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(54) **Support frame of a road maintenance device**

(57) The invention provides a pivotable and liftable support frame for plough and vehicle, which main element is a bearing beam 2, which can be lifted up-down by lift cylinder 3 and turned to left-right by beam move cylinder 4. The frame of the construction acts as double parallelogram. Namely parallelogram acting in vertical plane is formed by bearing beam 2 and connecting element 5 in cooperation with the plough 1 and fixing mount

6 on the vehicle, parallelogram acting in horizontal plane is formed by bearing beam 2 and turn cylinder 7 in cooperation with the plough 1 and fixing mount 6 on the vehicle. Support frame according to the invention differs in that due to the use of connecting element 5 the support frame maintains feature of traditional "parallelogram" of the snow ploughs, which assures that the raised plough in transport position remains parallel to the ground.

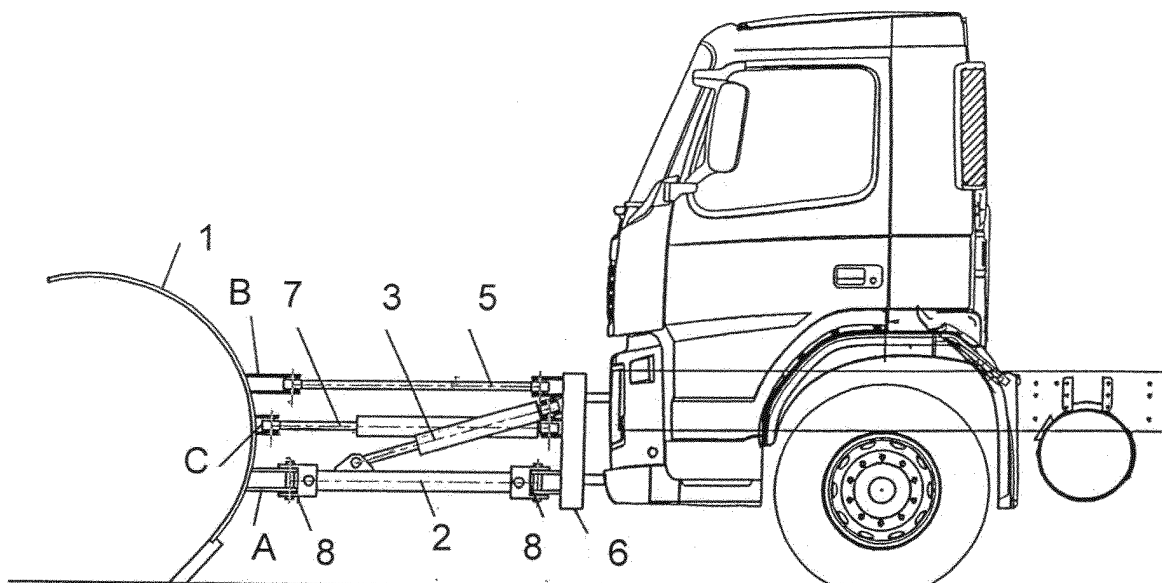


FIG 1

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Description

Field of the invention

[0001] The present invention relates to a support frame for road maintenance device used for mounting a road maintenance device such as a snowplough blade or a sweeper brush onto a road maintenance vehicle. The invention is related to a support frame for turning and lifting a plough, as well as shifting it to the left and right perpendicular to the road centre line. In addition, the invention provides the possibility of combining different blades (front- and side-mounted snowplough blades) in order to achieve a maximally wide footprint while ensuring that the blade is compact when lifted up in the transport position.

State of the art

[0002] Constructions of road maintenance machines, scrapers and snowploughs are known in the state of the art.

[0003] Different enterprises have developed ancillary devices for the lateral shifting of the snowplough blade. Such an ancillary device is generally a hydraulically shifted intermediate frame with control surfaces, which is added to a traditional lifting frame. The disadvantages of such a solution are the high production cost and the weightiness of the product.

