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**Proulx**

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(54) **FRONT SKI SUSPENSION SYSTEM FOR A SNOWMOBILE AND METHOD FOR INSTALLING THE SAME**

(58) **Field of Classification Search**  
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See application file for complete search history.

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**Related U.S. Application Data**

(57) **ABSTRACT**

(60) Provisional application No. 62/551,022, filed on Aug. 28, 2017.

The present invention is directed to a single-ski assembly being configured to convert a double-ski conventional snowmobile to a single-ski snowmobile while improving the steerability, the maneuverability and the floatation of snowmobiles and thus by providing an adjustable angular front orientation of the ski. The single-ski assembly comprises a damping system adapted to control the longitudinal direction of the snowmobile and a steering mechanism adapted to control the upward and downward rotation of the ski.

(51) **Int. Cl.**

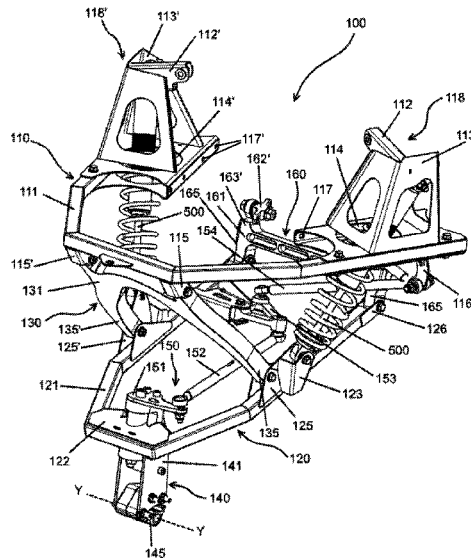
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**15 Claims, 10 Drawing Sheets**



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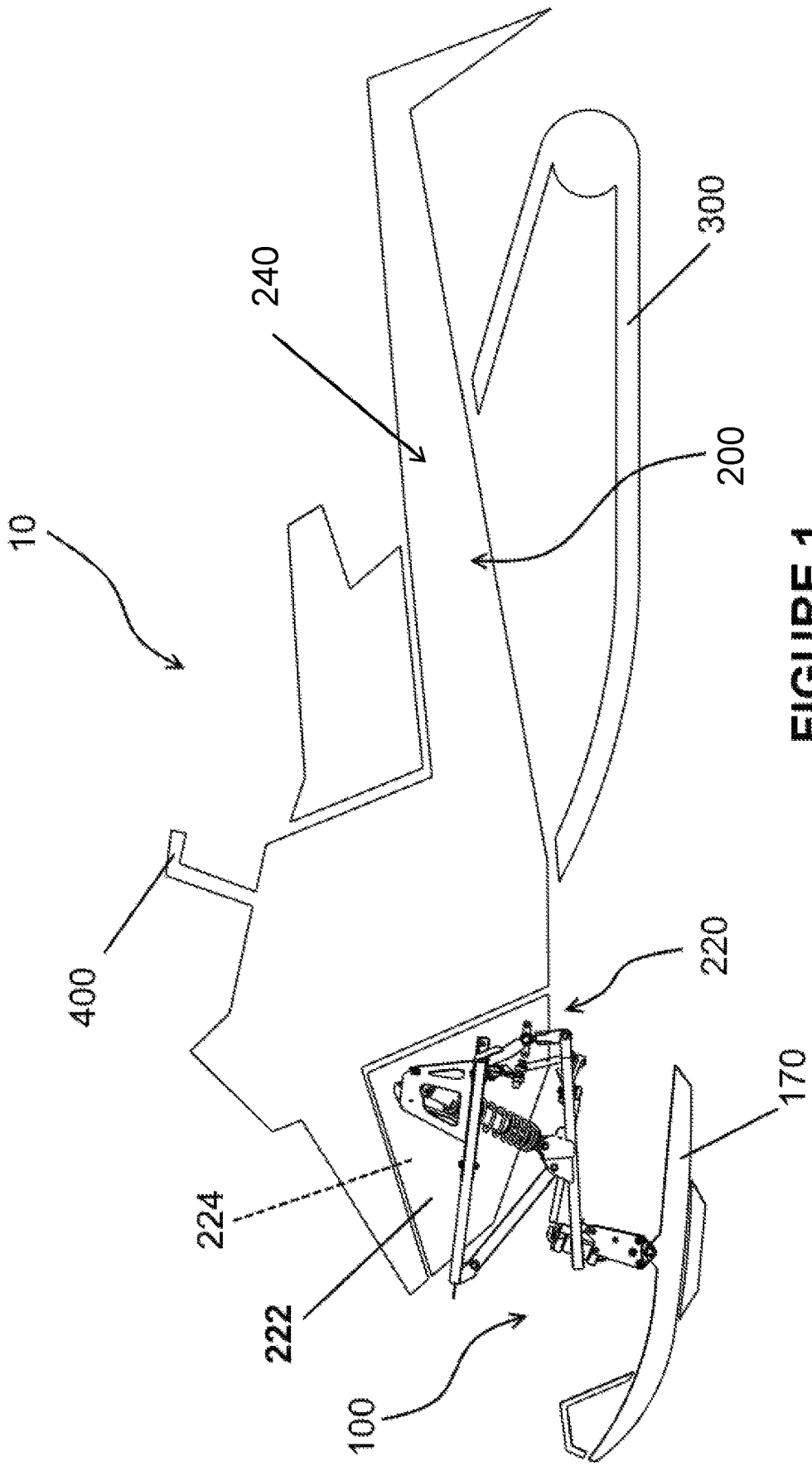


