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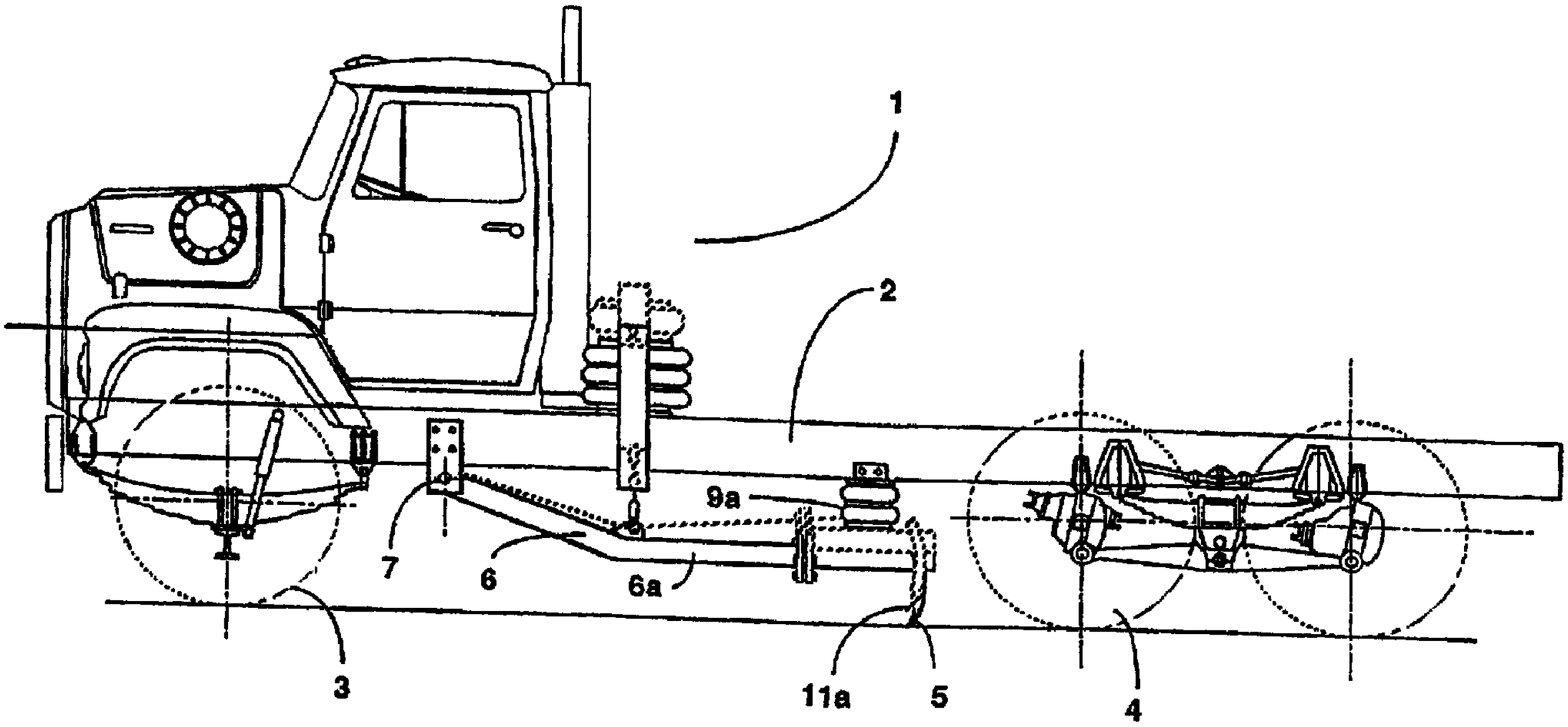
(54) Titre : SUPPORT PLACE SOUS LE CHASSIS D'UNE NIVELEUSE EN SON MILIEU POUR RECEVOIR UNE LAME BIAISE OU RACLEUSE

(54) Title: MID-CHASSIS UNDERBODY PLOW OR SCRAPPER SUPPORT



(57) Abrégé/Abstract:
A mid-chassis, underbody plow or scraper blade is mounted at the trailing end of the pivot arm assembly hinged to a vehicle chassis between the vehicle wheels about a transverse horizontal axis at its forward end. The blade is further mounted to permit the outer ends of the blade to move vertically. Pneumatic pressure actuators mounted on either side of the center line of the vehicle apply pressure to the respective ends of the blade to control the scraping action.

ABSTRACT

A mid-chassis, underbody plow or scraper blade is mounted at the trailing end of the pivot arm assembly hinged to a vehicle chassis between the vehicle wheels about a transverse horizontal axis at its forward end. The blade is further mounted to permit the outer ends of the blade to move vertically. Pneumatic pressure actuators mounted on either side of the center line of the vehicle apply pressure to the respective ends of the blade to control the scraping action.

Title: MID-CHASSIS UNDERBODY PLOW OR SCRAPER SUPPORT

Field of the Invention

This invention relates to plowing equipment. More particularly, it relates to a support system for a mid-chassis, underbody plow or scraper system that controls the deployment of a blade and its orientation to the surface being scraped. The invention is suited especially for installation on the underbody of trucks used as snow plows.

Background to the Invention

Mid-chassis or underbody plows and scrapers are well known vis. U.S. Patent Nos. 2,062,544 to Weeks; 4,031,966 to Farrell; 4,337,832 to Whitlow and 4,304,304 to Anderson. It is also known to provide scrapers that are positioned in pairs on a vehicle, between the front and rear tires vis. U.S. Patent 4,665,636 to Borras. In this latter arrangement, the scrapers are independently vertically adjustable in terms of the positions of the lower edges of the blades below the vehicle chassis.

It is also known to relieve the weight of a snowplow blade resting on a road surface through the controlled application of an hydraulically lifting force to the plow blade, vis U.S. Patent 5,265,356 to Winter. Alternately, it is known to position a light weight scraper array vertically using two hydraulic cylinders, cf U.S. Patent 4,553,608 to Miskin.

A further known arrangement in the field of plowing blade supports is to provide an air-cushioned positioning system that holds a plowing blade in an upright orientation until an obstruction is struck, whereupon the blade will "trip" to pass over the obstacle, cf U.S. patent 4,031,966 to Farrell.

In designing an underbody plow or scraper it is desirable to provide adjustability to raise or lower the blade, to rotate the blade up and down at its outer ends about a horizontal axis that is generally pointed in the direction of motion and to angle the blade to the left and right about a vertical axis. It is also desirable when the plow blade is light, to provide a supplementary force-control mechanism that will apply a downward force to the plow blade to maintain it in contact with the surface being plowed with the appropriate level of pressure.

These features of control should ideally be achievable, in whole or in part, at minimal cost and with a minimal addition of weight to the vehicle. Fluid hydraulic systems are capable of serving in such applications, but they are relatively expensive and heavy.

It is therefore an object of the invention to provide an underbody blade support system that has features of adjustability combined with simplicity and low cost.