[0004] AB Mähler & Söner has developed a novel solution in which the blade can be shifted, lifted and turned by the same telescopic lifting frame. This solution is considerably more compact and is presumed to have a lower production cost. However, one disadvantage of this solution is its limited movement kinematics - the range of turning the blade right and left is too small (only 25-30 degrees). Neither does this mechanism act as a parallelogram, i.e. when the blade is lifted the mechanism fails to keep the blade parallel to the ground. If the blade is not parallel to the ground, its lower edge may scrape the ground if the road is uneven. Another disadvantage is the use of telescopic tubes for turning the blade, since this is presumed to decrease the reliability of the device. Apart from that, this solution also makes turning the blade more inconvenient, since it is done by shifting the telescopic tubes in and out, and the blade has no specific turning axis. The distance between the plough and the vehicle is also too big, making it difficult to manoeuvre the vehicle. RU2198979 discloses a snowplough connected to a vehicle with an articulated parallelogram suspension attached to both the plough blade and the vehicle, and consisting of at least two frames. The rod of a hydraulic cylinder is connected to one of the suspension frames so that it can be articulated.

[0005] FR2750715 discloses a snowplough consisting of a blade attached to a housing that can be vertically adjusted by a driving mechanism.

[0006] DE19617480 discloses a snowplough consist-

ing of a blade attached to a frame, which in turn is attached to the vehicle. The frame support system includes two pneumatic cylinders, connected to the frame and the blade for turning the blade.

[0007] EP0587175 discloses a snowplough with a blade that can be adjusted to the left and to the right and which also includes an automatic device for monitoring and maintaining the position of the plough in relation to the vehicle's axis. The device includes connection rods that can be moved left and right in relation to the axis, and a lifting device. DE4205612 discloses a sweeping blade attached to the front of the vehicle by a rigid bracket with two turning rods at either end. This creates a rectangular frame that can be turned around its vertical axis using hydraulic pushers.

[0008] FR2639007 discloses a device for connecting a vehicle to a mechanism, in particular to a snowplough, consisting of a system of multiple frames attached to the vehicle with articulated couplings, with the frames in turn vertically connected to articulating couplings. The device is equipped with hydraulic or pneumatic jacks for turning the frames vertically, perpendicular to the operating direction, or in the operating direction. EP0467310 discloses a snowplough with a spring-actuated support that allows the plough to be moved laterally in relation to the vertical axis; the support is attached to the vehicle with a parallelogram intermediate part, while the support and the vehicle are also connected with a hydraulic lifting cylinder.

Summary of the invention

[0009] Increasingly higher demands are made on the movement and steering of a snowplough attached in front of a road maintenance vehicle. In addition to turning and lifting the plough, it is also necessary to shift the plough to the left and right perpendicular to the road centre line. This makes it possible to achieve a maximum footprint by combining different ploughs (front- and side-mounted ploughs), while ensuring the compact size of the plough in its transport position.

[0010] The present invention provides a novel support frame for ploughs, free from all the disadvantages known from the state of the art. The main element of the support frame is a support beam that can be moved up and down with a lifting cylinder (hereafter, a cylinder stands for a hydraulic or pneumatic cylinder or a cylinder using any other techniques known from the state of the art), and turned left and right with the beam turning cylinder. The elements of the support frame are located between the plough and the fixing base on the vehicle in a way forming a double parallelogram, both horizontal direction and vertical direction.

List of figures

[0011] A preferred embodiment of the invention is described by reference to the attached figures, where:

Fig. 1 presents a side view of a support frame of the present invention;

Fig. 2 presents a top-down view of a support frame of the present invention;

Fig. 3 presents a side view of an alternative embodiment of the support frame of the present invention;

Fig. 4 presents the view D of an alternative embodiment of the support frame of the present invention.