FIGURE 1

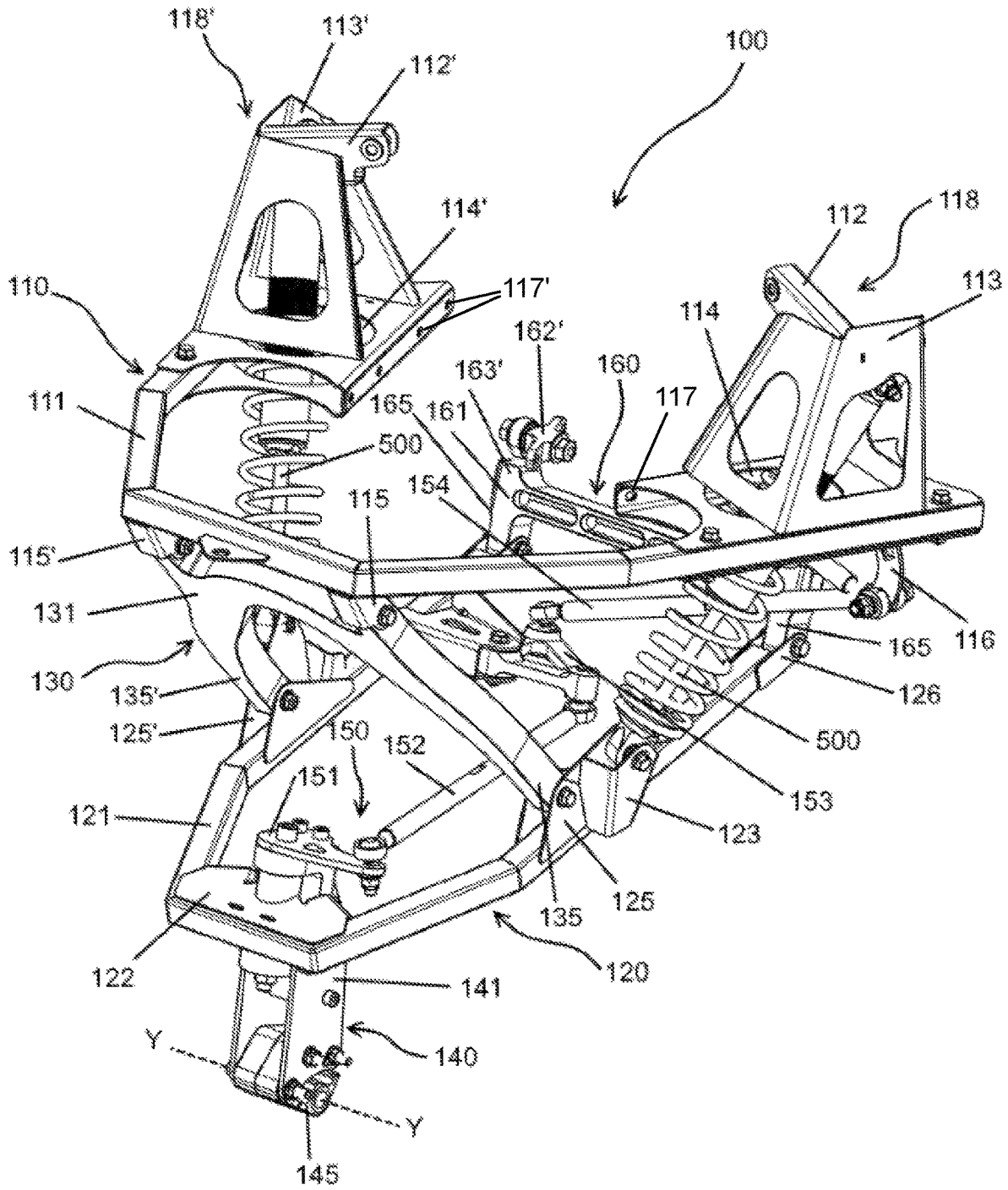
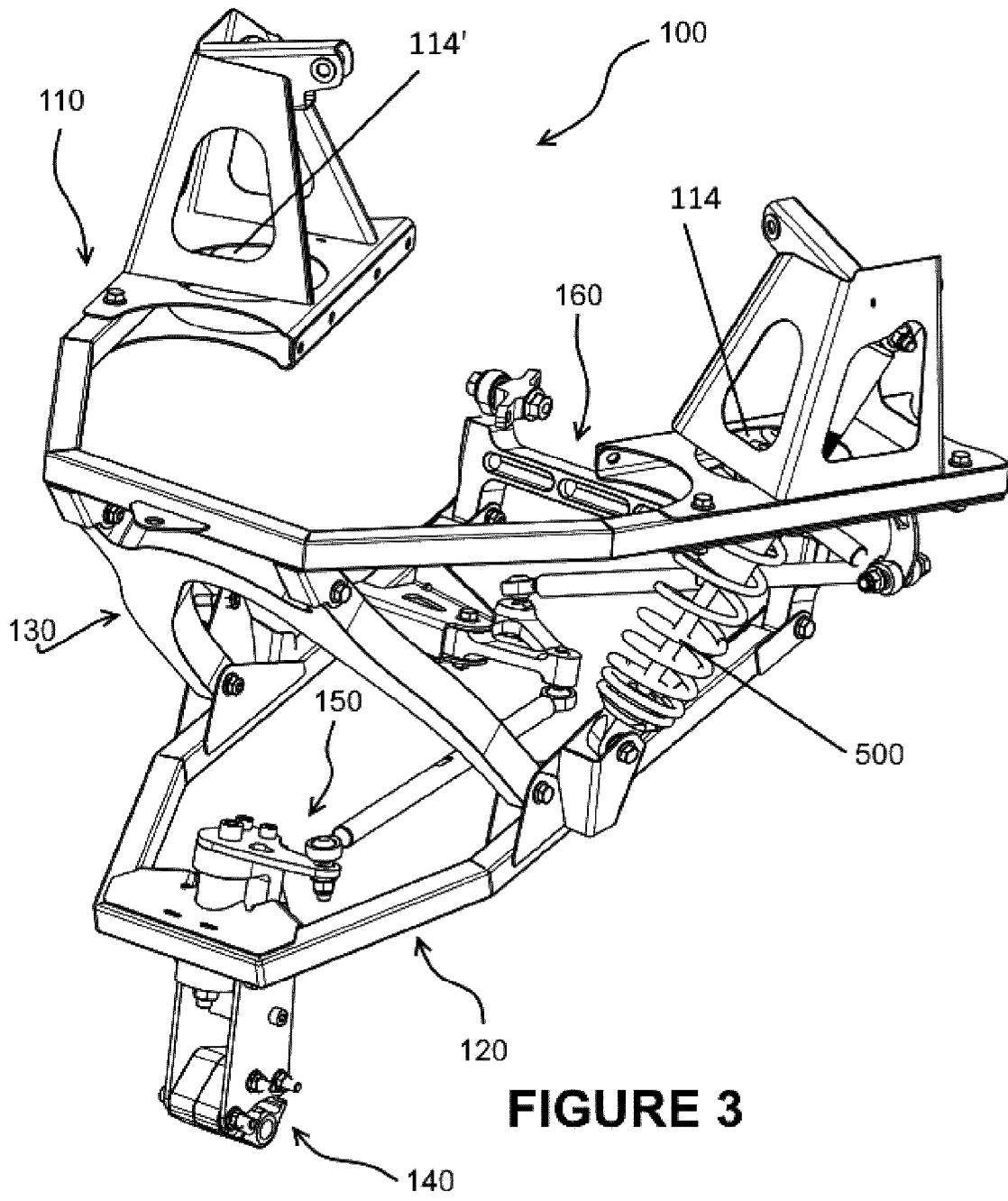
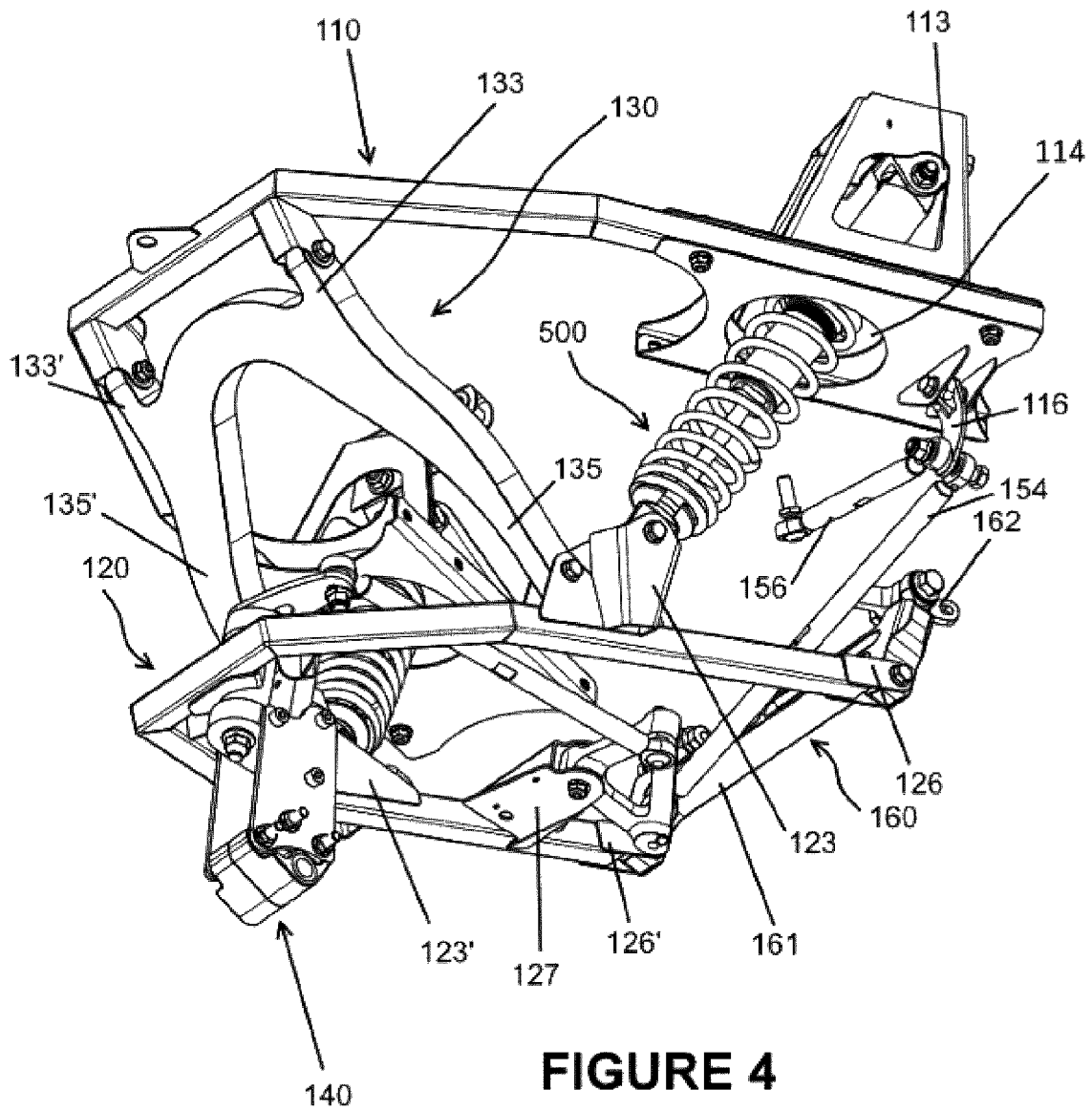