The invention in its general form will first be described, and then its implementation in terms of specific embodiments will be detailed with reference to the drawings following hereafter. These embodiments are intended to demonstrate the principle of the invention, and the manner of its implementation. The invention in its broadest and more specific forms will then be further described, and defined, in each of the individual claims which conclude this Specification.

Summary of the Invention

According to the present invention, there is provided a vehicle underbody scraper blade support system for a vehicle having a chassis and forward and rearward sets of wheels comprising:

(1) blade support means to support a scraper blade beneath the chassis of a vehicle at a location intermediate the forward and rearward sets of wheels on said vehicle, said blade support means extending longitudinally in the direction for motion of the vehicle and having forward and rearward ends;

(2) pivot means for connecting the forward end of the blade support means to said chassis to permit rotation of the rearward end of the blade support means in the vertical plane;

(3) a scraper blade carried by said blade support means, positioned proximate the rearward end of the blade support means for extending generally transversely with respect to said vehicle, and having outer ends;

(4) rotational means within said blade support means located rearwardly of its forward end and intermediate the locations of the forward and rearward sets of wheels on said vehicle to allow the outer ends of the scraper blade to effect respective displacements in the vertical direction;

(5) two pressure actuators carried by the blade support means for being positioned between the blade support means and the vehicle chassis, at spaced locations on either side of the centerline of the vehicle to apply downward pressure on the blade; and

(6) pressure actuator control means by which the pressure applied by the pressure actuators can be controlled to permit the outer ends of the scraper blade to effect respective displacements in the vertical direction and apply pressure to the road surface.

According to the present invention, there is also provided an underbody scraper blade support system for a vehicle having a chassis and forward and rearward sets of wheels for traversing a road surfaces, said support system comprising:

(1) a pivot arm assembly for being mounted beneath the chassis of a vehicle, said pivot arm assembly including two pivot arms with forward and rearward ends located within the support system for coupling to the chassis of the vehicle towards the forward end of such chassis through pivots that allow each pivot arm to rotate independently about a respective pivot arm axis at its forward end that is generally aligned transversely to the direction of motion of the vehicle and;

(2) a scraper blade with two outer ends;

(3) a blade support frame carrying the scraper blade and, in turn, itself being carried by said pivot arm assembly, the blade support frame being located within the support system to position the scraper blade intermediate the forward and rearward sets of wheels on a vehicle with the scraper blade extending generally transversely with respect to said vehicle;

(4) rotational means within said blade support system located at the rearward ends of the pivot arms for positioning intermediate the locations of the forward and rearward sets of wheels on said vehicle to allow the outer ends of the scraper blade to effect respective displacements in a vertical direction;

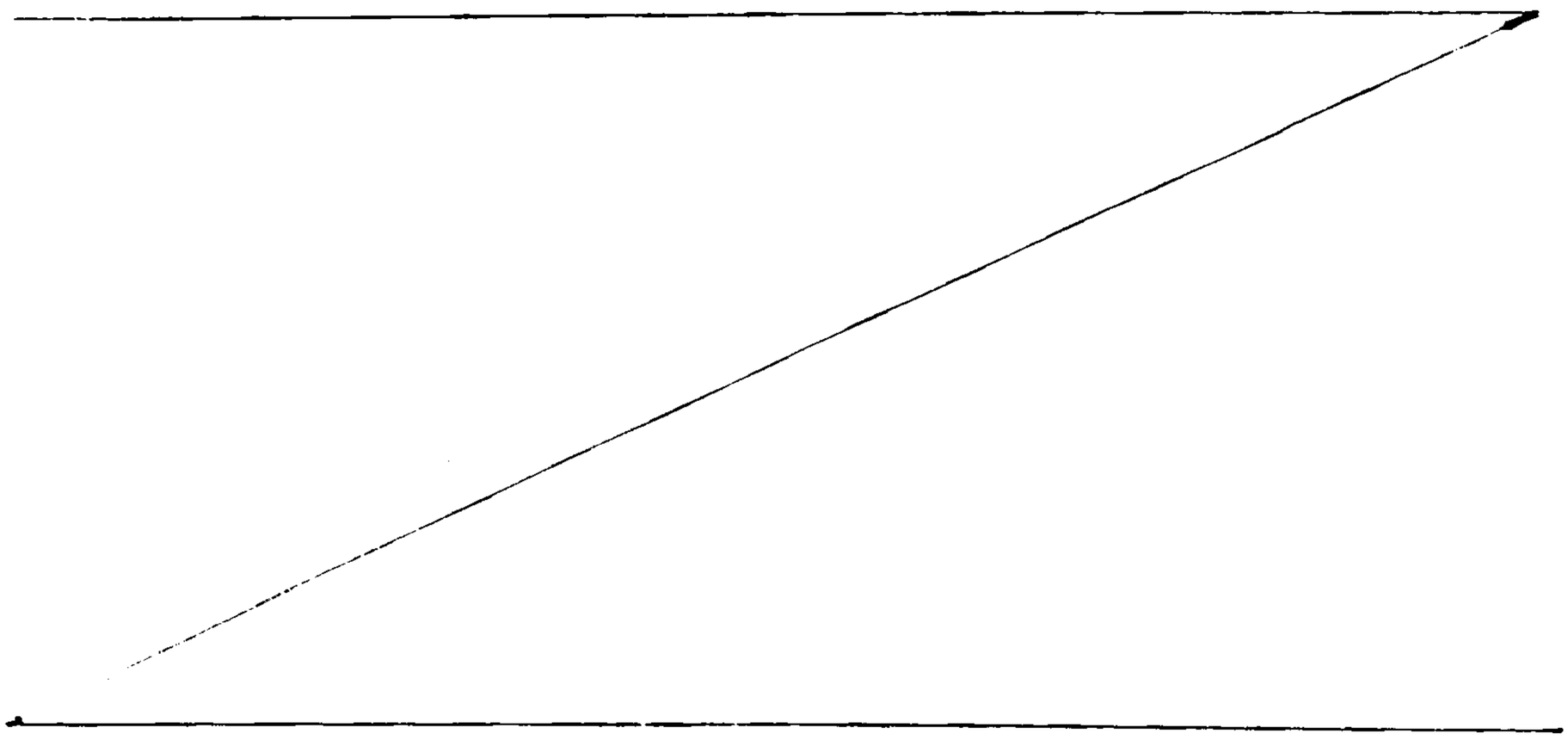
(5) two pressure actuators carried by the blade support frame for being positioned between the blade support frame and the vehicle chassis, said respective pressure

actuators being positioned at spaced locations on either side of the centerline of the vehicle to apply vertical pressure to the scraper blade, directing such blade to press against a road surface beneath the vehicle; and

(6) pressure actuator control means by which the pressure applied by the two pressure actuators can be controlled.

According to one aspect of the invention, an underbody plow blade or scraper with two outer ends, (hereafter referred to generally as a scraper blade) which is mounted to extend transversely beneath the chassis of a vehicle. This scraper blade is positioned intermediate forward and rearward sets of wheels on the vehicle. Preferably, it is carried at the end of a blade support means which preferably may be in the form of a pivot arm assembly including two trailing arms that are mounted to the chassis so as to extend downwardly from a forwardly-mounted hinge mount that allows rotation of the pivot arm assembly about an axis that is generally transverse to the direction of motion of the vehicle.