Example of an embodiment of the invention

[0012] In a preferred embodiment of the present invention, the plough 1 is connected to the vehicle by a frame (see Figures 1, 2), the main element of which is the support beam 2 that can be lifted up and down with the lifting cylinder 3 and shifted left and right with the shifting cylinder 4. Alternatively, the shifting cylinder can be replaced by a rigid connector (not displayed in the figure). The construction of the frame acts as a double parallelogram: on the vertical plane, a parallelogram is formed by the support beam 2 and the coupling 5 with the plough 1 and the fixing base on the vehicle 6; on the horizontal plane, the parallelogram is formed by the support beam 2 and the rotary cylinder 7 with the plough 1 and the fixing base on the vehicle 6. If the plough 1 is shifted left or right using the shifting cylinder 4, the rotary cylinder 7 acts as a link in the horizontal parallelogram and keeps the plough at approximately the same angle that the driver has turned it to, either to the right - in which case the rotary cylinder 7 is at its internal limit, or left - in which case the rotary cylinder 7 is at its external limit. In an alternative embodiment, the rotary cylinder 7 may be replaced by a rigid connector (not displayed in the figure). The support frame of the present invention is distinguished by the fact that thanks to the use of the coupling 5, the support frame retains the parallelogram shape traditional to snowploughs, ensuring that the plough remains parallel to the ground when lifted up in the transport position. Another distinguishing feature is that the rotary cylinder 7 also acts as a link in the parallelogram when the plough is shifted laterally using cylinder 4. In the preferred embodiment of the invention the coupling 5 and rotary cylinder 7 are provided with spherical (wide angle) plain-shaft bearings, which are connected with the plough 1 and the fixing base on the vehicle 6 by fingers. In an alternative embodiment of the invention the coupling 5 and rotary cylinder 7 are provided with Hooke's joints. Unlike in solutions known from the state of the art, turning the mouldboard of the plough is achieved by using the beam shifting cylinder 4. When shifting the plough left or right using the shifting cylinder 4, the beam shifting cylinder 4 also acts as a lever for the intersecting parallelogram, ensuring that the angle of the mouldboard in relation to the centre line of the road changes minimally when shifting the plough. Thus, unlike other solutions, the present solution acts as a double parallelogram: both vertically and horizontally.

[0013] To attach the mouldboard to the support frame

as efficiently as possible, only three movable joints are required (A, B, C), which is the minimum number of points for defining a geometric plane and which, therefore, ensures the simplicity of the technical solution.

[0014] So that the plough would not rotate around the axis of the support beam 2 when it is in the transport position, the support beam is equipped with Hooke's joints 8 at either end. In an alternative embodiment, the support beam may be connected to the plough and vehicle using bolted joints. At the same time, the support beam 2 acts as a torsion spring, enabling the plough to follow changes in the slope of the road (around the longitudinal axis). In a preferred embodiment of the invention, it is unnecessary to use ancillary parts (such as springs, elastic rubber or elastomer bushes, elastic cushions) to follow the slope of the road, as used in traditional support frames.

[0015] In an alternative embodiment of the present invention, the ancillary parts listed above can be added to the support frame to increase its elasticity. Fig. 3 displays an alternative embodiment of the support frame including an elastic element 9, which enables the plough to follow the slope of the road around its longitudinal axis to a greater degree. In case of this solution, the support beam 2 can be made significantly more rigid. Such an elastic element may be located on the Hooke's joints 8 at either end of the support beam, if necessary. In an alternative embodiment, the coupling 5 includes a hydraulic/pneumatic cylinder (not shown in the figure) with which to change the length of the connector. Unlike in the solution known from the state of the art, the plough is not shifted left and right symmetrically in the solution of the present invention. In a preferred embodiment of the invention, the plough can be shifted left along the operating direction further than to the right, which is also what is actually required when working with a plough. The extent of how far the plough can be shifted depends on the size of specific details and can vary in different models. Symmetrical shifting both to the left and to the right can be achieved if necessary.