FIGURE 2



**FIGURE 3**



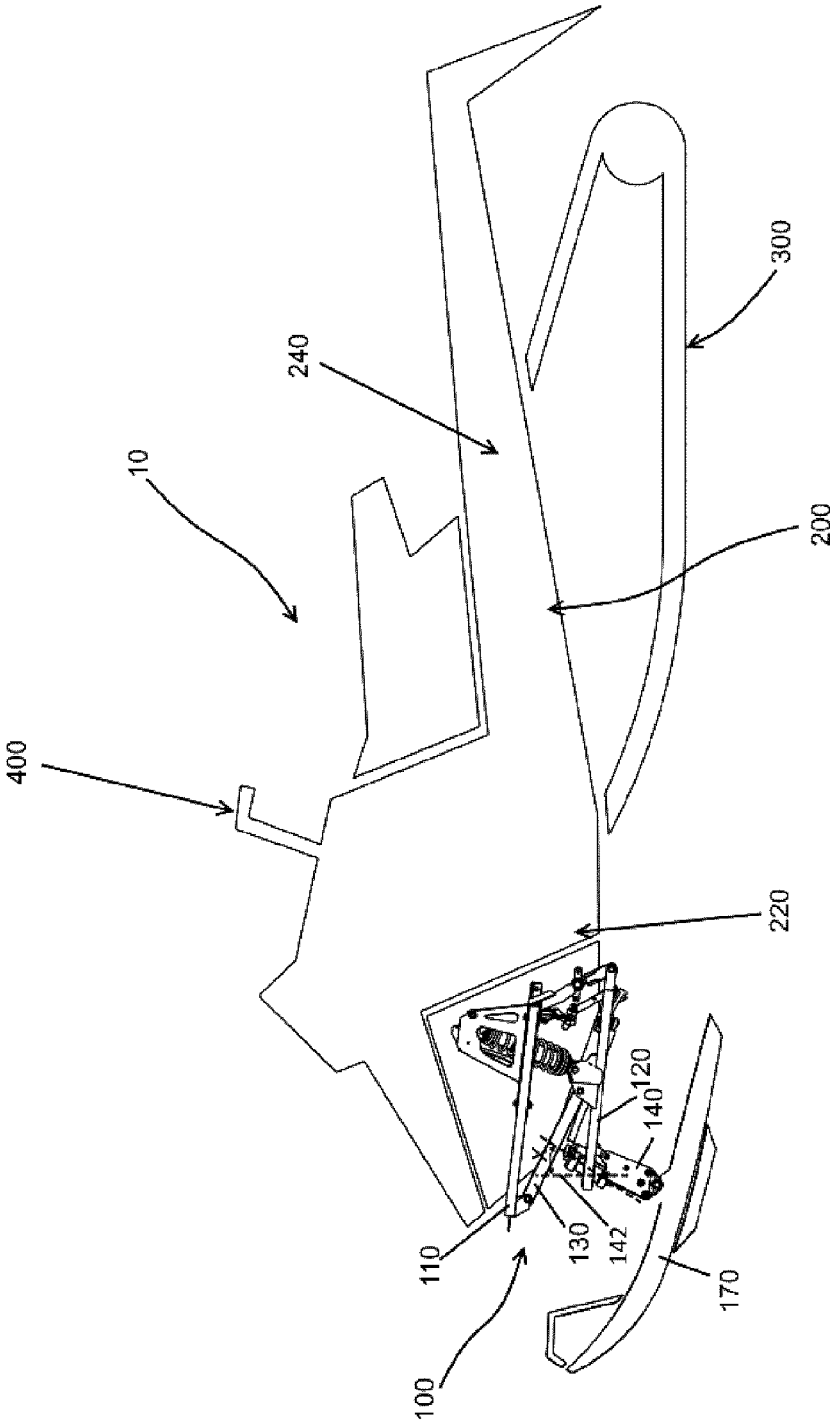


FIGURE 5

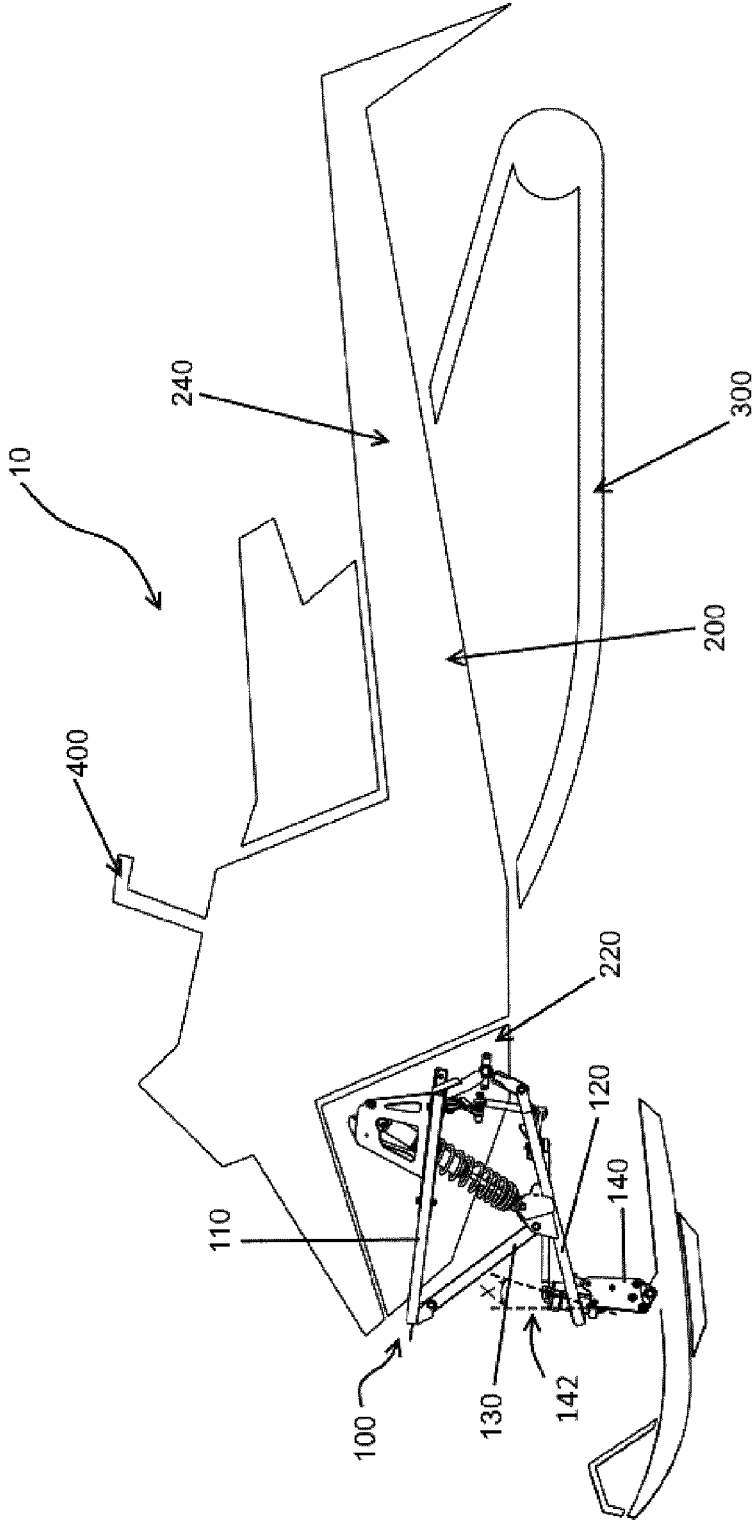


FIGURE 6

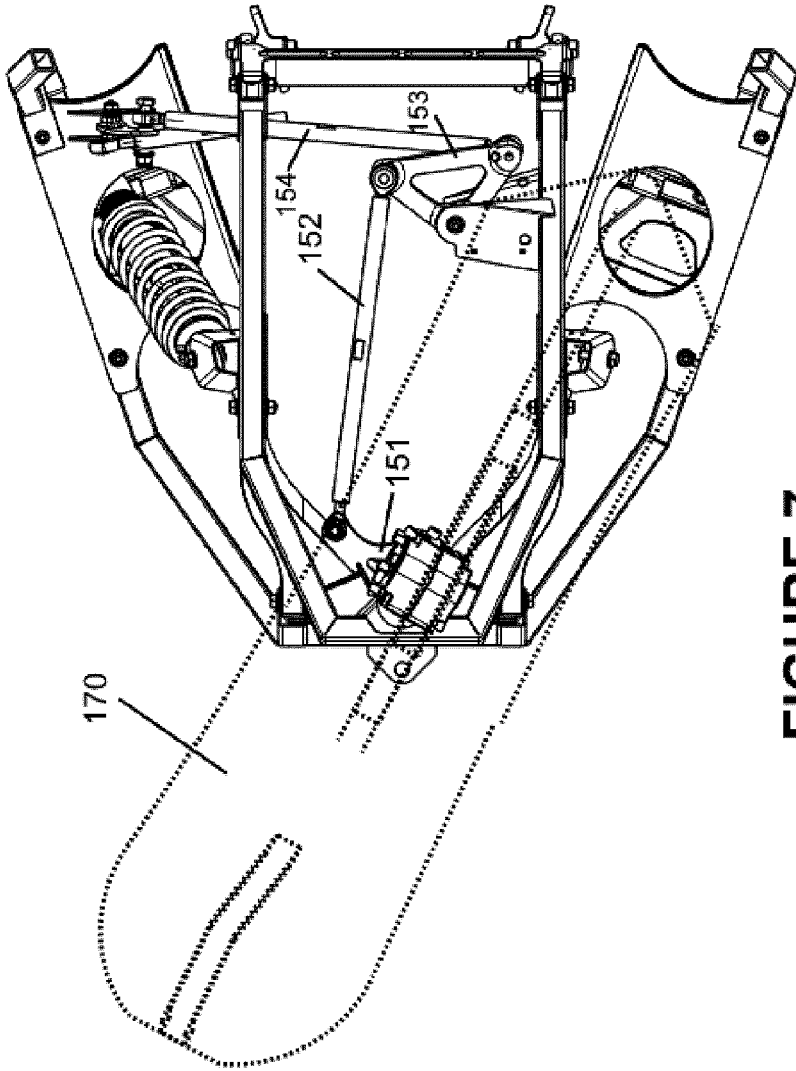


FIGURE 7

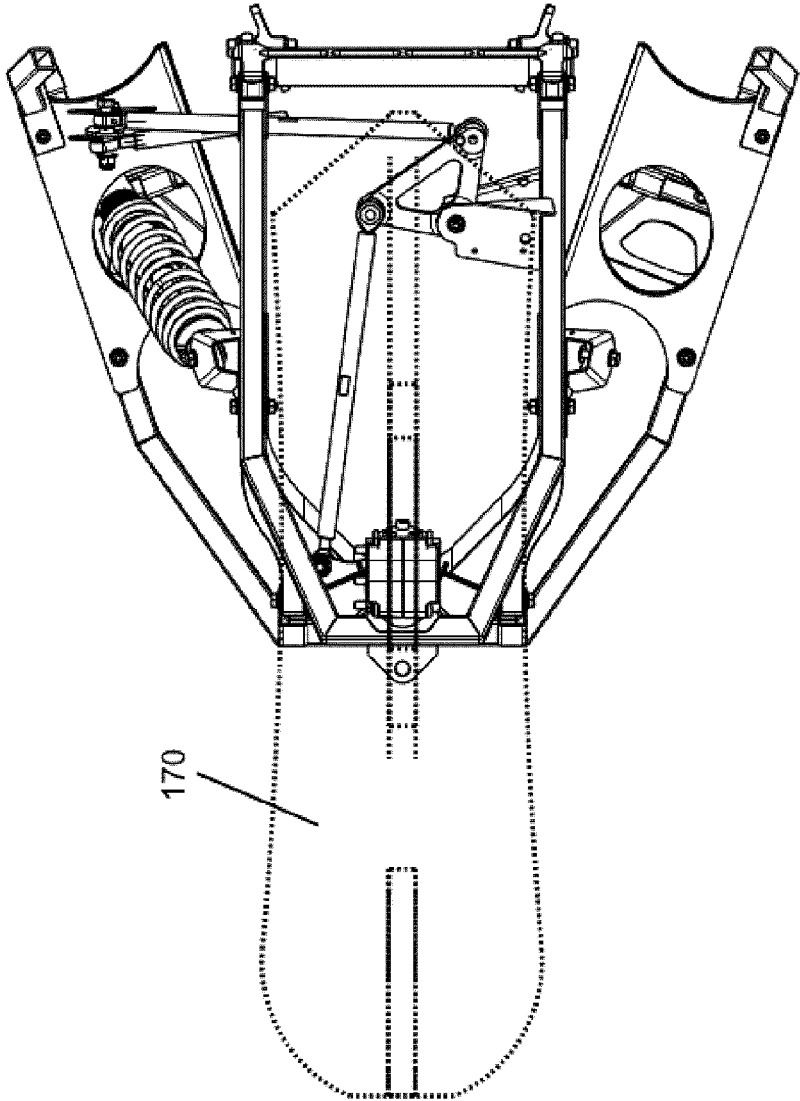


FIGURE 8

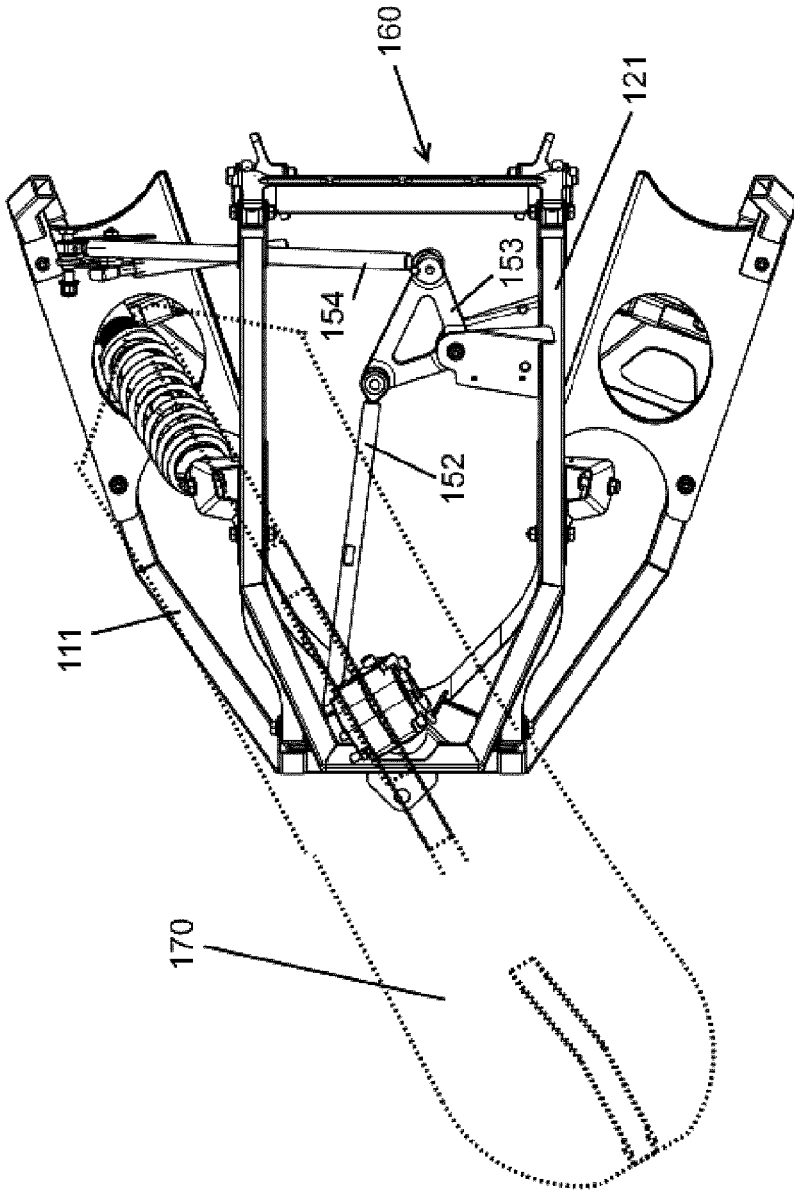