The scraper blade is preferably carried by the pivot arm assembly at a position remote from the pivot arm hinge axis in such a manner that its outer ends are capable of a degree of independent vertical displacement with respect to the vehicle chassis. This may be effected in one preferred manner by providing a rotatable coupling between the pivot arm assembly, and the scraper blade that allows the scraper blade to rotate about a generally horizontal axis that is substantially aligned with the direction of motion of the vehicle. Other means of providing for such freedom of motion may also be employed.



However, the rotational coupling is located intermediate the front and rear wheels of the vehicle.

Preferably the scraper blade is positioned by two pressure actuators respectively positioned between it and the vehicle chassis at spaced locations on either side of the centerline of the vehicle. The function of these pressure actuators is to apply downward pressure on the scraper blade. As an optional feature, by independent control of the pressure actuators, differing vertical forces may be applied to the respective outer ends of the scraper blade. Consequently a greater amount of contact pressure may be maintained between the scraper blade and the surface being scraped at one outer end of the blade than at the other outer end. This greatly facilitates the removal of snow, ice or other debris from a road surface when the level of material to be removed is higher on one side of the vehicle than on the other side of the vehicle.

The preferred type of pressure activator is a pneumatic bladder of the type generally employed in air springs. Their role is to press the blade edge resiliently against the road surface, lifting-off ice, snow and debris from that surface. Such devices are not only relatively inexpensive, but also provide a "spring" resilience that allows the scraper to move vertically to accommodate vertical variation in the surface being scraped.

To raise the scraper blade, the pivot arm assembly is provided with a lifting actuator coupled between the pivot arm and the vehicle chassis. Preferably this lifting actuator is an air bladder seated on the vehicle chassis and having on its upper side a coupling link that extends down to the pivot arm assembly. In one version of the invention this coupling link may be provided by a transverse bar and two descending chains.

The foregoing summarizes the principal features of the invention and some of its optional aspects. The invention may be further understood by the description of the preferred embodiments, in conjunction with the drawings, which now follow.

Summary of the Figures

Figure 1 is a side view of a vehicle carrying a mid-chassis, underbody plow with a blade support structure in accordance with the invention;

Figure 2 is a perspective view of a cut-away portion of the vehicle of Figure 1 taken from the left rear quarter;

Figure 3 is the view of Figure 2 with pneumatic actuators depicted in position;

Figure 4 is a rearward view of the vehicle of Figure 1 with the pivot arm assembly lowered;

Figure 4a is a rearward view of the vehicle of Figure 1 with the pivot arm assembly raised;

Figure 4b shows a rearward face view of the tilting plate assembly;

Figure 5 is a perspective view of the vehicle of Figure 1 with dual air cylinders in place of the pneumatic lifting bellows;

Figure 6 depicts the vehicle of Figure 2 with the air distribution and control system in place.

Description of the Preferred Embodiment

In Figure 1 a vehicle 1 having a chassis 2, forward wheels 3 and rearward wheels 4 carries between these sets of wheels 3,4 a scraper blade or plow blade 5. While reference hereafter will be made to a "blade" 5 this language is intended to encompass any form of scraper blade, including rake and chisel-like constructions.

The blade 5 is carried by a pivot arm assembly 6 having two pivot arms 6a, 6b that trail below the chassis 2 from hinges 7 coupled to the chassis 2 at the forward end of each pivot arm 6a, 6b. The hinges 7 permit rotation of the pivot arms 6a, 6b about an axis that is transverse to the direction of the vehicle 1. This assembly serves as a blade support means.

Positioned between the chassis 2 and blade 5 are two pneumatic bellows 9a, 9b respectively mounted on opposite sides of the centerline 10 of the vehicle 1. Based on pneumatic springs, these bellows 9a, 9b act as controllable pressure actuators which are able, in a preferred arrangement, to apply independently differing pressures to the outer ends 11a, 11b of the blade 5. Pneumatic bladders of this type have the desirable feature of applying a resilient force.

As best seen in Figure 2, the outer ends 11a, 11b of the blade 5 are rendered vertically displaceable by the presence of a rotary coupling 12 incorporated into a pair of

transverse tilting plates 13a, 13b. These form part of the blade support means. A first one of these plates 13a extends between the pivot arms 6a, 6b; the second of these plates 13b extends between two blade support arms 14a, 14b that connect to the blade 5. A central pin 15 coupled to the two tilting plates 13a, 13b permits rotation of the blade support arms 14a, 14b, which serve as part of a blade support frame on the blade side of the rotational coupling, and blade 5 about a horizontal axis aligned with the direction of travel 10 of the vehicle 1. The plates 13a, 13b preferably are positioned closely together so that their outer ends may brush together to absorb dislocating forces that tend to swivel the blade 5 to the left or right. As well, welded pins or bolts 45 may extend from one plate 13a to carry a containment plate 46, or conversely from the second plate 13b, so that the containment plate 46 contains or "traps" the outer ends of the second plate 13b, or in the converse case the first plate 13a. This is to absorb tensional forces while permitting vertical movement between the plates 13a, 13b. Specific bearing surfaces may be provided on each of the plates 13a, 13b to absorb the brushing contact action.

In Figure 2 the alternate position of the blade 5 is shown in ghost outline 5a with one end 11b raised and the other end 11a (not shown in Figure 2) lowered.

In Figure 3 the pneumatic bellows 9a, 9b omitted from Figure 2 for clarity are shown positioned to apply force between the chassis 2 and the blade 5 through the respective blade support arms 14a, 14b. These pressure actuators 9a, 9b are spaced apart and positioned to apply similar or differing pressures at the outer ends of the blade 5 in pressing the blades downward onto the road surface.

The pivot arm assembly 6 is raised by chains 16 descending from a frame 17 that includes a transverse bar 18 that overlies a further air spring lifting bellows 19 positioned on the chassis 2. The pivot arms 6a, 6b are coupled to the chains 16 at locations between their ends to provide the action of a third class lever.

To raise the blade 5, the pressure in the pressure actuator bellows 9a, 9b is released (through valves 24) and that in the lifting bellows 19 is increased. The force of the lifting bellows 19 is transmitted through the frame 17 and chains 16 to the pivot arm assembly 6 raising the blade 5 upwardly off of the surface being scrapped. This operation may be seen in Figures 4 and 4a wherein the pivot arm assembly is respectively lowered and raised.

As an alternative to a lifting bellows 19 of Figure 4, the chains 16 may terminate in two respective air cylinders 20 or the like mounted on the vehicle chassis 2 as shown in Figure 5. Also shown in Figure 5 are optional crossed bracing struts 47 extending between the pivot arms 6a, 6b to increase the stiffness of the pivot arm assembly 6.

