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(54) VENTILATING WHEEL FOR SNOWMOBILE SLIDE RAIL SUSPENSION SYSTEM

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(57) **ABSTRACT**

A ventilating wheel provides a plurality of angled vanes extending from a hub. The ventilating wheel secures to the slide rail of a snowmobile suspension system. An endless track extends over the underside of the slide rail. A hyfax may secure to the slide rail interposed between the track and slide rail to reduce friction therebetween. The ventilating wheel is in rolling contact with the track and is rotated thereby to draw air and snow over the slide rail. In some embodiments, air and snow flow over the radiator is induced. The ventilating wheel may serve as an idler wheel defining the shape of the track. In other embodiments, the ventilating wheel mounts to a straight portion of the slide rail and serves to reduce pressure on the hyfax. In still other embodiments, the ventilating wheel serves only to increase air and snow circulation.

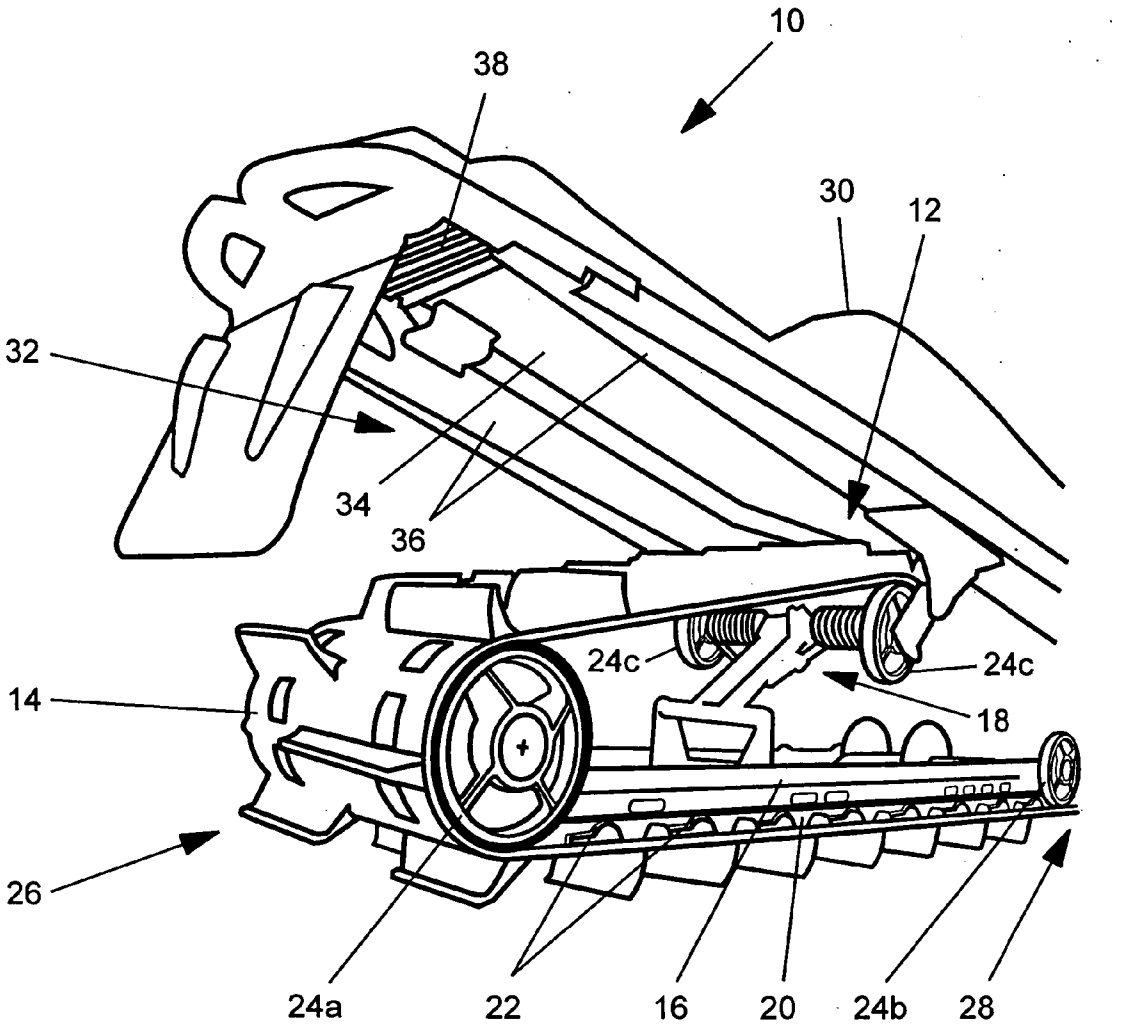


Figure 1

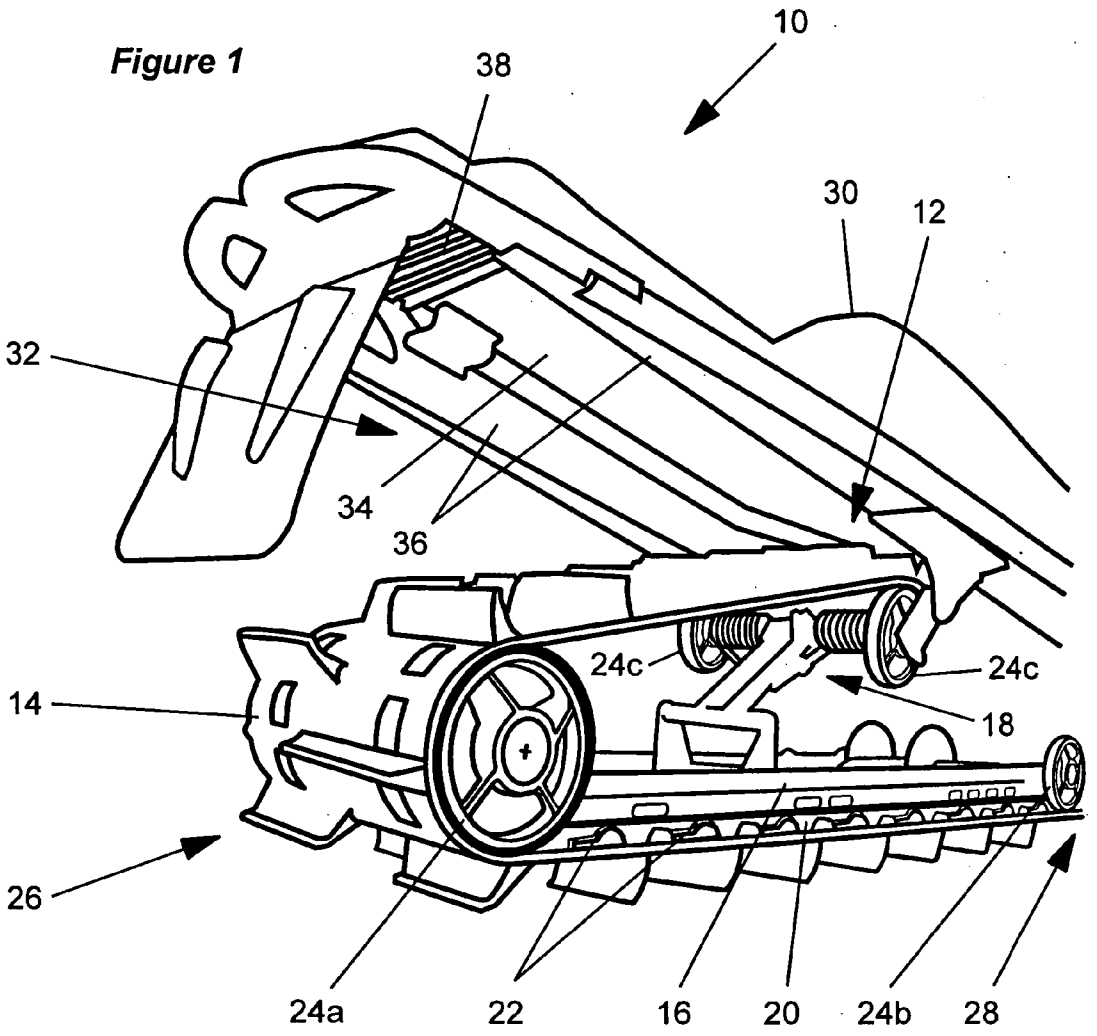


Figure 2

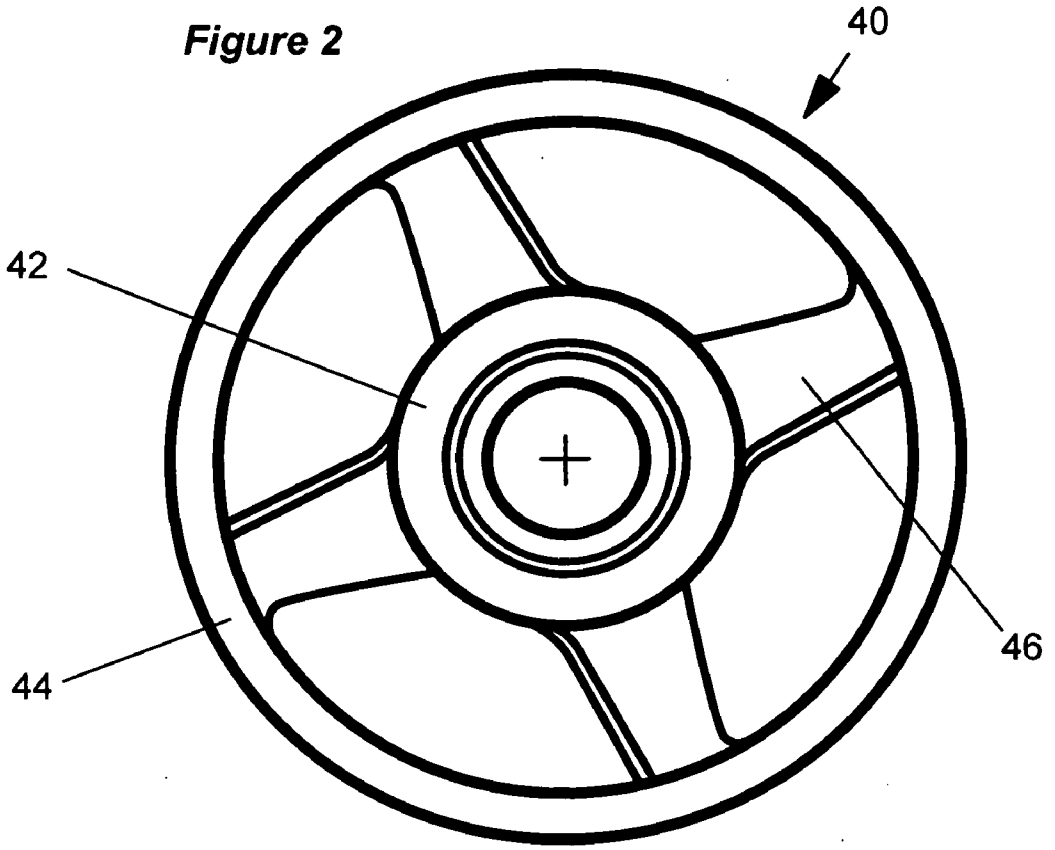
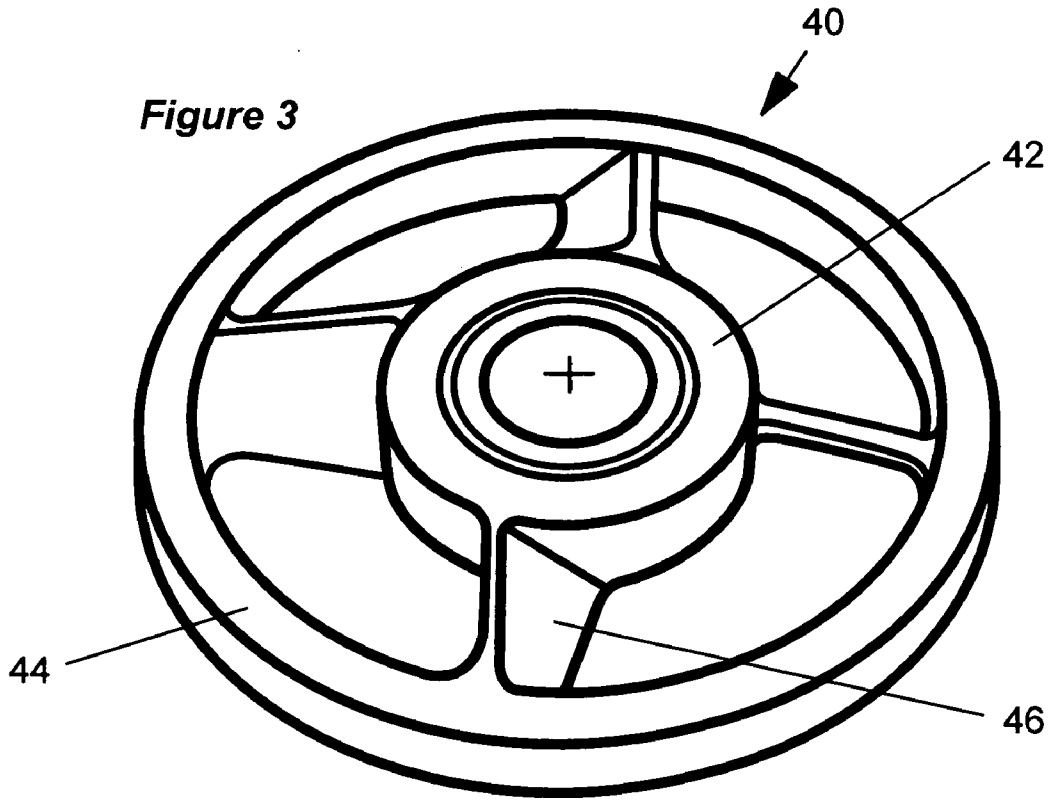