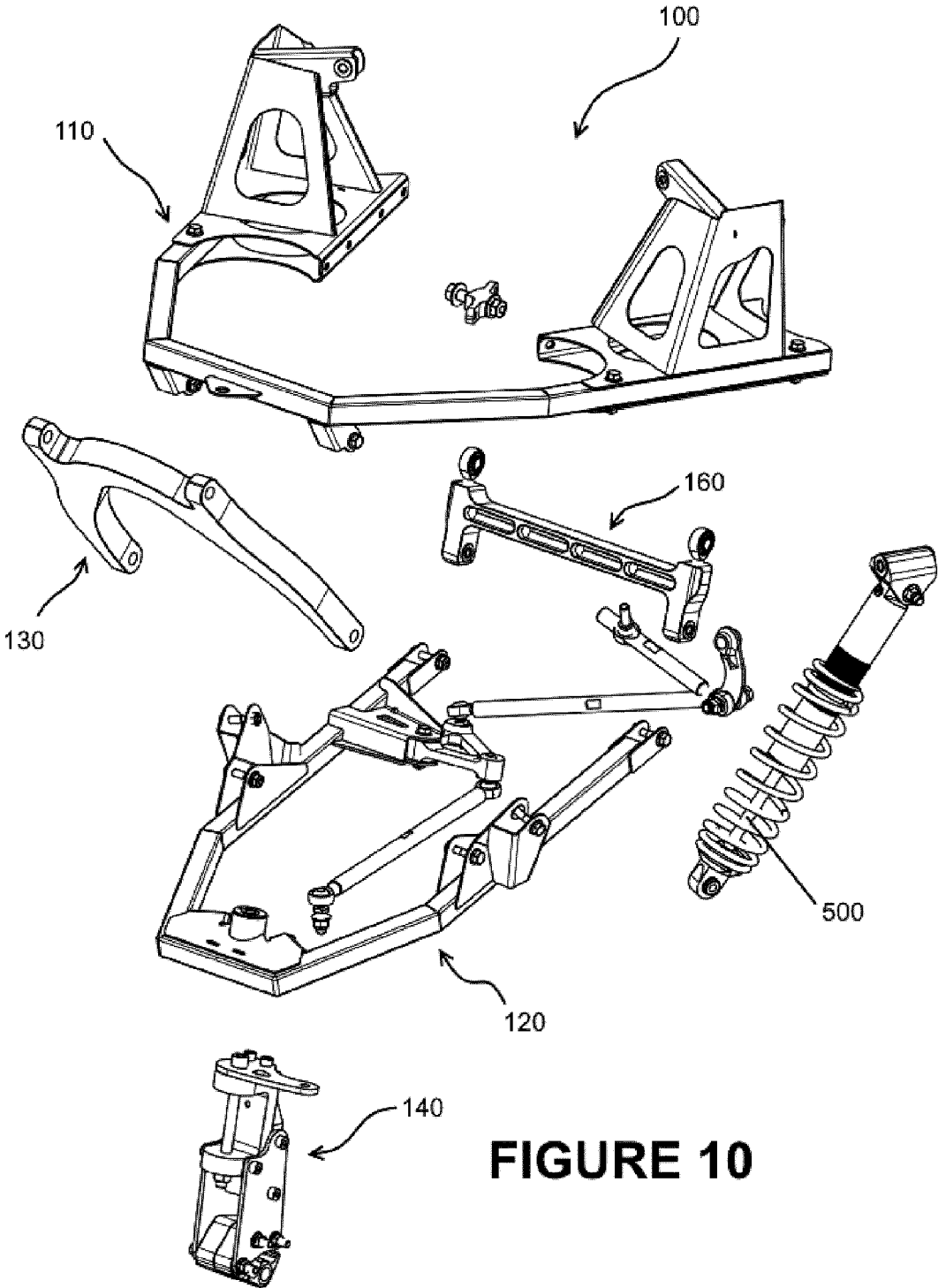


FIGURE 9



**FIGURE 10**

# FRONT SKI SUSPENSION SYSTEM FOR A SNOWMOBILE AND METHOD FOR INSTALLING THE SAME

## CROSS-REFERENCE TO RELATED APPLICATIONS

The present patent application claims the benefits of priority of Provisional U.S. Patent Application No. 62/551,022, entitled "FRONT SKI SUSPENSION SYSTEM FOR A SNOWMOBILE AND METHOD FOR INSTALLING THE SAME", and filed at the United States Patent and Trademark Office on Aug. 28, 2017, the content of which is incorporated herein by reference.