The control system for the blade support is depicted in Figure 6. A source of pressurized air 21, depicted as an air tank, provides air to a pressure distribution box 22. Pressurized air is directed from this box 22 to the lifting bellows 19 and pressure actuator bellows 9a, 9b, through air lines 23 in response manual input signals, preferably originating remotely from within the vehicle cab. Exhaust valves 24, responding in cooperation with the operation of the pressure distribution box 22, exhaust or vent air from bellows 9a, 9b, 19 when they are to be depressurized, e.g. venting lifting bellows 19 when pressure actuators 9a, 9b are pressurized. Manometers 25 display the pressure conditions within the system.

Through the pressure distribution box 22, controlled levels of pressure may preferably be developed independently in each of the bellows 9a, 9b controlling the scrapping effect of the blade 5 on the road surface. A different pressure need not necessarily be applied through the bellows 9a, 9b; but such option is available.

The use of air-activated pressure actuators 9a, 9b will render the blade support of the invention light in weight and less costly than hydraulic systems. The light weight of the blade 5 and pivot arm assembly is supplemented by pressure applied through the bellows 9a, 9b which respond resiliently to variations in the height of the road surface. The rotary coupling 12 in the pivot arm assembly allows the scraper blade to adjust to the contour of the road surface in the preferred variant of the invention. The angling feature of the blade 5 allows debris to be transferred to the left or right side of the vehicles. Individually and collectively an improved means is provided for clearing a road surface.

Conclusion

The foregoing has constituted a description of specific embodiments showing how the invention may be applied and put into use. These embodiments are only exemplary. The invention in its broadest, and more specific aspects, is further described and defined in the claims which now follow.

These claims, and the language used therein, are to be understood in terms of the variants of the invention which have been described. They are not to be restricted to such variants, but are to be read as covering the full scope of the invention as is implicit within the invention and the disclosure that has been provided herein.

WHAT IS CLAIMED IS:

1. A vehicle underbody scraper blade support system for a vehicle having a chassis and forward and rearward sets of wheels comprising:

(1) blade support means to support a scraper blade beneath the chassis of a vehicle at a location intermediate the forward and rearward sets of wheels on said vehicle, said blade support means extending longitudinally in the direction for motion of the vehicle and having forward and rearward ends;

(2) pivot means for connecting the forward end of the blade support means to said chassis to permit rotation of the rearward end of the blade support means in the vertical plane;

(3) a scraper blade carried by said blade support means, positioned proximate the rearward end of the blade support means for extending generally transversely with respect to said vehicle, and having outer ends;

(4) rotational means within said blade support means located rearwardly of its forward end and intermediate the locations of the forward and rearward sets of wheels on said vehicle to allow the outer ends of the scraper blade to effect respective displacements in the vertical direction;

(5) two pressure actuators carried by the blade support means for being positioned between the blade support means and the vehicle chassis, at spaced locations on either side of the centerline of the vehicle to apply downward pressure on the blade; and

(6) pressure actuator control means by which the pressure applied by the pressure actuators can be controlled to permit the outer ends of the scraper blade to effect respective displacements in the vertical direction and apply pressure to the road surface.

2. A blade support system as in claim 1, wherein the rotational means comprises a rotational coupling carried by the blade support means whereby the scraper blade is able to rotate about a horizontal axis generally aligned with the

direction of travel of the vehicle, thereby permitting the outer ends of the scrapper blade to effect complimentary displacements in the vertical direction.

3. A blade support system as claimed in any one of claims 1 and 2, wherein the rotational means comprises a pair of transverse tilting plates located within the blade support system intermediate the blade support means and the blade, the first tilting plate being coupled through the blade support means to its forward end, and the second tilting plate being connected to the blade, said plates being joined through a rotational joint whereby the scraper blade is able to rotate about a horizontal axis generally aligned with the direction of travel of the vehicle, thereby permitting the outer ends of the scraper blade to effect complimentary displacements in the vertical direction, whereby the scraper blade may be pressed against a road surface for removing ice, snow and debris from the surface by pivoting about the rotational joint.

4. A blade support system as in claim 3, wherein one of the tilting plates carries a containment plate to contain the outer ends of the other tilting plate while permitting the transmission of an applied force from one plate to the other.

5. A blade support system according to any one of claims 1 to 4, in combination with a vehicle having a chassis and forward and rearward sets of wheels.

6. A blade support system as in claim 5, wherein said blade support means is provided with a lifting actuator coupled between the blade support means and the vehicle chassis and extending to the blade support means between its forward and rearward ends.

7. A blade support system as in claim 6, wherein the lifting actuator is an air bladder seated on its lower side on the chassis and having on its upper side a coupling link that extends down to the blade support means.

8. A blade support system as in claim 7 wherein the coupling link comprises a transverse bar and two descending chains.

9. An underbody scraper blade support system for a vehicle having a chassis and forward and rearward sets of wheels for traversing a road surface, said support system comprising:

(l) a pivot arm assembly for being mounted beneath the chassis of a vehicle, said pivot arm assembly including two pivot arms with forward and rearward ends located within the support system for coupling to the chassis of the vehicle towards the forward end of such chassis through pivots that allow each pivot arm to rotate independently about a respective pivot arm axis at its forward end that is generally aligned transversely to the direction of motion of the vehicle and;

(2) a scraper blade with two outer ends;

(3) a blade support frame carrying the scraper blade and, in turn, itself being carried by said pivot arm assembly, the blade support frame being located within the support system to position the scraper blade intermediate the forward and rearward sets of wheels on a vehicle with the scraper blade extending generally transversely with respect to said vehicle;

(4) rotational means within said blade support system located at the rearward ends of the pivot arms for positioning intermediate the locations of the forward and rearward sets of wheels on said vehicle to allow the outer ends of the scraper blade to effect respective displacements in a vertical direction;

(5) two pressure actuators carried by the blade support frame for being positioned between the blade support frame and the vehicle chassis, said respective pressure actuators being positioned at spaced locations on either side of the centerline of the vehicle to apply vertical pressure to the scraper blade, directing such blade to press against a road surface beneath the vehicle; and

(6) pressure actuator control means by which the pressure applied by the two pressure actuators can be controlled.

whereby the scraper blade may be pressed resiliently against the road surface.

10. A blade support system as in claim 9 wherein the rotational means comprises a rotational coupling positioned between the blade support frame and the pivot arm assembly whereby the scraper blade is able to rotate about a horizontal axis generally aligned with the direction of travel of the vehicle, thereby permitting the outer ends of the scraper blade to effect complimentary displacements in the vertical direction.

11. A blade support system as in claim 10 wherein the rotational means comprises a pair of transverse tilting plates located within the blade support system intermediate the pivot arm assembly and the blade, the first tilting plate being coupled to the rearward ends of the pivot arms and the second tilting plate being connected to the blade, said plates being joined through a rotational joint whereby the scraper blade is able to rotate about a horizontal axis generally aligned with the direction of travel of the vehicle, thereby permitting the outer ends of the scrapper blade to effect complimentary displacements in the vertical direction, whereby the scrapper blade may be pressed against a road surface for removing ice, snow and debris from the surface by pivoting about the rotational joint.

12. A blade support system as in claim 11 wherein one of the tilting plates carries a containment plate to contain the outer ends of the other tilting plate while permitting the transmission of an applied force from one plate to the other.