Claims

1. A support frame for a plough which is used for attaching the plough to a vehicle, where the elements of the frame include articulated intermediate parts and hydraulic/pneumatic lifting rotary cylinders, **characterised in that** the elements of the support frame are located between the plough (1) and the fixing base on the vehicle (6) on the vertical plane in such a way that they form a vertical parallelogram, and between the plough (1) and the fixing base on the vehicle (6) on the horizontal plane in such a way that they form a horizontal parallelogram, where the parallelogram-shaped support frame is adapted for shifting the plough (1) laterally and/or for rotating it, and for adjusting the pressure applied to the surface

being worked on, and where an element of the support frame located on principally the same horizontal plane as the support beam (2) is attached to the fixing base (6), with its other end attached to the support beam (2) between the two ends of the beam (2).

2. A support frame according to claim 1, **characterised in that** the links of the vertical parallelogram comprise the support beam (2) equipped with a lifting device, and the coupling (5). 5
3. A support frame according to claims 1 and 2, **characterised in that** the lifting device is a hydraulic/pneumatic lifting cylinder (3). 10
4. A support frame according to claim 1, **characterised in that** the links of the horizontal parallelogram comprise the support beam (2) equipped with a lifting device, and another coupling. 15
5. A support frame according to any of the previous claims, **characterised in that** the support beam (2) is connected to the plough (1) and the fixing base on the vehicle (6) using Hooke's joints. 20
6. A support frame according to any of the previous claims, **characterised in that** at least one of the Hooke's joints on the support beam (2) includes an elastic element (9). 25
7. A support frame according to claim 1, **characterised in that** the support beam (2) is connected to the plough (1) and the fixing base on the vehicle (6) by bolted joints. 30
8. A support frame according to claim 1, **characterised in that** the support beam (2) is connected to the plough (1) and the fixing base on the vehicle (6) by spherical plain bearings, equipped with fingers. 35
9. A support frame according to claim 2, **characterised in that** the coupling (5) comprises a hydraulic/pneumatic cylinder for changing the length of the coupling (5). 40
10. A support frame according to claim 1, **characterised in that** the other link forming the horizontal parallelogram is a rotary cylinder (7). 45
11. A support frame according to any of the previous claims, **characterised in that** the coupling (5) and rotary cylinder (7) are equipped with spherical plain-shaft bearings, which are connected with the plough (1) and the fixing base on the vehicle (6) by fingers. 50
12. A support frame according to any of the previous claims, **characterised in that** the coupling (5) and rotary cylinder (7) are equipped with Hooke's joints, 55

which are connected with the plough (1) and the fixing base on the vehicle (6).

13. A support frame according to claim 1, **characterised in that** one element of the support frame located on principally the same horizontal plane as the support beam (2) is a rigid connector.
14. A support frame according to claim 1, **characterised in that** the element of the support frame located on principally the same horizontal plane as the support beam (2) is a shifting cylinder (4).

