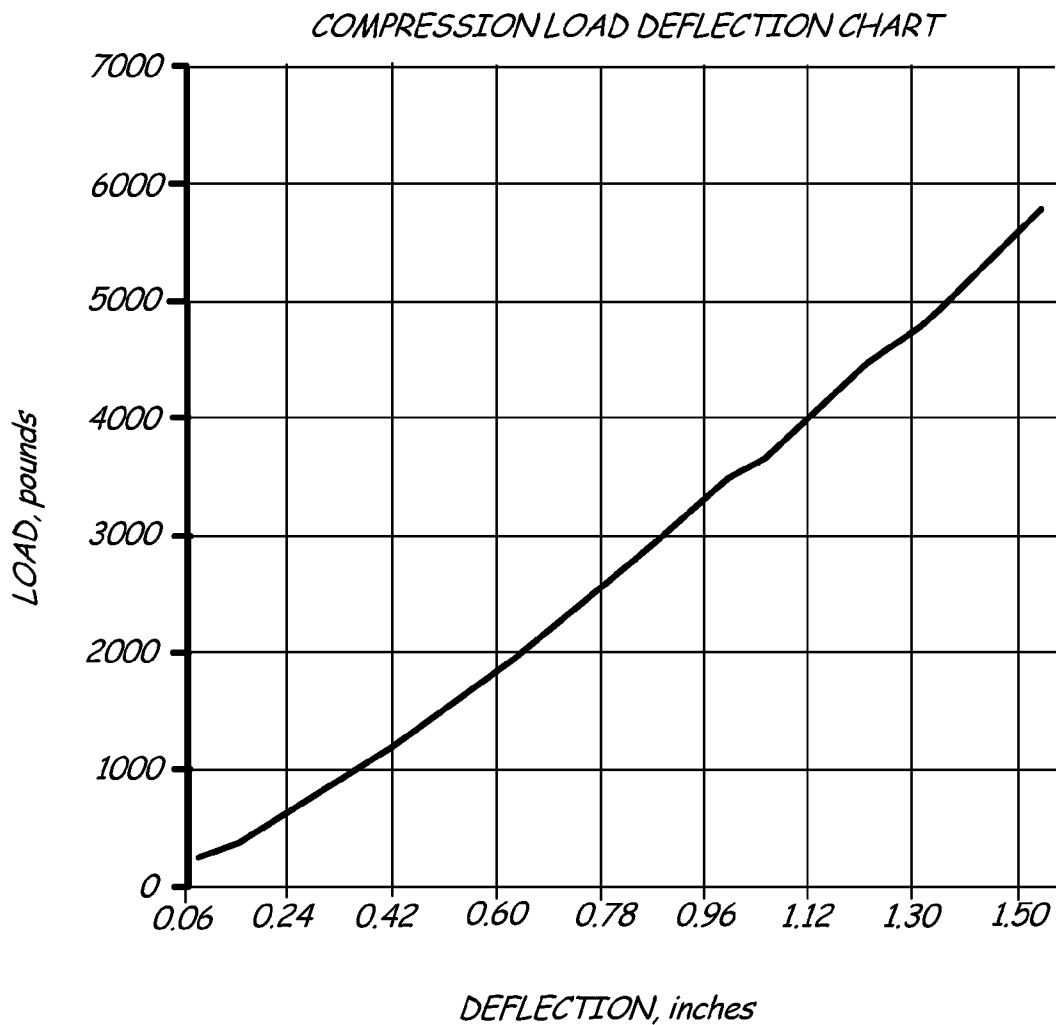


Fig. 12

SKID STEER LOADERS WITH VARIABLE ISOLATION ON VIBRATORY ROLLER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application is based on and claims the benefit of U.S. provisional patent application Ser. No. 61/105,183, filed Oct. 14, 2008, the content of which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] Mounted within vibratory rollers are powered shafts that are generally driven by hydraulic motors. Attached to the shaft are weights that are placed with their mass centers a distance away from the axis of rotation of the shaft, thereby creating centripetal force with shaft rotation, referred to by the industry as dynamic force. The dynamic forces are used to compact substrates prior to construction but are also transmitted through frame members of the attachment to the carrier and ultimately to the operator. When used with a skid steer loader carrier, vibratory rollers can cause a high degree of vibration in the loader, and ultimately for the operator.