13. A blade support system as in any one of claims 9, 10, 11 or 12 in combination with a vehicle having a chassis and forward and rearward sets of wheels.

14. A blade support system as in claim 13 wherein said pivot arm assembly means is provided with a lifting actuator coupled between the pivot arm assembly and the vehicle chassis and extending to the pivot arms between their forward and rearward ends.

15. A blade support system as in claim 14 wherein the lifting actuator is an air bladder seated on its lower side on the chassis and having on its upper side a coupling link that extends down to the pivot arm assembly.

16. A blade support system as in claim 15, wherein the coupling link comprises a transverse bar and two descending chains that connect to the respective pivot arms.

17. A blade support system according to any one of claims 1 to 16, wherein the pressure actuator control means permits independent control of the pressure actuators, whereby different vertical forces may be applied to the respective outer ends of the scraper blade to individually cause the outer ends of the scraper blade to effect respective displacements in the vertical direction.

18. A blade support system as in claim 17, wherein the pressure actuator control means permits independent control of the pressure actuators, whereby different vertical forces may be applied to the blade to individually cause the outer ends of the scraper blade to apply respective pressures to the road surface.

19. A blade support system according to any one of claims 1 to 18, wherein the pressure actuators apply pressure resiliently in pressing the scraper blade against a road surface.

