

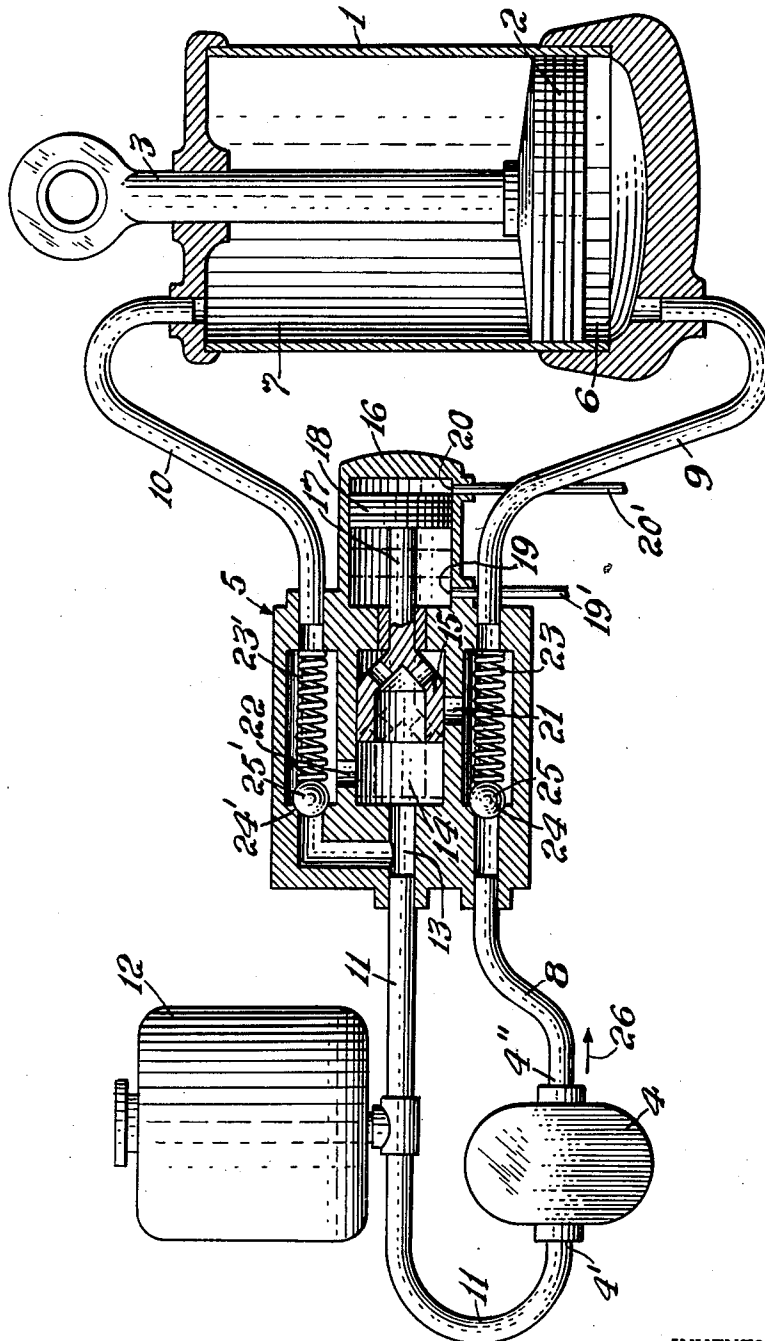
Jan. 26, 1960

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2,922,401

HYDRAULIC LIFTING DEVICE FOR TIPPING VEHICLES

Filed May 2, 1958



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Application May 2, 1958, Serial No. 732,646

Claims priority, application Czechoslovakia May 3, 1957

4 Claims. (Cl. 121—46)

The invention relates to a hydraulic lifting device for tipping vehicles.