[0003] To improve operator comfort and reduce metal fatigue caused by the vibrations due to dynamic forces, rubber isolators have been used to suspend the roller. This practice works very well for ride on vibratory rollers as their operating weight is consistent and isolators can be sized to accommodate the fixed weight. However, vibratory rollers used on skid steer loaders are operated with the front wheels of the loader off of the ground and must carry all the weight of the front of the loader. The down forces applied by the skid steer loader onto the vibratory roller varies dramatically. The large variation in down force makes vibration isolation very difficult as the isolator must be stiff enough to accommodate the loads of the largest loaders. Consequently, small loader vibration isolation is very poor. Isolating vibrations from the vibratory roller for a range of skid steer loader designs and sizes has been problematic.

[0004] The discussion above is merely provided for general background information and is not intended to be used as an aid in determining the scope of the claimed subject matter.

SUMMARY

[0005] Disclosed are skid steer loaders and vibratory roller attachment embodiments in which an improved variable isolator is provided to isolate the skid steer loader, and thus the operator of the loader, from the severity of the vibrations in the vibratory roller.

[0006] The vibratory roller attachment includes a frame configured to be mounted to the skid steer loader. A drum is supported by the frame, and an eccentric weight is positioned within the drum. A plurality of variable isolators couple the drum to the frame to provide isolation of the skid steer loader from vibrations of the vibratory roller. The plurality of variable isolators each have a non-cylindrical exterior shape. The non-cylindrical shape can include an exterior surface having curved end portions separated by a substantially linear middle portion to allow for improved deflection of the variable isolators, and thus improved vibration isolation between the attachment and the skid steer loader.

[0007] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not

intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a perspective view of a skid steer loader with a vibratory roller attachment.

[0009] FIG. 2 is a diagrammatic perspective view illustration of interior portions of the vibratory roller attachment, showing variable isolators in accordance with disclosed embodiments.

[0010] FIGS. 3-6 are diagrammatic side view illustrations of portions of the vibratory roller attachment of FIGS. 1 and 2.

[0011] FIG. 7 is a diagrammatic perspective view illustration of interior portions of the vibratory roller attachment of FIGS. 1-6.

[0012] FIG. 8 is a diagrammatic perspective view illustration of a variable isolator in accordance with disclosed embodiments.

[0013] FIGS. 9 and 10 are diagrammatic side view illustrations of a variable isolator in accordance with disclosed embodiments.

[0014] FIG. 11 is a shear load deflection chart for a variable isolator in accordance with disclosed embodiments.

[0015] FIG. 12 is a compression load deflection chart in accordance with disclosed embodiments.

DETAILED DESCRIPTION

[0016] FIG. 1 shows a skid steer loader 100 having a vibratory roller implement or attachment 200. Skid steer loader 100 has numerous components which are well known in the art, and which are not described here. Discussions of such common features can be found, for example, in U.S. Pat. Nos. 6,910,731, 6,866,466, and 6,695,568, which are all herein incorporated by reference. For illustrative purposes, skid steer loader 100 includes a body portion 110 and an operator compartment 120. A set of lift arms 130 is coupled to the body portion, and supports the vibratory roller 200. The vibratory roller includes, among other components, a drum 205 supported by a frame 210. Disclosed embodiments utilize an improved isolator configuration to isolate the loader 100, and particularly the operator compartment 120, from vibrations in the vibratory roller.

[0017] Referring now to FIG. 2, shown is a partially exploded view of vibratory roller 200, with the drum 205 removed to illustrate some interior components. The frame 210 is coupled to loader 100 via a back plate 220. A plurality of pads 230 can be mounted to the drum and are shown in exploded format in FIG. 2. Discs 240 are welded or otherwise secured within the drum itself. An eccentric weight 250 is supported by eccentric bearings, (drum bearing mounting plate 260 is shown) and allowed to rotate free from drum rotation.

[0018] In accordance with disclosed embodiments, isolators 270 having an improved configuration isolate the vibrations, associated with the dynamic force, from the frame 210, and thus from the loader and the loader operator. Isolator attachment members 265 are used to bolt or otherwise attach the isolators 270 to the drum bearing mounting plate 260. The isolators are also bolted or otherwise attached to an isolator mount 275 which is coupled to (or is part of) the frame weldment.