20. A blade support system according to any one of claims 1 to 19, wherein the pressure actuator are pneumatic bladders.

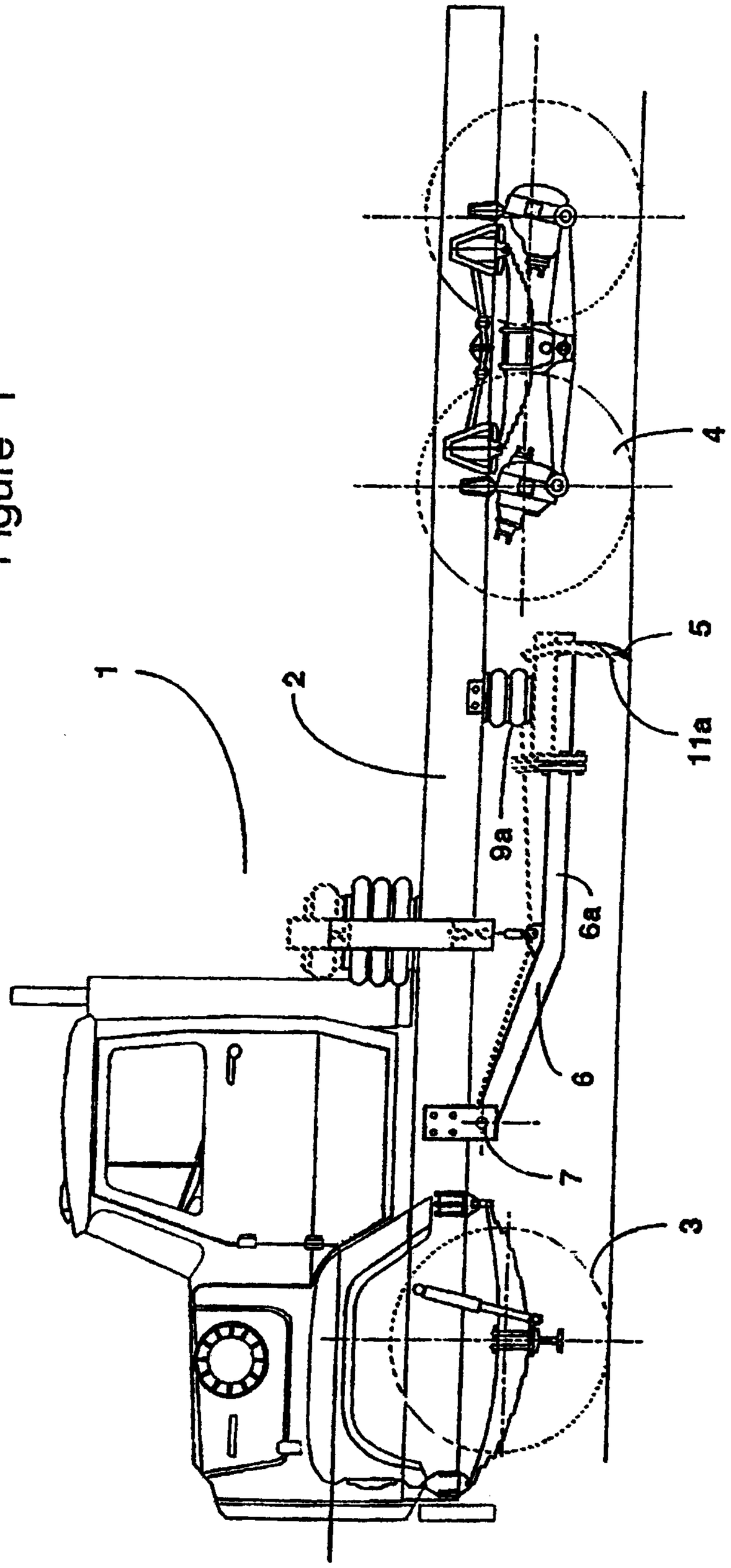


Figure 1

Figure 2

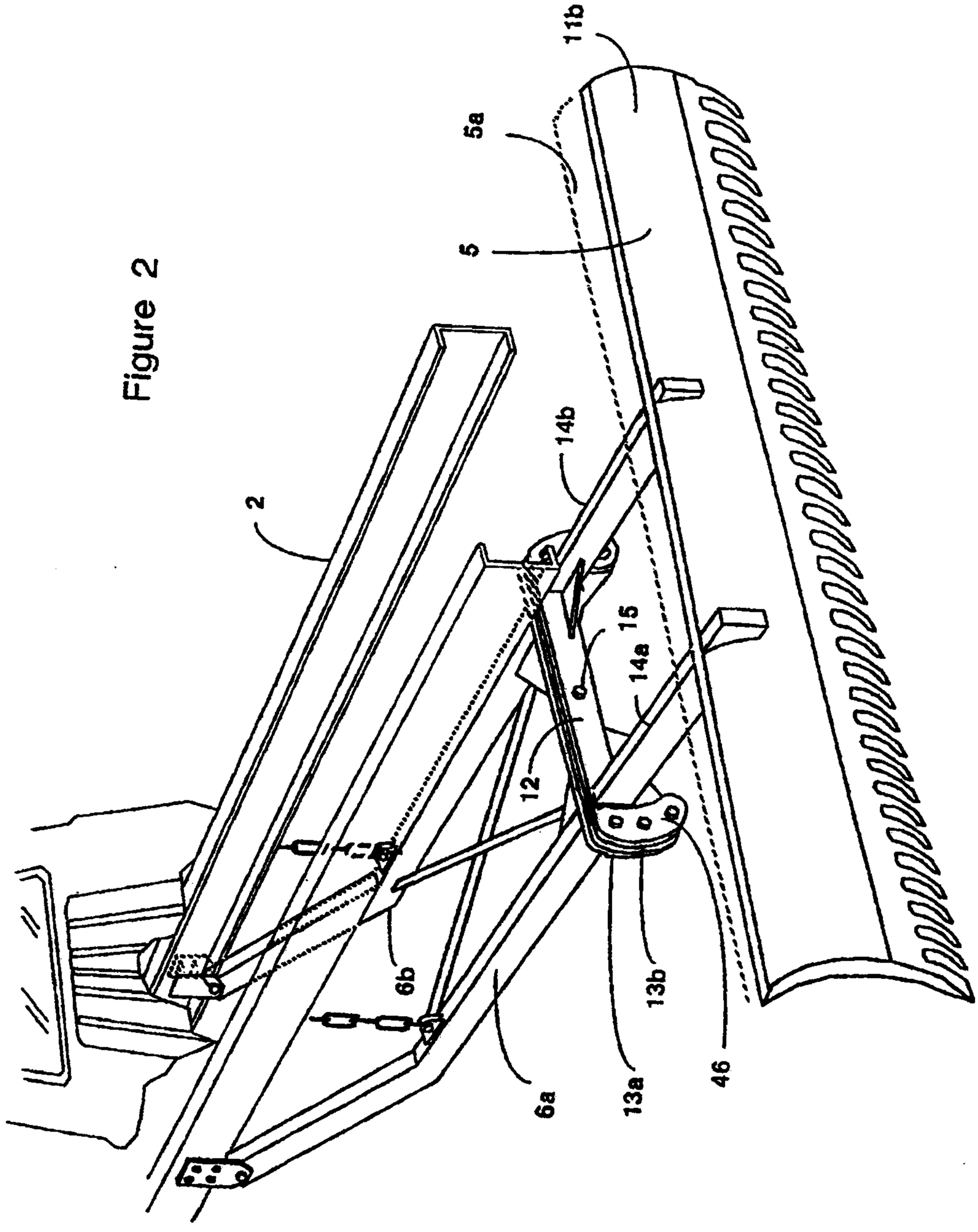
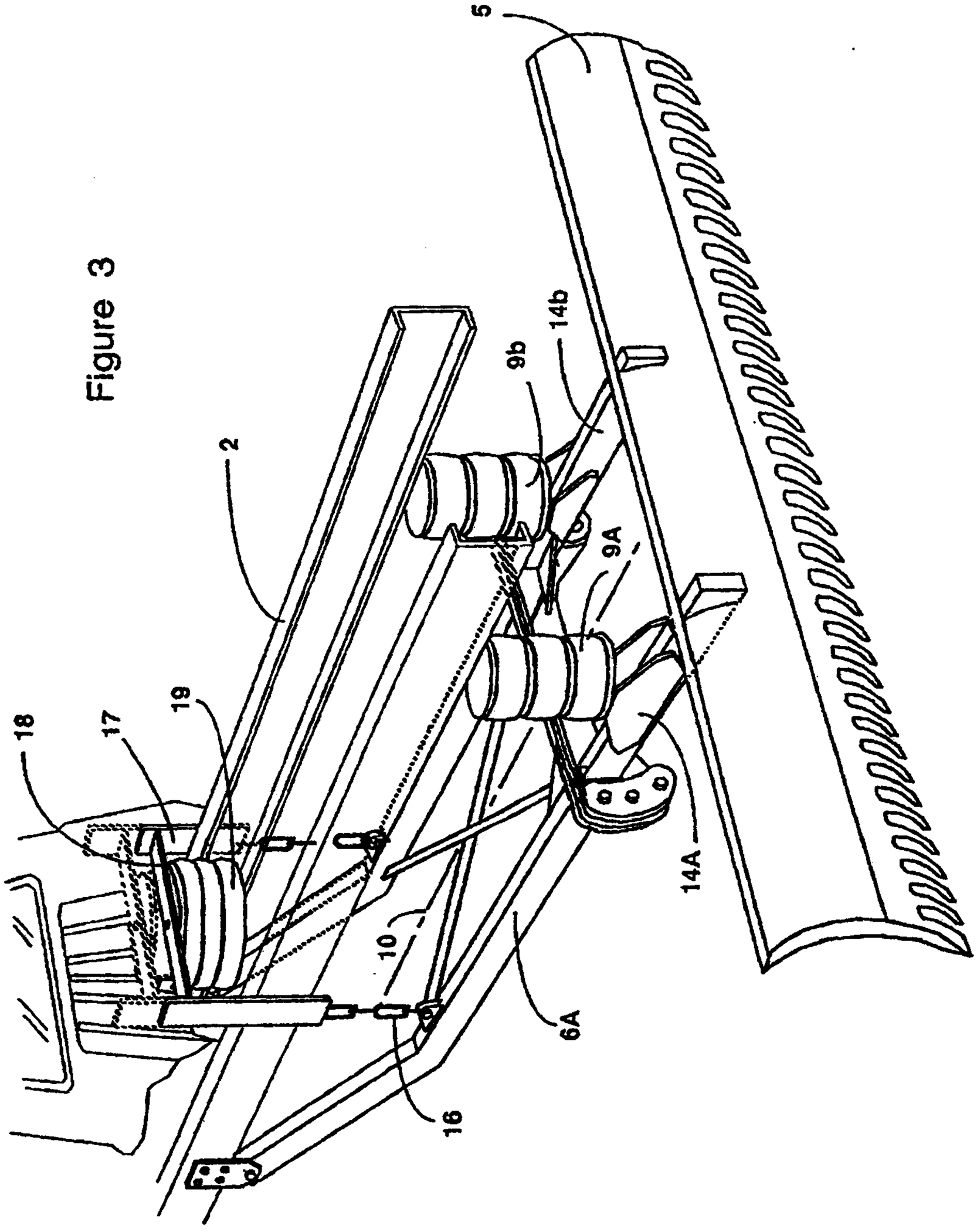