In conventional hydraulic lifting devices for tipping vehicles, independently operated securing means comprising additional lever systems or the like are necessary so that the loading surface, which is constructed for example as a loading bridge, may in its lowered normal position be secured against vibrations occurring during travel. When the fully raised position is reached on the tipping of the loading bridge, a mechanical action of some part of the lifting device usually operates a change-over valve through which the pressure medium can flow out of the lifting chamber of the pressure cylinder into the pressure medium tank. Although the swinging back of the loading bridge is also rendered possible by these conventional valves, they cannot counteract renewed tipping of the loading bridge—due perhaps to the load slipping down on one side. It is therefore customary to use ropes, rubber or other elastic stops to secure the loading bridge against a maximum tipping angle being exceeded.

Apart from the fact that the additional provision of securing means, stops, ropes or the like and, in addition, lever systems, entails undesirable expenditure, as also does the required additional maintenance of said parts, practice shows that correct operation of the additional securing means is easily neglected, especially when the driver has to leave the vehicle for this purpose. Consequently, conventional tipping vehicles frequently travel with the loading bridge unsecured, so that at relatively high speeds and, in particular, on uneven roads or off the road the loading bridge is subjected to vibrations which compel the driver of the vehicle to reduce speed and which, in addition, result in greatly increased wear of the bearing parts of the loading bridge.

It is an object of the invention to obviate the aforesaid disadvantages and above all to effect the desired securing of the loading bridge automatically with simple means.

To this end, according to the invention, a hydraulic lifting device for tipping vehicles comprises a source of pressure medium, pressure cylinder means having a lowering chamber and a lifting chamber separated by piston means movable within said cylinder means, connection means for connecting said piston means with a part to be tipped, a suction pipe line connecting said lowering chamber with the suction side of said source of pressure medium, a pressure pipe line connecting said lifting chamber with the pressure side of said source of pressure, and a regulating member connected in the pipe lines between said cylinder means and said source of pressure medium, said regulating member comprising a control cylinder, which is in constant communication with said suction pipe line and which has in one end portion thereof, a transverse aperture communicating with said suction pipe line and, in the other end portion thereof, a transverse aperture communicating with said pressure pipe line, an axially bored slide member arranged for longitudinal movement in said control cylinder, and a

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non-return valve mounted in each pipe line between the respective transverse aperture and the source of pressure medium, the dimensions of said slide member and the positions of said transverse apertures being such that one of said apertures is closed at each end position of said slide member.

If the loading bridge of a tipping vehicle provided with the lifting device according to the invention is in its fully lowered position, inadvertent lifting of the loading bridge from the vehicle frame is impossible while the lifting device is set for lowering the bridge because the pressure medium situated in the lowering chamber of the pressure cylinder is dependably prevented from flowing out. Thus any further securing of the lowered loaded bridge on the vehicle frame is unnecessary. Since the aforesaid securing also automatically gives the lowering adjustment of the regulating member, there is no danger of any disadvantages resulting, for example, from neglecting to carry out certain operations. If the loading bridge is to be swung back again from its inclined position after the beginning of unloading, renewed tipping, which could occur in conventional equipment of this type when the center of gravity of a slipping load shifts, is impossible with the device of the invention because the piston of the pressure cylinder is prevented by the pressure medium in any outward movement from the pressure cylinder—as in the case of the completely lowered loading bridge. Thus no special securing means such as stops, ropes or the like are necessary.

According to a feature of the invention, operation of the slide is effected by means of a piston rod which projects through the control cylinder into an operating cylinder and which has a piston slidable in the operating cylinder under the action of a pressure medium admitted and released through apertures situated at the ends of the operating cylinder, the pressure medium, preferably being compressed air. In each case therefore only two different lever positions of a lever operating the control slide either indirectly through the further pressure medium or directly are required to tilt, lower and secure the loading bridge in any tilted position and also in the fully lowered position.

The invention is illustrated by way of example with reference to the drawing which shows a lifting device according to the invention, partially in section.

The hydraulic lifting device illustrated comprises essentially a pressure oil cylinder 1 with a slidable piston 2, the piston rod 3 of which is coupled to a loading bridge (not shown) of a tipping vehicle, an oil pump 4, constructed for example as a gear pump, and a system consisting of the lines 8, 9, 10, 11, connecting the oil pump 4 through a regulating member 5 both to the lifting chamber 6 and to the lowering chamber 7 of the pressure cylinder 1. A conventional oil tank 12 may also be connected to the line 11 leading to the suction branch 4' of the oil pump 4.