Figure 3



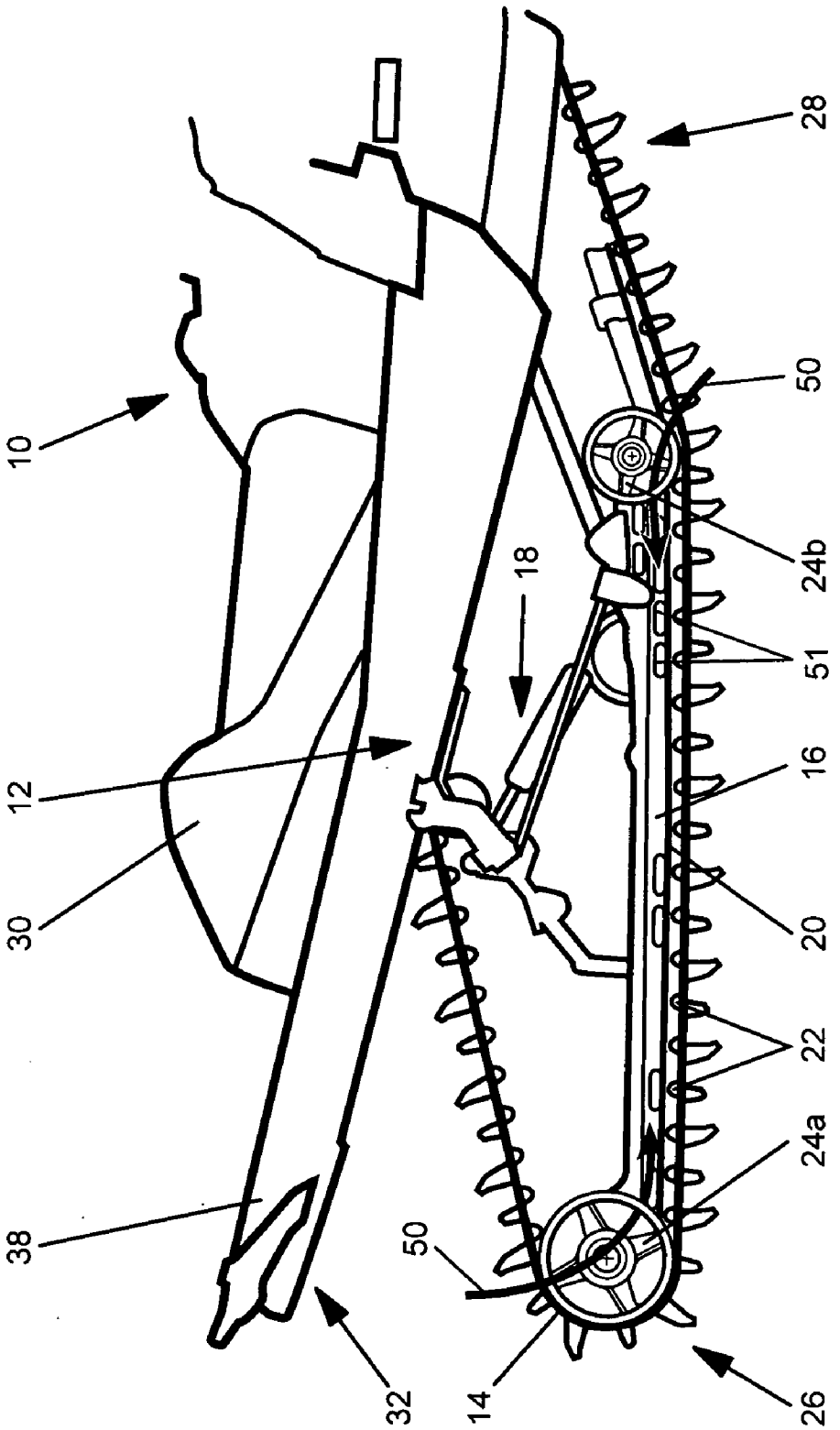
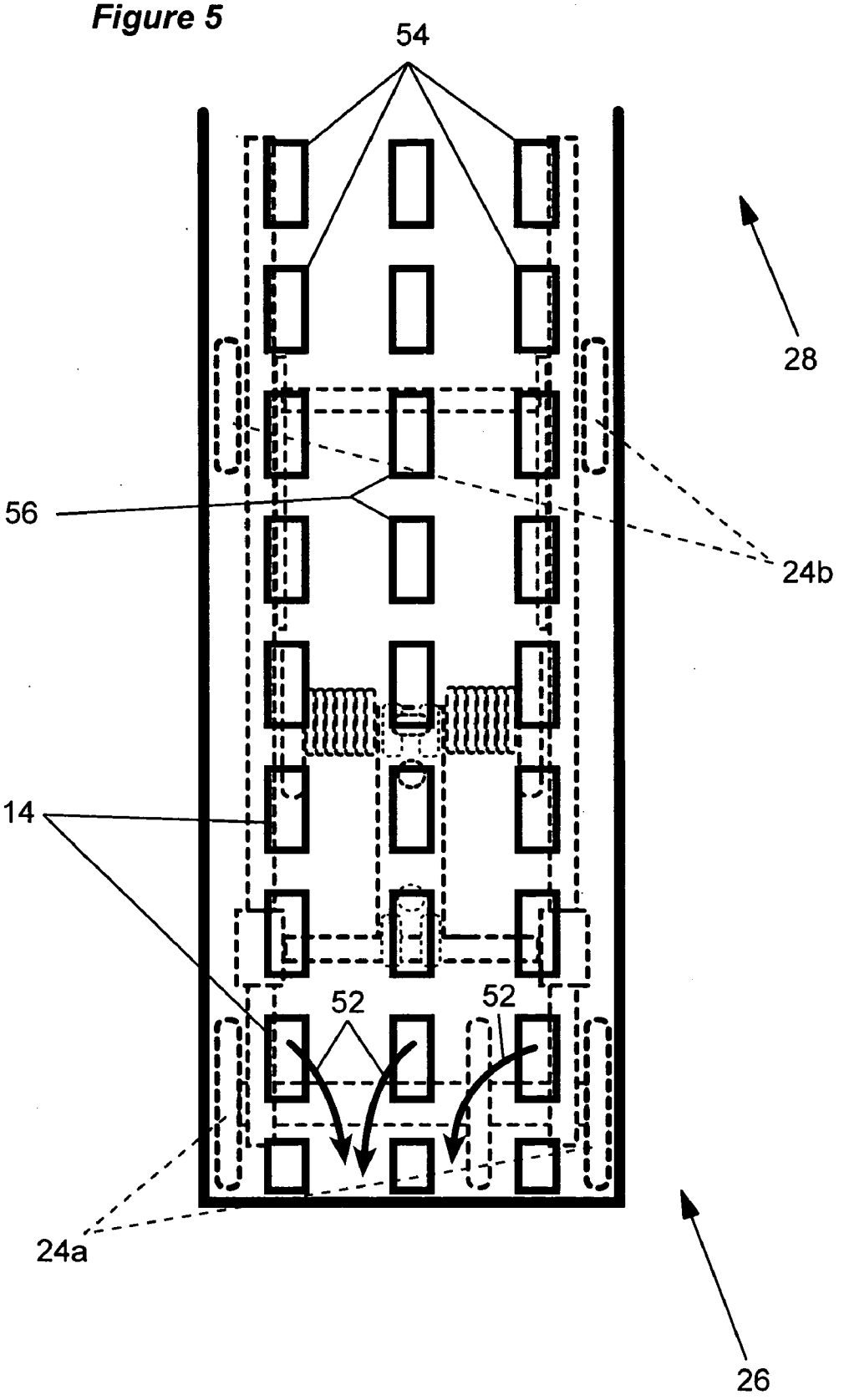