Figure 3



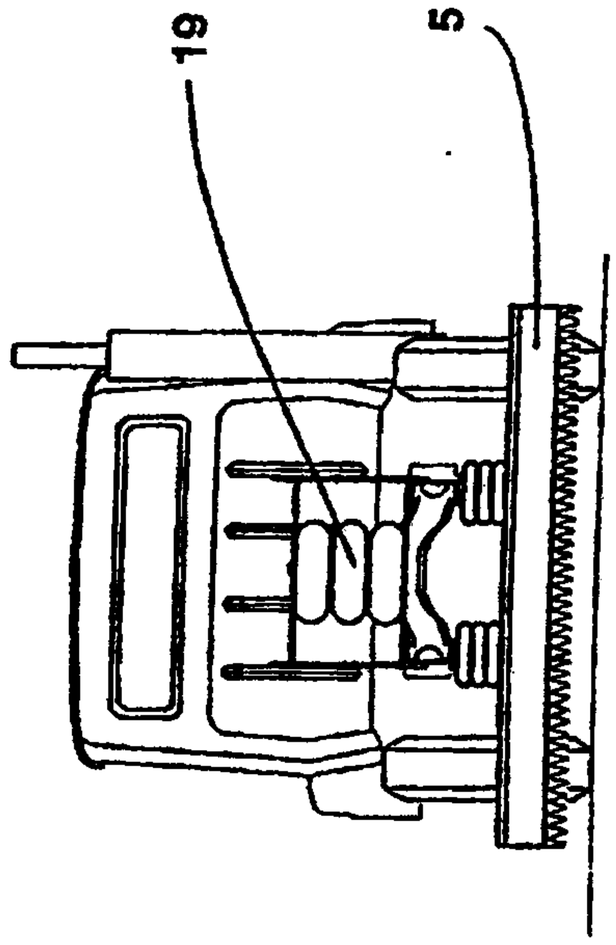


Figure 4a

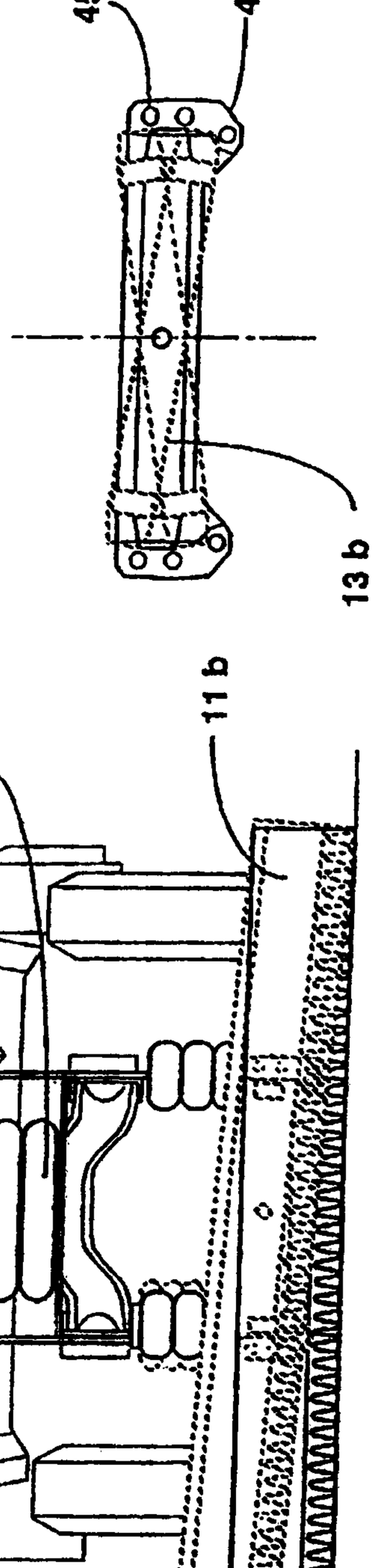


Figure 4b

Figure 4

Figure 5

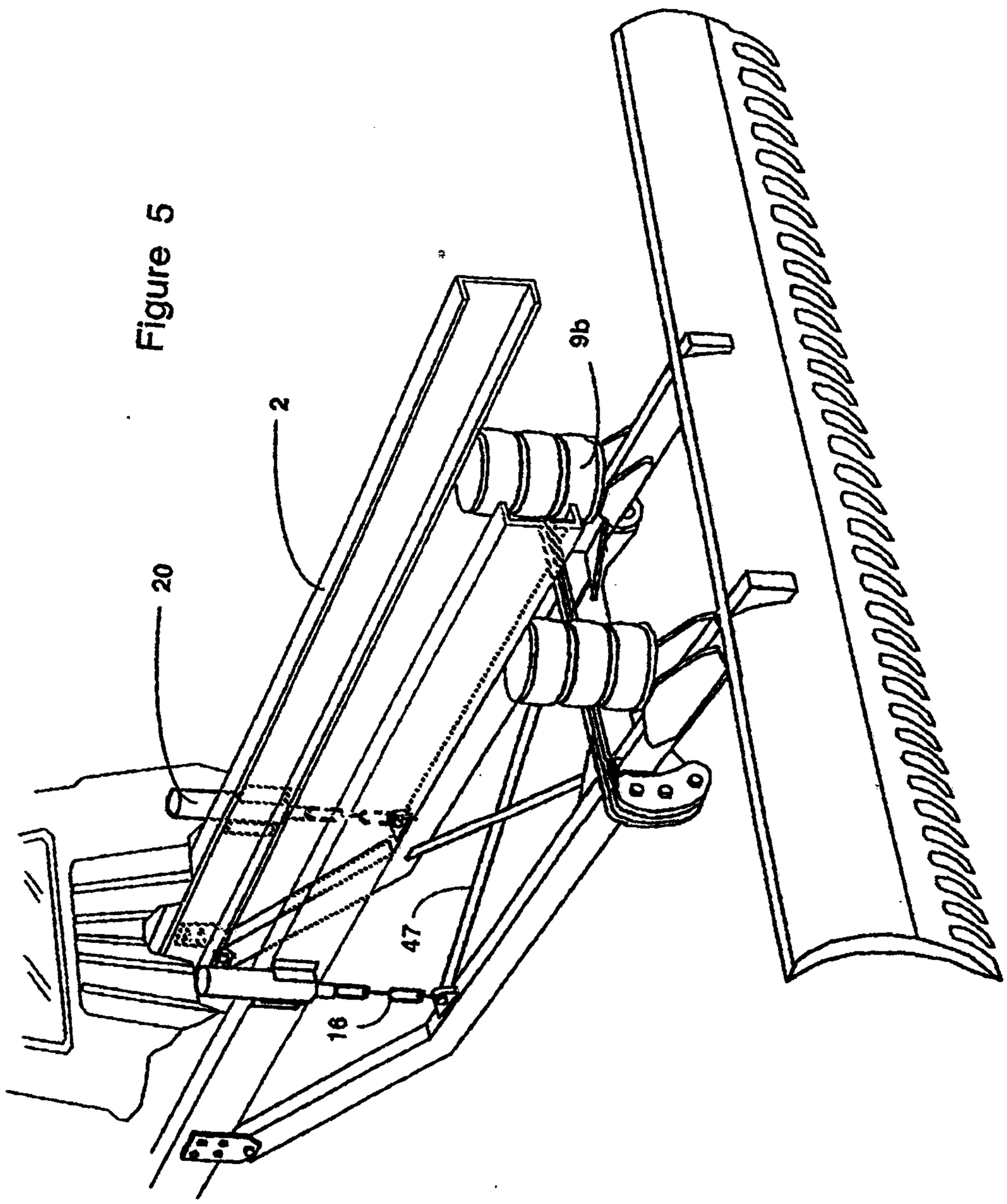