The regulating member 5 comprises a control cylinder 14, one end of which is in constant communication with the line 11 through an aperture 13 and in which an axially bored slide 15 is longitudinally slidable. Said slide 15 is situated at the free end of a piston rod 17, which at the end of the control cylinder 15 remote from outlet aperture 13 projects out of said control cylinder into an adjacent operating cylinder 16 and is connected to a piston 18 slidable in the operating cylinder 16. Apertures 19 and 20 situated one at each end of the operating cylinder 16 serve for the supply and discharge of compressed air through corresponding lines 19', 20', whereby the slide 15 can be moved to and fro between its two end positions indirectly through any known compressed air control valve (not shown).

In the region of one of its ends the control cylinder 14

communicates through a transverse aperture 21 with the line 8, 9 leading from the pressure branch 4' of the oil pump 4 to the lifting chamber 6 of the pressure cylinder 1, while in the region of its other end the control cylinder 14 communicates through a transverse aperture 22 with the line 10, 11 leading from the lowering chamber 7 to the suction branch 4' of the oil pump 4. The dimensions of the slide 15 and the arrangement of the transverse apertures 21, 22 are in such relation to one another that the slide 15 in each end position covers only one transverse aperture 21 or 22 respectively.

At each of the points of connection of the transverse apertures 21, 22 to the lines 8 and 11 respectively leading to the oil pump there is further disposed in the regulating member 5 a non-return valve which closes towards the oil pump 4 and consists of a ball 25 and 25' respectively pressed by a spring 23 and 23' against a valve seat 24 and 24' respectively.

The lifting device described operates in the following way:

If the piston 18 is brought into the (right-hand) end position shown in the drawing by appropriate supply of compressed air through the line 19' and simultaneous venting of the operating cylinder 16 through the line 20', the transverse aperture 21 of the control cylinder 14 is shut off by the slide 15 while the transverse aperture 22 establishes a connection from the line 10, leading from the lowering chamber 7 of the pressure cylinder 1, to the suction line 11, connected to the suction branch 4' of the oil pump 4. If, in this position of the slide, the oil pump is put into operation, pressure oil is delivered in the direction of the arrow 26 through the lines 8 and 9 into the lifting chamber 6 of the pressure cylinder 1, while the oil situated in the lowering chamber 7 of the pressure cylinder 1 can pass through the line 10, the transverse aperture 22, the control cylinder 14, the outlet aperture 13 and the suction line 11 to the suction branch of the oil pump 4. The piston 2 thus rises and by way of the piston rod 3 causes the loading bridge (not shown) to tip. As long as no change-over occurs in the compressed air control of the piston 18, the piston 2 is pushed upward by the oil pressure until it is finally pressed tightly against the upper end of the pressure cylinder 1.

If the loading bridge is to be held in a position intermediate its fully raised and fully lowered positions, it is only necessary to put the oil pump 4 out of operation. In these circumstances inadvertent lowering of the loading bridge is impossible because the non-return valve 24, 25 prevents the oil from flowing back to the stopped oil pump 4. At the moment of the change-over of the supply of compressed air to the operating piston 18, which change-over may also take place before the loading bridge is situated in its fully raised position, the slide 15 is moved into its other end position (shown by broken lines in the drawing), in which position it closes the transverse aperture 22. In this position of the slide, the pressure line 8 and also the line 9 communicating with the lifting chamber 6 are connected to the suction line 11 through the transverse aperture 21, the control cylinder 14 and the outlet aperture 13, while said suction line 11 also communicates with the line 10 in the direction towards the lowering chamber 7 through the non-return valve 24', 25'. In these circumstances, when the oil pump 4 is running, the oil can pass in short-circuit through the regulating member 5 back to the suction branch of the oil pump. Thus the oil present in the lifting chamber 6 can flow towards the suction line 11, and oil can pass from this suction line 11 through the non-return valve 24', 25' and the line 10 into the lowering chamber 7. If renewed tipping of the loading bridge should be caused during such lowering of the loading bridge owing to the shifting of the centre of gravity of the load slipping down from the loading bridge, then in such a case any rocking of the loading bridge would be impossible because the oil present in the lowering chamber 7 cannot flow back

towards the regulating member 5 when the slide is in the last mentioned position. While the slide 15 prevents a return flow to the control cylinder 14, the non-return valve 24', 25' prevents a return flow to the suction line 11. The loading bridge is thus secured from inadvertent sudden rocking and no special holding or supporting devices are required for the loading bridge.