Figure 4

Figure 5



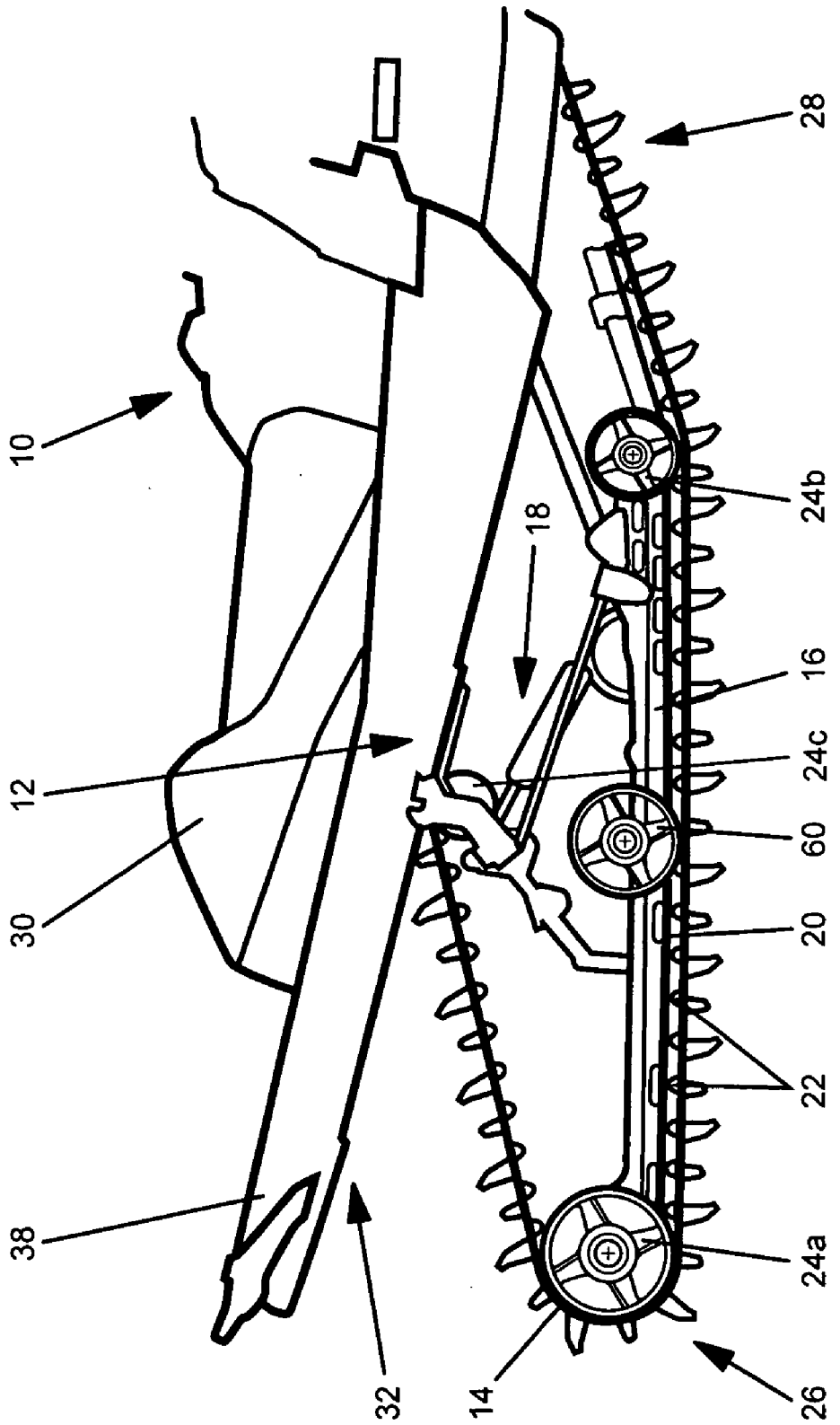


Figure 6

VENTILATING WHEEL FOR SNOWMOBILE SLIDE RAIL SUSPENSION SYSTEM

FIELD OF THE INVENTION

[0001] This invention relates generally to snowmobile endless track propulsion systems, and, more specifically, to slide rail suspensions for such systems.