## FIELD OF THE INVENTION

The present invention generally relates to apparatus, devices, and methods in relation to conversion kits for snowmobiles. More particularly, the present invention relates to a front ski suspension system for a snowmobile.

## BACKGROUND OF THE INVENTION

Snow bikes are well known in the art. Furthermore, various track conversion kits and ski steering assemblies exist to convert a two-wheeled vehicle, such as a motorbike, to a snow bike. Also, dedicated vehicles having a single ski and a track kit have also been known in the art.

The international patent application publication no. WO 2017/031592 discloses a ski system and track system for a vehicle. As disclosed, such vehicle uses a frame similar to a motocross bike. A ski is mounted to a standard front suspension and a track kit is attached to the rear drive shaft.

The U.S. Pat. No. 9,469,327 discloses a front suspension system for a snow bike. The front suspension system comprises two front skis to provide better stability.

Other track conversion kits and assemblies have been disclosed, such as the U.S. Pat. No. 6,431,301 and the US patent application No. 2016/0280331. Such kits are used to convert a two-wheeled vehicle such as a motorbike to a snow bike by replacing the front wheel with a front central ski system and the rear wheel with a track kit system.

However, none of the above-mentioned kits and assemblies allows converting a snowmobile having two front ski systems disposed each on one front side of the snowmobile to a snowmobile having one front central ski system. Thus, there is still a need to improve the conversion of a snowmobile having two front skis to a single-ski snowmobile, typically known as a snowbike.

## SUMMARY OF THE INVENTION

The shortcomings of the prior art are generally mitigated by providing a front ski suspension system for a snowmobile configured to convert a double-ski snowmobile to a single-ski snowmobile while allowing an adjustable angular front orientation of the single-ski.

In one aspect of the invention, the present system aims at improving the steering of single-ski snowmobiles and aims at improving floatation on snow of the front portion of the single-ski snowmobile.

In another aspect of the invention, the present system aims at improving the steerability, maneuverability and floatation of snowmobiles by providing an adjustable angular front orientation of the ski.

In a further aspect of the invention, the present system aims at facilitating snowmobiling in mountain conditions, where the snow is generally loose, powder snow, and being often deeper than the height of the skis.

In yet another aspect of the invention, the present system aims at providing improved stability to single-ski snowmobiles when travelling over compacted snow and wherein the runner on the bottom of the ski is always in contact with compacted surface.

Other and further aspects and advantages of the present invention will be obvious upon an understanding of the illustrative embodiments about to be described or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

## BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and advantages of the invention will become more readily apparent from the following description, reference being made to the accompanying drawings in which:

FIG. 1 is an elevation view of a side of a snowmobile comprising a single-ski assembly in accordance with the principles of the present invention.

FIG. 2 is a top perspective view of the single-ski assembly of FIG. 1.

FIG. 3 is a top perspective view of the single-ski assembly of FIG. 1 shown with only one damping assembly.

FIG. 4 is a bottom perspective view of the single-ski assembly of FIG. 1.

FIG. 5 is an elevation view of a side of the single-ski assembly of FIG. 1 being compressed.

FIG. 6 is an elevation view of a side of the single-ski assembly of FIG. 1 being expanded.

FIG. 7 is a bottom view of a single-ski assembly in accordance with the principles of the present invention shown with the ski being turned to the left.

FIG. 8 is a bottom view of the single-ski assembly of FIG. 7 shown with the ski being straight.

FIG. 9 is a bottom view of the single-ski assembly of FIG. 7 shown with the ski being turned to the right.

FIG. 10 is a top perspective exploded view of the single-ski assembly of FIG. 1 shown with only one damping assembly.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A novel front ski suspension system for a snowmobile will be described hereinafter. Although the invention is described in terms of specific illustrative embodiments, it is to be understood that the embodiments described herein are by way of example only and that the scope of the invention is not intended to be limited thereby.

Referring to FIG. 1, a snowmobile 10 equipped with a front ski suspension assembly 100 is shown. The snowmobile 10 generally comprises a main frame or body 200 comprising a front section 220 and a rear section 240. The front section 220 is generally adapted to receive a ski suspension assembly 100 and the rear section 240 is generally adapted to receive an endless track 300. The front section 220 typically comprises a driver left end 222 and a driver right end 224. The snowmobile 10 further comprises a steering system 400, preferably handlebars, adapted to turn or pivot the front ski assembly 100. The steering system 400 generally aims at allowing a user to drive and to control the

movement of the snowmobile 10. Typically, the steering system 400 is operatively connected, via a steering rod or another suitable connector, to the ski assembly 100. When the ski assembly pivots through the movement of the steering assembly 400, the orientation of the ski 101 controls the direction of the snowmobile 10.

Understandably, the front ski assembly 100 may be embodied as a conversion kit for typical snowmobile 10 comprising two front skis. In yet other embodiments, the ski assembly 100 may be installed by a snowmobile manufacturer as original equipment of the manufacturer.

In a preferred embodiment, the single-ski front assembly 100 is attached to the front portion 220 of the frame 200 of the snowmobile 10 with standard or factory attaching means generally adapted to receive two skis. Understandably, in other embodiments, other specific attachment means may be used to attach the single-ski front assembly 100 to the snowmobile 10.

Still referring to FIG. 1, the single-ski assembly 100 may be installed to the front underside section 220 of the snowmobile 10. The single-ski assembly 100 is preferably symmetrically mounted to both sides 222 and 224 (not shown) of the snowmobile. Such attachment generally aims at centering the single-ski assembly 100 about a central longitudinal axis (not shown) of the snowmobile 10. Understandably, other methods of attachment to the snowmobile 10 (i.e. asymmetrical mounting) may be used without departing from the scope of the present invention.

Referring now to FIGS. 2 to 4 and 10, a preferred embodiment of the single-ski assembly 100 is illustrated. The assembly 100 generally forms a three arches suspension. The three arches suspension comprises three arch-shaped portions 110, 120 and 130. Two of the arch-shaped portions 110 and 120 are attached to the snowmobile 10. The third substantially arch-shaped portion connects the first 110 and the second 120 arch-shaped portions. The attaching sections 110 and 120 are preferably symmetrically attached to the front left underside 222 (see FIG. 1) and to the front right underside 224 (not shown) of the snowmobile 10.

In other embodiments, the assembly 100 may comprise two arches 110 and 120 or may further comprise four arches 110, 120, 130 and 160.

In a preferred embodiment, the single-ski assembly 100 is generally symmetric about a central longitudinal axis (not shown).

Still referring to FIGS. 2 to 4, the first attaching section 110 comprises a frame 111 connected to two attaching portions 118 and 118'. The attaching portions 118 and 118' are adapted to be attached to the snowmobile 10 and to receive one end of the suspension assembly 500. Each attaching portion 118 and 118' generally comprises connecting members 112 and 112' adapted to be attached to the front underside 222 or 224 (not shown) of the snowmobile 10, typically being the upper suspension attachment point of the suspension assemblies 500. The attaching portions 118 and 118' further comprise attaching points 113 and 113' for one of the ends of the suspension assemblies 500 of the snowmobile 10. In certain embodiments, the first attaching section 110 may further comprise attachment points 117 and 117' adapted to further secure the attaching section 110 to the front underside 222 or 224 (not shown) of the snowmobile 10. In particular, the attachment points 117 and 117' may be affixed to an upper mounting point (not shown) of the snowmobile 10 typically adapted to receive an upper control arm of a conventional snowmobile front suspension assembly.