When the loading bridge has arrived in its fully lowered position with the slide in the last mentioned position, the said securing remains operative in this end position as well, so that any additional securing of the loading bridge from inadvertently lifting off the vehicle frame of the tipping vehicle, as might occur for example owing to vibration during travel, is unnecessary.

It will be obvious that many changes can be made to the above described device within the scope of the invention as defined in the appended claims.

We claim:

1. A hydraulic lifting device for tipping vehicles, comprising a source of pressure medium having a suction side and a pressure side; pressure cylinder means; piston means movable in said cylinder means and defining a lowering chamber and a lifting chamber therein; connection means for connecting said piston means with a part to be tipped; a first conduit connecting said lowering chamber with said suction side of said source of pressure medium; a second conduit connecting said lifting chamber with said pressure side of said source of pressure medium; a first and a second non-return valve arranged in said first and said second conduits respectively intermediate said chambers and said source of pressure medium for selectively preventing flow of pressure medium from said chambers toward said source; control valve means having an opening permanently communicating with said first conduit intermediate said first non-return valve and said suction side, said control valve means being formed with two apertures respectively communicating with portions of said first and said second conduit intermediate the respective non-return valve and chamber; a control member movable in said control valve means between two positions for alternately connecting one and the other one of said apertures with said opening in said control valve means; and means for actuating movement of said control member between said two positions thereof.

2. A hydraulic lifting device for tipping vehicles, comprising a source of pressure medium having a suction side and a pressure side; pressure cylinder means; piston means movable in said cylinder means and defining a lowering chamber and a lifting chamber therein; connection means for connecting said piston means with a part to be tipped; a first conduit connecting said lowering chamber with said suction side of said source of pressure medium; a second conduit connecting said lifting chamber with said pressure side of said source of pressure medium; a first and a second non-return valve arranged in said first and said second conduits respectively intermediate said chambers and said source of pressure medium for selectively preventing flow of pressure medium from said chambers toward said source; control valve means having an opening permanently communicating with said first conduit intermediate said first non-return valve and said suction side, said control valve means being formed with two apertures respectively communicating with portions of said first and said second conduit intermediate the respective non-return valve and chamber, said non-return valves and said control valve means jointly forming a unitary control structure; a control member movable in said control valve means between two positions for alternately connecting one and the other one of said apertures with said opening in said control valve means; and pressure fluid operated means for actuating movement of said control member between said two positions thereof.

3. A hydraulic lifting device for tipping vehicles, com-

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prising a source of pressure medium having a suction side and a pressure side; pressure cylinder means; piston means movable in said cylinder means and defining a lowering chamber and a lifting chamber therein; connection means for connecting said piston means with a part to be tipped; a first conduit connecting said lowering chamber with said suction side of said source of pressure medium; a second conduit connecting said lifting chamber with said pressure side of said source of pressure medium; a first and a second non-return valve arranged in said first and said second conduits respectively intermediate said chambers and said source of pressure medium for selectively preventing flow of pressure medium from said chambers toward said source; a control cylinder having an opening permanently communicating with said first conduit intermediate said first non-return valve and said suction side, said control cylinder being formed

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with two axially spaced transverse apertures respectively communicating with portions of said first and said second conduit intermediate the respective non-return valve and chamber, said non-return valves and said control cylinder jointly forming a unitary control structure; control piston means formed with an axial bore and axially movable in said control cylinder between two positions for alternately connecting one and the other one of said apertures with said opening in said control cylinder; and pressure fluid operated means for actuating movement of said control piston means between said two positions thereof.

4. A hydraulic lifting device as claimed in claim 2, wherein said pressure fluid is compressed air.

No references cited.