BACKGROUND OF THE INVENTION

[0002] In snowmobile design, lightness of weight is essential. In order to reduce the weight of snowmobiles, manufacturers are constantly attempting to simplify the operations of snowmobiles and shrink the size of parts. In modern snowmobiles, the operation of the endless track system, which interfaces with the snow, has been greatly simplified through the use of slide rails to support the track. A typical modern endless track system includes a wide loop of track, which may have ridges formed on the outer surface thereof to increase traction with the snow. The track extends around a drive wheel, driven by an engine. The track likewise surrounds two parallel slide rails, which may each have one or more idler wheels at one or both of its ends. A suspension may couple the slide rails to the body of the snowmobile to absorb shocks from uneven terrain.

[0003] The slide rails provide a simple lightweight structure for maintaining a large portion of the track parallel to the ground in a position to engage the snow. During operation, the track slides over the rails, creating a great deal of heat and friction losses. To reduce friction, the lower surface of the slide rails bear strips of material, referred to as hyfax, formed of a low-friction material. In typical applications the hyfax is formed of an ultra-high molecular weight (UHMW) polymer. Series of metal clips secured along the interior surface of the track engage the hyfax to provide a low friction interface.

[0004] Although the hyfax and track clips are designed to reduce friction as much as possible, friction is nonetheless present along with the heat it generates. In some snow conditions, snow from the environment will melt on the hyfax, providing both cooling and lubrication. In very cold conditions, the snow may contact the hyfax, but not melt to provide a lubricant. In addition, in very fine, dry snow and on ice, such as frozen lakes and well traveled trails, an insufficient volume of snow will contact the hyfax. Heat will therefore build up in the hyfax. When the UHMW polymer constituting the hyfax reaches 180° to 212° F., it begins to break down. It may become distorted and soften, causing the track clips to start sticking to the sliders, increasing both friction and wear. At temperatures at or above 267° F., the hyfax will melt.

[0005] The weight of snowmobiles is also reduced by using a small radiator that takes advantage of surrounding snow for cooling, rather than relying solely on air as in most other types of vehicles. A typical radiator mounts above the track, beneath the seat of the snowmobile. In some conditions, the track will throw snow onto the radiator. However, as with the hyfax, on ice and in fine, dry snow, the volume of snow contacting the radiator may be insufficient to provide adequate cooling.

[0006] In view of the foregoing, it would be an advancement in the art to provide a more effective system for cooling the hyfax and radiator of a snowmobile. Such a system should improve cooling regardless of snow conditions and be both inexpensive and lightweight. It would be a further advantage to provide an improved cooling system that could be incorporated into an existing endless track drive system without extensive modification thereof.

SUMMARY OF THE INVENTION

[0007] The present invention provides one or more ventilating wheels secured to a snowmobile each with its rim in rolling engagement with the endless track to be rotated thereby. In some embodiments, the ventilating wheel secures to a linear bearing, such as a slide rail, that supports the lower portion of an endless track. Extending radially from the hub of the ventilating wheel to the rim are vanes oriented to propel air and snow over the hyfax of the snowmobile. In some embodiments flows of air and snow created by the vanes are also directed toward the radiator of the snowmobile. The vanes may be embodied as planar members that are angled relative to the plane of rotation of the wheel. The vanes are typically the sole means securing the rim to the hub.

[0008] The ventilating wheel may be dedicated to supplying air and snow flow or may also function as a bogey wheel tangentially engaging the track for reducing pressure on the hyfax. In other embodiments, the ventilating wheel functions as an idler wheel engaging a substantial angular portion of the track. Multiple ventilating wheels may secure to a single slide rail for increased airflow. For example, idler wheels and bogey wheels may both be present in a slide rail suspension system and all be embodied as ventilating wheels.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The preferred and alternative embodiments of the present invention are described in detail below with reference to the following drawings.

[0010] **FIG. 1** is rear quarter perspective view of a snowmobile;

[0011] **FIG. 2** is a side elevational view of a ventilating wheel, in accordance with the present invention;

[0012] **FIG. 3** is an isometric view of a ventilating wheel, in accordance with the present invention;

[0013] **FIG. 4** is a side view of a simplified representation of an endless track propulsion system having ventilating wheels, in accordance with the present invention;

[0014] **FIG. 5** is a top view of a simplified representation of an endless track propulsion system, in accordance with the present invention; and

[0015] **FIG. 6** is a side view of a simplified representation of an endless track propulsion system having a ventilating bogey wheel, in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0016] Referring to **FIG. 1**, a snowmobile **10** typically has an endless track propulsion system **12** providing both traction and a surface for preventing the snowmobile from sinking into the snow. This surface is provided by a wide

flexible endless track **14** (hereinafter track **14**). In typical applications, a broad flat portion of the track **14** must engage the snow in order to provide enough traction to propel the snowmobile. Accordingly, linear bearings, such as slide rails **16** are positioned within the area encircled by the track **14** and shape the track **14** at the point of engagement with the snow. Typical snowmobile systems include at least two slide rails **16** positioned parallel to one another near the edges of the track **14**. The slide rails **16** are positioned near the lower extent of the path of the track **14** and are typically oriented parallel to the ground. A suspension system **18** maintains the substantially parallel orientation of the slide rails **16** and provides a shock absorbing coupling between the slide rails **16** and the body of the snowmobile **10**.