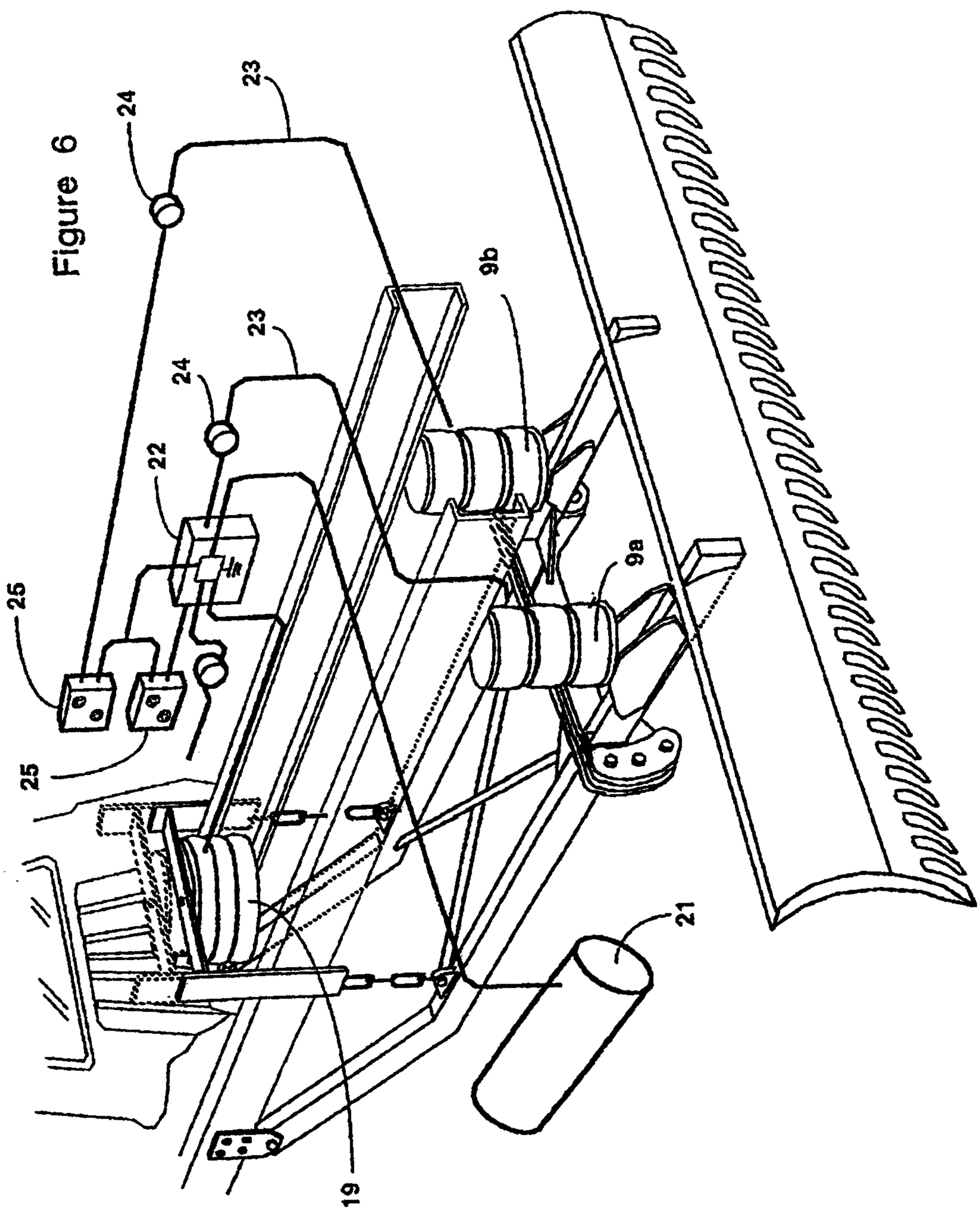
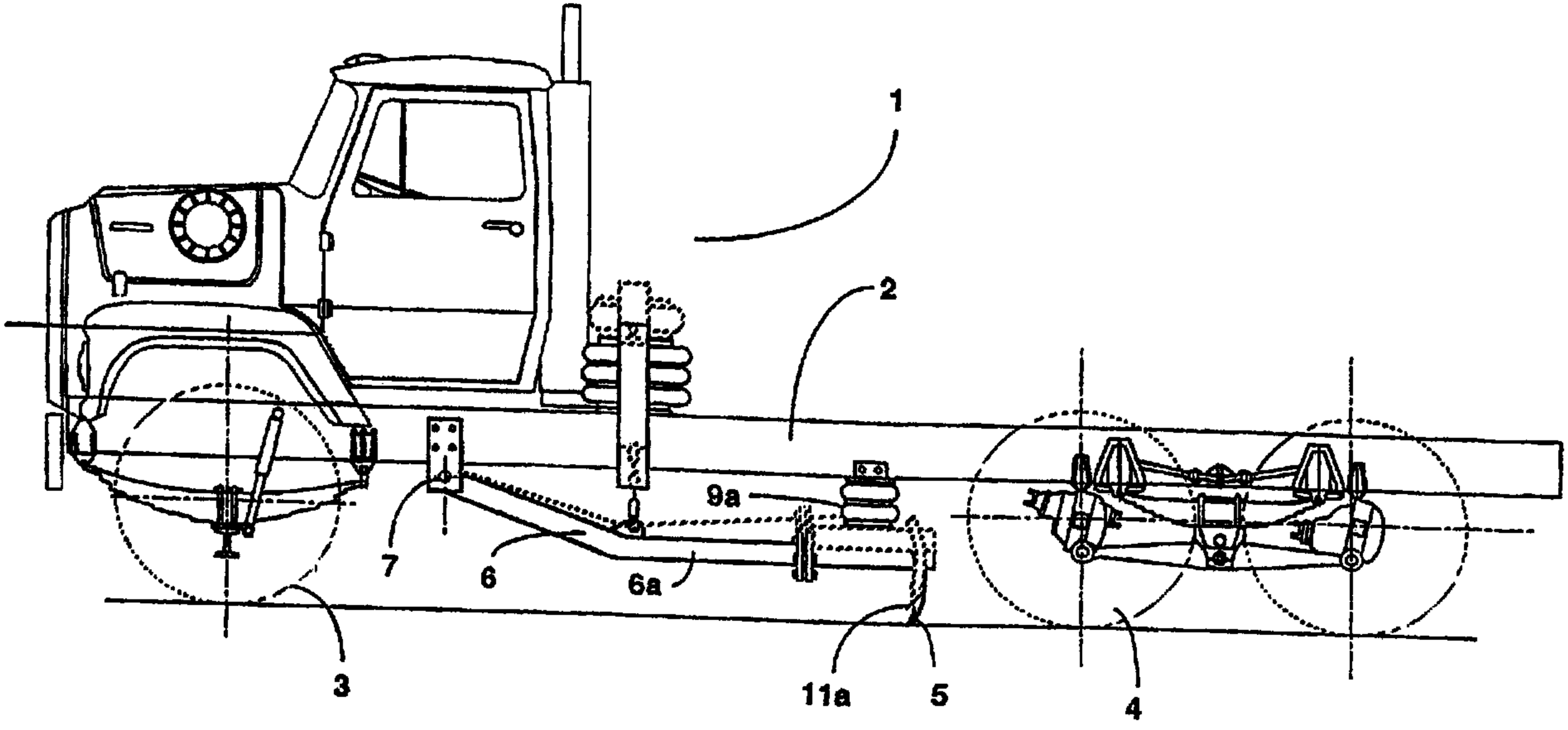


Figure 6

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