One skilled in the art shall understand that even if the present document refers to pivotally attaching the assembly 100 to the snowmobile 10 and/or to pivotally attaching other components, the present invention is not limited insofar to such pivoting attachment system. Indeed, other attachment could be used such as slides.

In a preferred embodiment, the connecting members 112 and 112' are pivotally attached to the front underside 222 or 224 of the snowmobile 10. Such pivoting attachment 112 and 112' generally allows the connecting member to pivot about a first axis. The first axis is typically adapted to be substantially parallel along the length of the snowmobile.

In a preferred embodiment, the attaching portions 118 and 118' further comprise an aperture or passage 114 and 114', each of the apertures 114 or 114' being adapted to allow passage of one of the suspension assembly 500 of the snowmobile 10.

In a preferred embodiment, the frame 111 is generally U-shaped. Understandably, any other shape known in the art allowing the assembly 100 to be attached on each side 222 and 224 of the snowmobile 10 could be use without departing from the scope of the present invention. As an example, the frame 121 may be shaped in more than one plan.

The second attaching section 120 comprises a frame 121, an attachment point 122 of the steering rod of the snowmobile 10, attaching points 123 and 123' for the other end of the suspension assemblies 500 and attachment points 126 and 126' adapted to receive a lower attaching portion 160. In a preferred embodiment, the second attaching section 120 further comprises a second attaching point 127 adapted to receive the steering link assembly 150. Understandably, such linking assembly 150 could be unitary with the frame 121 or could be replaced with any other linking assembly known in the art.

In some embodiments, the said other end of the suspension assemblies 500 may be pivotally attached to the attaching points 123 and 123'. Such pivoting attachment points 123 and 123' generally allows the connecting member to pivot about a second axis. The second axis is typically adapted to be substantially parallel along the width of the snowmobile. In such embodiments, the lower portion of the system 120 is adapted to pivot along the second axis while the upper portion 110 is adapted to pivot along the first axis. The combined pivoting movements generally aims at raising the front portion of the snowmobile ski when the suspension is compressed and to lower the said front portion of the snowmobile ski when the suspension expands.

In a preferred embodiment, the frame 121 is generally U-shaped. Understandably, any other shape known in the art allowing the assembly 100 to be attached on each bottom side 222 and 224 of the snowmobile 10 could be use without departing from the scope of the present invention. As an example, the frame 121 may be shaped in more than one plan.

The first attaching section 110 and the second attaching section 120 are pivotally connected to one another. In a preferred embodiment, the third portion 130 connects the first attaching section 110 and the second attaching section 120. Preferably, the first section 110 is located above the second section 120.

The third portion 130 comprises a frame 131. In a preferred embodiment, the frame 131 is generally H-shaped, the frame 131 comprising two upper legs 133 and 133' and two lower legs 135 and 135'. The upper legs 133 and 133' are adapted to be pivotally connected to the first portion 110, preferably using attaching points 115 and 115'. The lower legs are adapted to be pivotally connected to the second

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portion **120**, preferably using attaching points **125** and **125'**. In a preferred embodiment, the lower legs **135** and **135'** are positioned rearward of the upper legs **133** and **133'**, thus having the third portion **130** being at an angle with regard to first **110** and second **120** portions.

Still referring to FIGS. **2** to **4**, in a preferred embodiment, the second section **120** is pivotally connected to a rear transversal frame **160** adapted to pivotally connect the second section **120** to the snowmobile **10**. The rear transversal frame **160** comprises a frame **161** and is preferably H-shaped having two upper legs **163** and **163'** and two lower legs **165** and **165'**. The upper legs **133** and **133'** may comprise connecting members **162** and **162'** adapted to be attached to the snowmobile **10**. The connecting members **162** and **162'** are generally adapted to be mounted to a lower mounting point (not shown) of the snowmobile **10** typically adapted to receive a lower control arm of a conventional snowmobile front suspension assembly. The lower legs **165** and **165'** are adapted to be pivotally connected to the second portion **120**, preferably using attaching points **126** and **126'**.

The assembly **100** further comprises a ski attachment section or steering member **140**, as shown in FIGS. **2** to **4**. In a preferred embodiment, the steering member **140** is pivotally connected to the second section **120**, preferably at the front attachment point **122**. The steering member **140** is further connected to the steering assembly of the snowmobile **10**, preferably through a steering link assembly **150**. The steering member **140** generally comprises a frame **141** and a ski attaching point **145**. The frame **141** is attached to the second portion **120** at an angle X (see, for instance, FIGS. **5** and **6**). The angle X is defined with respect to the axis **142** and is preferably within the range of 0 to 60 degrees. The axis **142** is preferably substantially vertical. Understandably, the axis **142** is substantially perpendicular to the ground surface. The ski attaching point **145** is preferably adapted to receive a kingpin or other attaching means to allow the ski **170** to freely rotate about the transversal axis Y-Y (see FIG. **2**). Such free rotation aims at providing a front angular orientation of the ski **170** to adapt the floatation angle of the ski **170**.

In a preferred embodiment, the assembly **100** comprises a steering link assembly **150** adapted to link the rotation of the steering of the snowmobile **10** to the ski **170**. The steering link assembly **150** generally comprises a front pivoting member **151** and a rear pivoting member **153**. The front pivoting member **151** is generally attached at an angle, being preferably between 25° and 50° and more preferably about 35°, to the front of the second section **120** using an attachment point **122**. The rear pivoting member **153** is preferably pivotally attached to the rear of the second portion **120**, preferably at attachment point **127**. The rear pivoting member is also attached at an angle with the second portion **120**. The pivoting of the front **151** and rear **153** pivoting members are linked or synchronized, preferably using a connecting member **152**. The connecting member **152** is typically connected to each member **151** and **153** using ball joints.

In another embodiment, the steering link assembly **150** could be embodied as cable, such as a push-pull cable. In such an embodiment, the pushing of the cable triggers the rotation of the ski **170** in one direction while the pulling of the cable triggers the rotation of the ski **170** in the other direction.

It should be understood by one skilled in the art that any other known mechanism of linking the steering of the snowmobile **10** to the ski may be used without departing from the scope of the present invention.

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The rear pivoting member **153** is preferably connected to the steering rod (not shown) of the snowmobile **10** using link members **154** and **156**, the link members **154** and **156** being connected to one of the attaching portions **118** or **118'** at an attaching point **116**.

In another embodiment, the link members **154** and **156** may be connected to the first section **110**.

Understandably, other methods and configurations of attachment of the rear pivoting member **153** to the steering rod (not shown) of the snowmobile **10** may be used without departing from the scope of the present invention.

In a preferred embodiment, the link members **152**, **154** or **156** are bearing rods.

Understandably, in order to ensure a structural rigid assembly of the single-ski conversion kit **100**, both top and bottom sections **110** and **120** may be further connected using rear rigid members.

In a preferred embodiment, the assembly **100** is adapted to receive at least one damping assembly **500** of the snowmobile **10** and preferably but not limited to two damping assemblies **500**. Such configuration aims at keeping both sides balanced when impact efforts are transmitted from the ski **170**. Typically, the angle of the damping assemblies **500** as originally installed on a snowmobile **10** is reversed from a A-shape configuration to a V-shape configuration. The angle of the damping assemblies **500** generally aims at improving the maneuverability of the snowmobile while climbing mountains or other uneven terrains.