[**0017**] The interface between the slide rails **16** and the track **14** is simply sliding contact. Accordingly, friction between the slide rails **16** and track **14** is present, resulting in wear, heat build up, and friction losses. A hyfax **20** embodied as a strip of low coefficient of friction material secures to the lower surface of each slide rail **16** and serves to reduce friction between the track **14** and the slide rails **16**. The hyfax **20** is typically formed of an ultra-high molecular weight (UHMW) polymer.

[**0018**] In a typical system, the portion of the track **14** engaging the hyfax **20** has a series of metal clips **22** secured thereto. The clips **22** serve to reduce friction and wear and distribute the force exerted on the track **14** by a toothed drive wheel (not shown) that engages the track and is driven by the engine of the snowmobile.

[**0019**] An idler wheel **24***a* may be positioned at a distal end **26** of the slide rails **16**. The idler wheel **24***a* may function to reduce friction at the point where the track **14** angles sharply upward prior to the upper portion of the path of the track **14**. In some embodiments, a second idler wheel **24***b* may be positioned near a proximal end **28** of the slide rails **16** to reduce friction as the track **14** changes direction at that point. In some embodiments, the slide rails **16** are curved near the proximal end **28** to accomplish the change in direction and the idler wheel **24***b* is eliminated. An additional idler wheel **24***c* may support the upper extent of the track **14**. The idler wheel **24***c* typically secures to the frame of the snowmobile **10**.

[**0020**] A rider may sit on a seat **30** positioned above the track **14**. In typical snowmobiles the seat **30** rests on a tunnel **32** having a top **34** and sides **36** for encasing a substantial portion of the upper portion of the track **14**. The tunnel **32** typically provides structural support for the seat **30**. The idler wheel **24***c* may also secure to the tunnel **32**. A radiator **38** secures within the tunnel, typically near the rearward end of the tunnel **32**, such that snow and ice thrown out by the track **14** may be used to cool the engine.

[**0021**] Referring to **FIGS. 2 and 3**, one or more of the idler wheels **24***a*-**24***c* may be configured to facilitate cooling and lubricating of the hyfax **20**, the radiator **38**, or both. During operation, the hyfax **20** typically increases in temperature as a result of the friction between itself and the track **14**. In ideal snow conditions, the snow from the environment melts on the hyfax, providing water that serves as a lubricant. However, in very cold conditions, the snow may contact the hyfax **20**, but not melt to provide a lubricant, resulting in increased wear. In addition, in very fine, dry snow and on ice, such as frozen lakes and well traveled trails, an insufficient volume of snow will contact the hyfax **20**. Heat will therefore build up in the hyfax **20**. When the UHMW polymer constituting the hyfax **20** reaches 180° to 212° F., it begins to break down. It may become distorted and soften, causing the clips **22** to start sticking to the hyfax **20**, increasing both friction and wear. At temperatures at or above 267° F., the hyfax **20** will melt. As with the hyfax **20**, the radiator **38** may not be sufficiently cooled when the snowmobile **10** is driven on ice and in fine, dry snow. In such conditions, the volume of air and snow passing over the radiator **38** may be insufficient to provide adequate cooling.

[**0022**] One or more of the idler wheels **24***a*-**24***c* may therefore be embodied as a ventilating wheel **40** of **FIGS. 2 and 3** to improve cooling of the hyfax **20**, the radiator **38**, or both. The wheel **40** includes a hub **42** secured to the slide rail **16** or tunnel **32** and a rim **44** concentric with the hub **42**. The hub **42** secures to the slide rail **16** or tunnel **32** by means of a bearing such that substantially friction free rotation relative to the slide rail **16** or tunnel **32** is permitted. Vanes **46** extend radially from the hub **42** and secure to the rim **44**. The vanes **46** are typically oriented to draw air and snow toward the slide rail **16** and hyfax **20** or to otherwise draw air and snow into the space encircled by the track **14**. The number and shape of the vanes **46** may be chosen to increase air and snow flow according to known principles of aerodynamics. In the illustrated embodiments four vanes are used. The vanes **46** of **FIGS. 2 and 3** have a substantially planar shape and are angled relative to the plane of rotation of the wheel **40**. The vanes **46** are typically of sufficient strength to transfer the force exerted on the rim **44** by the track **14** to the hub **42**. The hub **42**, rim **44**, and vanes **46** may be made of steel or high-strength plastic.

[**0023**] Referring to **FIG. 4**, the position of the idler wheels **24***a*, **24***b* near the surface of the snow, enables the vanes **46** to induce a flow **50** of air, snow, or both, over the slide rail **16** and hyfax **20**. In some embodiments, a slide rail **16** may have apertures **51** formed therein to decrease the weight of the slide rail **16**. In such embodiments, the air and snow flow **50** may be directed through the aperture **51**, such that the hyfax **20** of the slide rail **16** to which it is not secured is also cooled thereby.