[0019] Referring now to FIGS. 3-6, shown are portions of vibratory roller 200 from an end view perspective, with various components removed for illustrative purposes. FIG. 3 shows the entire assembly, including the drum 205, frame 210, back plate 220, and pads 230. Isolator mount 275 is shown diagrammatically, though it would be hidden behind frame 210 ordinarily. FIG. 4 has part of the side frame removed, showing the isolator attachment members 265 and the isolator mount 275, which is part of the frame weldment. FIG. 5 shows the isolators 270 and the drum bearing mounting plate 260, along with other components such as drum 205. FIG. 6 illustrates just the isolators 270 and the drum bearing mounting plate 260.

[0020] Referring now to FIG. 7, shown is a diagrammatic isometric view illustrating portions of the weight 250, the drum support bearing plate 260, the isolator attachment members 265 and the isolators 270, etc. in further detail. The drive shaft 305 transmits power from the motor 310 to the eccentric weight 250 to spin the weight to create the dynamic force of the vibratory roller. During use, the drum displaces relative to the frame by as much as 1.5 inches. The purpose for the displacement is to more effectively isolate vibrations over a wider range of carriers, and in this case, providing isolation for small loaders. The isolators 270 in accordance with disclosed embodiments provide for such a wide range of displacements, and thus provide vibration isolation for a wide range of different skid steer loader carrier models and sizes.

[0021] Referring now to FIG. 8, shown is a diagrammatic isometric view of an isolator 270 in accordance with disclosed embodiments. FIG. 8 shows some of the outer contour 805 of the isolator 270. Also shown diagrammatically is a representation of the hollow interior 810 of the isolator. Both the shapes of the outer and interior surfaces 805 and 810 of isolator 270 function to allow greater deflection, and thus greater displacements to isolate the loader from the vibratory roller.

[0022] In the previous figures, the drum is mounted to the frame of the vibratory roller through the isolators. The isolators are stationary relative to the frame. The down force of the loader causes deflection of the isolators, and thus provides isolation of the loader and the loader operator from the vibrations of the vibratory roller.

[0023] Conventionally, variable isolators have been solid pieces of rubber, frequently of cylindrical shape, with threaded holes on each end for mounting the isolators. With disclosed embodiments, the present vibratory rollers provide advantages over these conventional vibratory rollers by allowing a higher degree of deflection of the isolator. Both the internal and external profiles of the isolator aid in providing this higher degree of deflection. Also playing a role in providing the higher degree of deflection, while still providing the required support, is the material used in isolators 270. In exemplary embodiments, isolators 270 are compression molded rubber in order to achieve the desired strength and deflection.

[0024] Referring now to FIG. 9, shown is an example of variable isolator 270 from a side diagrammatic view, illustrating both the exterior 805 side surfaces and interior 810 surfaces in greater detail. As can be seen, variable isolator 270 has a shape similar to a hyperboloid, but with a straight middle portion. In isolator 270, curved ends 905 and 910 of the exterior side surface share a common radius, but are separated by a substantially linear middle portion 920. In other embodiments, curved portions 905 and 910 need not

have the same radius of curvature. This isolator design, having a hyperboloid like geometry at its end side portions, modified with a straight mid section, has been shown to provide improved isolation performance compared to conventional designs. Hollow interior 930 also aids in providing these improvements.

[0025] The internal shape of isolator 270 also helps to get the stiffness/flexibility that is desired. The tapered aspect of the interior surface 810, where it is tapered along a draft angle, is primarily to help remove isolator 270 out of the compression mold. The hollow interior in general though helps to establish the stiffness at a point to allow sufficient deflection instead of making isolator 270 too rigid. Conventional variable isolators for skid steer loaders have tended to be solid, without the hollow interior. Disclosed embodiments, allow for higher degrees of deflection. The hollow center also allows heat reduction, which is desirable with high frequency cycling while high deflection is experienced. FIG. 10 is an illustration of the same isolator 270 shown in FIG. 9, but with example dimensions (in inches) added for illustrative purposes.