Understandably, in other embodiments, the assembly **100** may further comprise one or more damping assemblies **500** adapted to be mounted to the snowmobile **10**. In such embodiments, the damping assemblies **500** typically present on the snowmobile must be first removed and the one or more damping assemblies **500** of the assembly **100** are then mounted to the snowmobile.

Now referring to FIGS. **1**, **5** and **6**, a single-ski assembly **100** is shown while the snowmobile **10** is at rest (FIG. **1**) is absorbing a shock or going over a bump (FIG. **5**) and is going over a lower terrain or is in the air (FIG. **6**). As shown in FIG. **5**, the angle X increases when the single-ski assembly absorbs a shock. In such an event (FIG. **5**), the first section **110** pivots with regard to the second section **120**. In some embodiments, the first section **110** and the second section **120** may be pivoted as being nearly parallel to each other. As the second section **120** is pushed upward, both ends of the third sections **130** pivot to absorb the movement.

As shown in FIG. **5**, the angle between the traveling surface of the snowmobile and the ski of the snowmobile increases as the suspension assembly **500** is compressed. Such compression typically occurs when the snowmobile travels over a bump or higher terrain as the ski is pushed toward the snowmobile. In preferred embodiments, as the suspension assembly is further compress, the angle further varies.

As shown in FIG. **6**, the angle between the traveling surface of the snowmobile and the ski of the snowmobile decreased as the suspension assembly **500** is expanded. Such expansion typically even typically occurs when the snowmobile travels over lower terrain or a depression as the ski is pulled toward the ground.

Still referring to FIG. **6**, the angle X decreases when the single-ski assembly **100** goes over lower terrain. In such an event, the first section **110** pivots with regard to the second section **120**, the two sections **110** and **120** being pulled away one from the other. As the second section **120** is pulled downward by gravity and by the weight of the ski **170**, both

ends of the third sections **130** pivot and thus controlling and limiting the movement of the second section **120**.

Such variation in the angle aims at increasing the maneuverability when turning and the general floatability of the snowmobile compared to known single-ski vehicles, such as snowbikes.

Referring now to FIGS. **7** to **9**, bottom views of the ski **170** being steered to the left (FIG. **7**), being straight (FIG. **8**) and being steered to the right (FIG. **9**) are illustrated. The FIGS. **7** to **9** show an example of a preferred steering link assembly in operation. As the steering is turned, the rear pivoting member **153** is pushed (FIG. **7**) or pulled (FIG. **9**) or is staying still (FIG. **8**). The movement of the rear pivoting member **153** triggers the movement of the front pivoting member **151** through the link member **152**. As the pivoting member **151** pivots, the ski **170** is moved left (FIG. **7**) or right (FIG. **9**).

A method for installing a single ski assembly **100** is also provided. The method comprises attaching the first section **110** to each upper front side **222**, **224** of the snowmobile **10**, attaching the second section **120** to the lower front sides **222**, **224** of the snowmobile, connecting each ends of each damping assembly to the first section **110** and to the second section **120**, attaching the steering rod or steering mechanism of the snowmobile **10** to the steering link assembly **150**. The step to attach the second section **120** to the lower front sides **222**, **224** may further comprise attaching the lower attaching portion **160** to the lower front sides **222**, **224** of the snowmobile **10**. The step to attach the steering rod or steering mechanism of the snowmobile **10** to the steering link assembly **150** may further comprise attaching a link member **156** to the steering rod of the snowmobile, the link member **156** being connected to the steering link assembly **150**.

In embodiments where the single ski assembly **100** is used to convert a two-ski snowmobile to a snowbike, the method may further comprise detaching the damping assemblies **500** of the snowmobile, detaching the steering rod from the two-ski assembly, detaching the two-ski assembly from the frame **200** of the snowmobile **10**.

In other embodiments, any other geometry, configuration or shape of the single ski assembly **100** may be used if such configuration provides an adjustable angular front orientation of the ski **170**. Furthermore, any other configuration may be used if the single-ski assembly **100** may be attached to a conventional snowmobile through the same original attaching means being initially configured to hold the double-ski assembly.

While illustrative and presently preferred embodiments of the invention have been described in detail hereinabove, it is to be understood that the inventive concepts may be otherwise variously embodied and employed and that the appended claims are intended to be construed to include such variations except insofar as limited by the prior art.

The invention claimed is:

**1.** A single-ski assembly for a snowmobile being adapted to receive at least two skis and comprising a steering assembly, the single-ski assembly comprising:

- a first plurality of attachment points attachable to a first front side portion of the snowmobile;
- a second plurality of attachment points attachable to a second front side portion of the snowmobile; and
- a steering member connectable to the steering assembly and attachable to a ski, the angle between the steering member and an axis substantially perpendicular to a travelling surface being between 0 degree and 60 degrees.

**2.** The single-ski assembly of claim **1**, the single-ski assembly further comprising a frame adapted to compress and expand with regard to the front portion of the snowmobile.

**3.** The single-ski assembly of claim **1**, the single-ski assembly further comprising:

- a first pivotable attachment portion attachable to the front portion of the snowmobile;

- a second pivotable attachment portion, the second pivotable attachment portion being pivotally connected to a ski about a first axis and being pivotally connected to a lower portion of the snowmobile;

- at least one suspension system comprising a first and a second end, the first end being attachable to the front portion of the snowmobile and the second end being attachable to the second pivotable attachment portion.

**4.** The single-ski assembly of claim **3**, the first pivotable attachment portion being pivotally attachable to the front portion of the snowmobile about an axis substantially parallel to the length of the snowmobile.

**5.** The single-ski assembly of claim **3**, the second attachment portion being pivotally attached to the second end of the suspension system about an axis substantially parallel to the width of the snowmobile.

**6.** The single-ski assembly of claim **3**, the single-ski assembly further comprising a third attachment portion, the third attachment portion comprising a first and a second end, the first end being pivotally attached to the first attachment portion and the second end being pivotally attached to the second attachment portion.

**7.** The single-ski assembly of claim **6**, the third attachment portion being H-shaped.

**8.** The single-ski assembly of claim **3**, the first and second attachment portions being U-shaped.

**9.** The single-ski assembly of claim **3** the suspension system comprising two suspension members, each suspension member comprising a first and a second end, each first end being attached to the first attachment portion and each second end being attached to the second attachment portion.

**10.** The single-ski assembly of claim **9**, the first and second suspension members being attached to the first and second attachment portions to form an angle about a vertical axis.

**11.** The single-ski assembly of claim **3**, the angle between a front portion of the ski and a travelling surface being between 0 degree and 60 degrees.

**12.** The single-ski assembly of claim **3**, the second attachment portion further comprising a ski attachment member adapted to be pivoted by the steering assembly of the snowmobile.

**13.** The single-ski assembly of claim **12**, the single-ski assembly further comprising a linking member between the ski attachment member and the steering assembly of the snowmobile.

**14.** The single-ski assembly of claim **3**, wherein when the suspension system is compressed, the angle between a front portion of the ski and a travelling surface increases and wherein when the suspension system is expanded, the angle between the front portion of the ski and the travelling surface decreases.

**15.** The single-ski assembly of claim **3** further comprising two suspension attaching assemblies, each of the two suspension attaching assemblies comprising:

- a first attachment point for receiving a suspension assembly of the snowmobile;

- a second attachment point for attaching to the snowmobile; and

a connecting member between the first and second attachment points of the suspension attaching assembly to distally position the first attachment point from the snowmobile.

\* \* \* \* \*