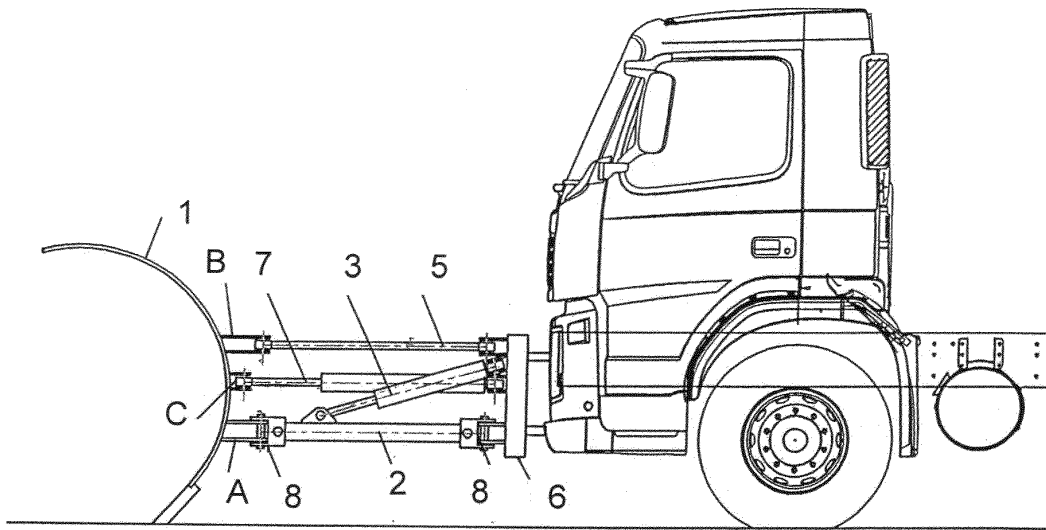


FIG 1

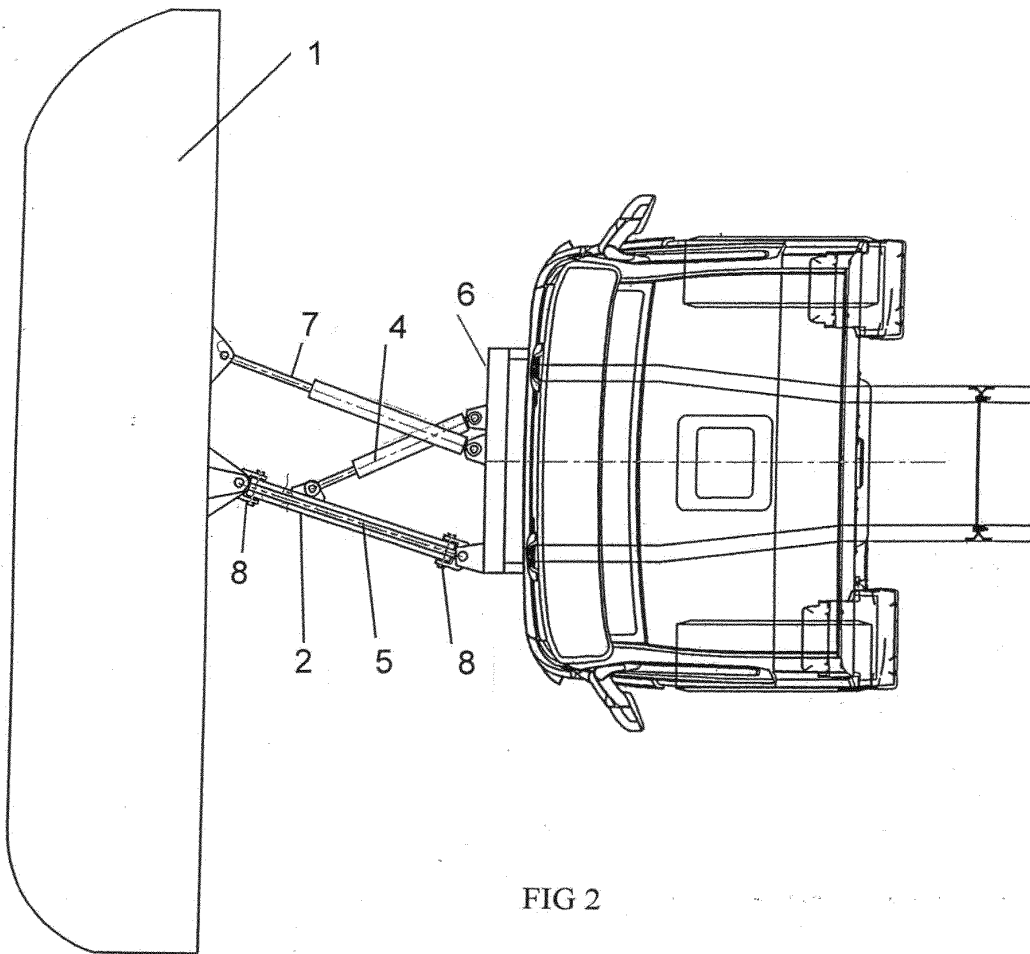


FIG 2

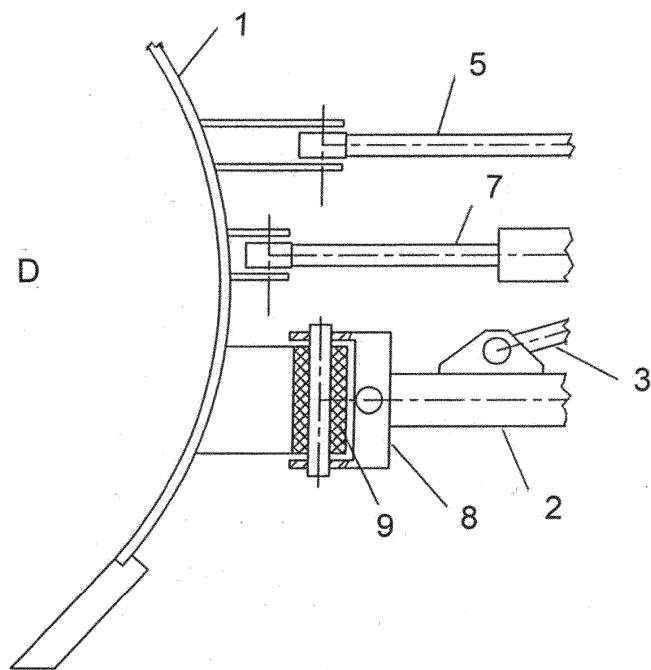