[0026] FIG. 11 illustrates a shear load deflection chart for these exemplary isolators. When carrying the weight of the loader, the isolators are being loaded in shear. The load in pounds per isolator is plotted against the deflection in inches of the isolator. This shows significantly more deflection for a particular load than conventional isolators. The variable rubber isolator is intended for loading in the radial direction. The spring rate of the isolator allows for effective isolation throughout all approved carriers. The down forces applied by the approved carriers ranges from 500 pounds to 2500 pounds respectively.

[0027] FIG. 12 shows a compression load deflection chart, showing deflection in inches for particular loads in pounds under compression conditions. The compression loading shown in FIG. 12 is applicable to circumstances where the loader is turning, placing the isolators in a compression mode.

[0028] The molding process as well as the internal and exterior profiles of the isolator allows the effective range of motion to be dramatically increased while providing superior isolation throughout a very large range of shear loads. Current production vibratory roller attachments for skid steer loaders utilize isolators that are sized for only the largest approved skid steer loaders. The variable isolators effectively dampen the vibration created by the vibratory roller throughout all approved loader sizes without overloading the isolators. The effective spring rate of the isolators in shear is, for example, 720 pounds per inch, providing improved performance.

[0029] Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims. For example, in various embodiments, different materials or manufacturing techniques can be used to form the isolators. Other examples of modifications of the disclosed concepts are also possible, without departing from the scope of the disclosed concepts.

What is claimed is:

1. A vibratory roller attachment for use with a skid steer loader, the vibratory roller attachment comprising:
 - a frame configured to be mounted to the skid steer loader;
 - a drum supported by the frame;

- an eccentric weight;
- a plurality of variable isolators coupling the drum to the frame to provide isolation of the skid steer loader from vibrations of the vibratory roller, the plurality of variable isolators each having a non-cylindrical shape.
- 2. The vibratory roller attachment of claim 1, wherein the plurality of variable isolators each have an at least partially hollow interior.
- 3. The vibratory roller attachment of claim 1, wherein the plurality of variable isolators each have exterior side surfaces which include curved end portions.
- 4. The vibratory roller attachment of claim 3, wherein the exterior side surfaces of each of the plurality of variable isolators include a substantially linear middle portion separating the curved end portions.
- 5. The vibratory roller attachment of claim 4, wherein for each of the plurality of variable isolators, the curved end portions of the exterior side surface have equal radii of curvature.
- 6. The vibratory roller attachment of claim 4, wherein for each of the plurality of variable isolators, the curved end portions of the exterior side surface share a common radius of curvature.
- 7. The vibratory roller attachment of claim 3, wherein the plurality of variable isolators each have an at least partially hollow interior.
- 8. The vibratory roller attachment of claim 1, wherein the plurality of variable isolators each have a hyperboloid-like geometry with an exterior side surface having curved end portions separated by a substantially linear middle portion.
- 9. The vibratory roller attachment of claim 1, wherein the plurality of variable isolators are formed of a rubber material.

- 10. A skid steer loader comprising:
 - a body;
 - an operator compartment;
 - a pair of lift arms coupled to the body; and
 - a vibratory roller attachment coupleable to the pair of lift arms, the vibratory roller attachment comprising:
 - a frame configured to be coupled to and supported by the pair of lift arms;
 - a drum supported by the frame;
 - an eccentric weight positioned inside the drum;
 - a plurality of variable isolators coupling the drum to the frame to provide isolation of the skid steer loader from vibrations of the vibratory roller, the plurality of variable isolators each having exterior side surfaces which include curved end portions.
- 11. The skid steer loader of claim 10, wherein the exterior side surfaces of each of the plurality of variable isolators include a substantially linear middle portion separating the curved end portions.
- 12. The skid steer loader of claim 11, wherein for each of the plurality of variable isolators, the curved end portions of the exterior side surface have substantially equal radii of curvature.
- 13. The skid steer loader of claim 11, wherein for each of the plurality of variable isolators, the curved end portions of the exterior side surface share a common radius of curvature.
- 14. The skid steer loader of claim 13, wherein the plurality of variable isolators each have an at least partially hollow interior.
- 15. The skid steer loader of claim 14, wherein the plurality of variable isolators are formed of a rubber material.

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