[**0024**] **FIG. 5** is a top view of a simplified endless track **14** having traction enhancing ridges omitted. The track **14** typically includes apertures **54** to receive teeth of a drive wheel driven by the engine. Additional apertures **56** serving ventilating or other purposes may also be formed in the track **14**. The idler wheels **24***a*-**24***c* may induce an air and snow flow **52** into the volume encircled by the track **14** and through the apertures **54** and **56** to provide increased cooling at the radiator **38**. The radiator **38** is typically positioned to the rear of the snowmobile **10** above the track **14** but may be positioned elsewhere to take advantage of air and snow flow **52**.

[**0025**] Referring to **FIG. 6**, in some embodiments a ventilating wheel **40** may serve as an additional bogey wheel **60** secured to the slide rail **16** at a high wear location to reduce pressure thereon, while also increasing air and snow flow. Alternatively, in some embodiments, the wheel **40** may be used primarily for ventilating purposes, rather than for support of the track **14**. For example, the bogey wheel **60** may secure to the slide rail **16** such that the track **14** exerts only sufficient force thereon to develop friction forces suf-

ficient to force rotation of the bogey wheel **60**. Accordingly, the hub **42**, rim **44**, and vanes **46** may be made lighter according to the reduction in force exerted thereon.

[**0026**] In other embodiments, a ventilating wheel **40** may secure to the frame of the snowmobile, such as to the tunnel **32** such that it is in rolling contact with the outer surface of the track **14**. The radiator **38** may be positioned proximate the ventilating wheel **40**, or wheels **40**, to enhance cooling.

[**0027**] While the preferred embodiments of the invention have been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. For example, the shape and configuration of the vanes **46** may be varied according to principles of aerodynamics. The position and number of ventilating wheels on the slide rails **16** may likewise vary from the illustrated embodiments. Accordingly, the scope of the invention is not limited by the disclosure of the preferred embodiment. Instead, the invention should be determined entirely by reference to the claims the follow.

[**0028**] The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A cooling system for a snowmobile suspension system comprising:

an endless track;

a linear bearing for supporting the endless track; and

a ventilating wheel coupled to the linear bearing and having a portion thereof in rolling engagement with the endless track.

2. The cooling system of claim 1, further comprising a hyfax interposed between the linear bearing and the endless track.

3. The cooling system of claim 1, wherein the ventilating wheel comprises:

a hub rotatably mounted to the linear bearing;

a plurality of vanes extending radially from the hub; and

a rim circumscribing the vanes and securing to the distal ends thereof, the rim in rolling engagement with the endless track.

4. The cooling system of claim 3, wherein the endless track engages a substantial angular portion of the rim.

5. The cooling system of claim 3, wherein the track tangentially contacts the ventilating wheel.

6. The cooling system of claim 3, wherein the vanes comprise substantially planar members angled relative to a plane of rotation of the ventilating wheel.

7. The cooling system of claim 1, comprising multiple ventilating wheels each secured to the linear bearing.

8. The cooling system of claim 1, wherein the linear bearing comprises two parallelly situated slide rails.

9. A cooling system for a snowmobile suspension system comprising:

an endless track;

a linear bearing for supporting the endless track; and

a ventilating wheel coupled to the linear bearing comprising

a hub rotatably mounted to the linear bearing,

a plurality of vanes extending radially from the hub, and

a rim in rolling engagement with the endless track, the rim circumscribing the vanes and securing to the distal ends thereof, the vanes being the sole means securing the rim to the hub.

10. The cooling system of claim 9, wherein the vanes comprise substantially planar members angled relative to a plane of rotation of the ventilating wheel.

11. The cooling system of claim 9, wherein the endless track engages a substantial angular portion of the rim.

12. The cooling system of claim 9, wherein the track tangentially contacts the rim.

13. The cooling system of claim 9, further comprising a hyfax interposed between the linear bearing and the endless track.

14. The cooling system of claim 9, wherein the linear bearing comprises two parallel slide rails.

15. The cooling system of claim 14, wherein multiple ventilating wheels secure to each slide rail.

16. A cooling system for a snowmobile comprising:

a snowmobile;

an endless track slidably secured to the snowmobile;

a ventilating wheel mounted to the snowmobile, the ventilating wheel comprising

a hub rotatably mounted to the snowmobile,

a plurality of vanes extending radially from the hub, and

a rim circumscribing the vanes and securing to the distal ends thereof, the rim in rolling engagement with the endless track.

17. The cooling system of claim 16, wherein the vanes have a planar shape and are angled relative to a plane of rotation of the ventilating wheel, the vanes being the sole means securing the rim to the hub.

18. The cooling system of claim 17, wherein the snowmobile comprises a linear bearing mounted thereto in sliding contact with the endless track, the ventilating wheel being mounted to the linear bearing having the rim in rolling engagement with an inner surface of the endless track.

19. A method for cooling a snowmobile comprising:

providing a ventilating wheel secured to a linear bearing of a snowmobile suspension; and

actuating the ventilating wheel to increase circulation about the linear bearing.

20. The method of claim 19, wherein actuating the ventilating wheel comprises rotation thereof by the track of a snowmobile.

21. The method of claim 19, wherein the ventilating wheel comprises:

a hub rotatably mounted to the linear bearing;

a plurality of vanes extending radially from the hub; and

a rim in rolling engagement with the endless track, the rim circumscribing the vanes and securing to the distal ends thereof.

* * * * *