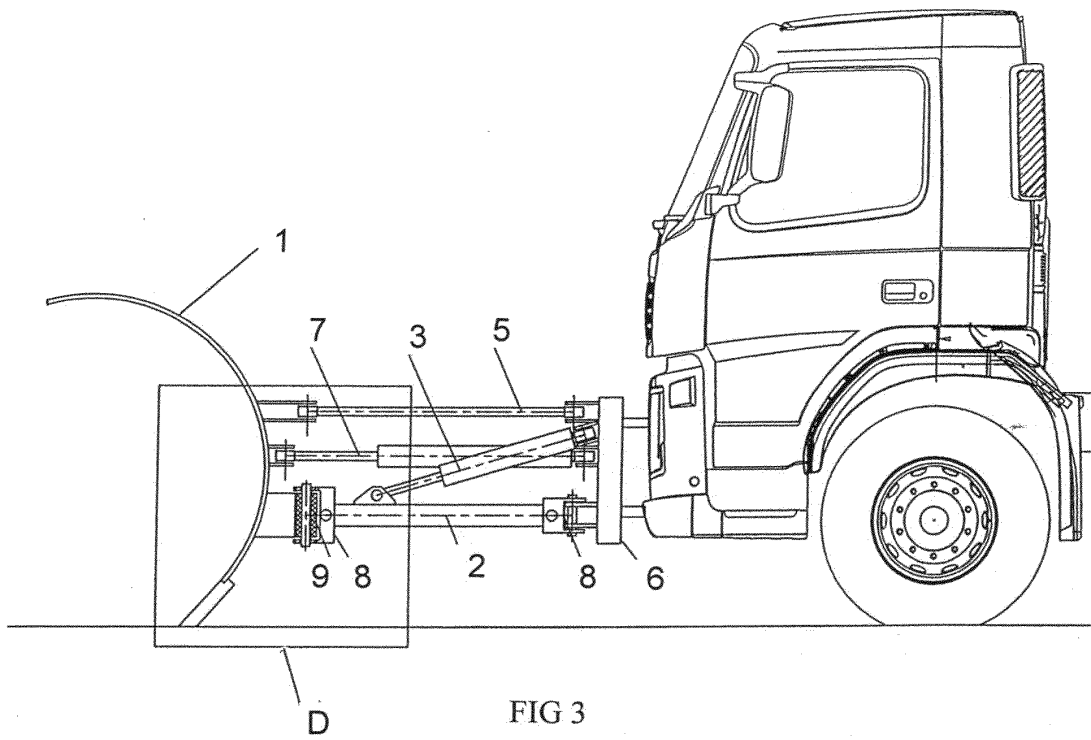


FIG 4

REFERENCES CITED IN THE DESCRIPTION

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