

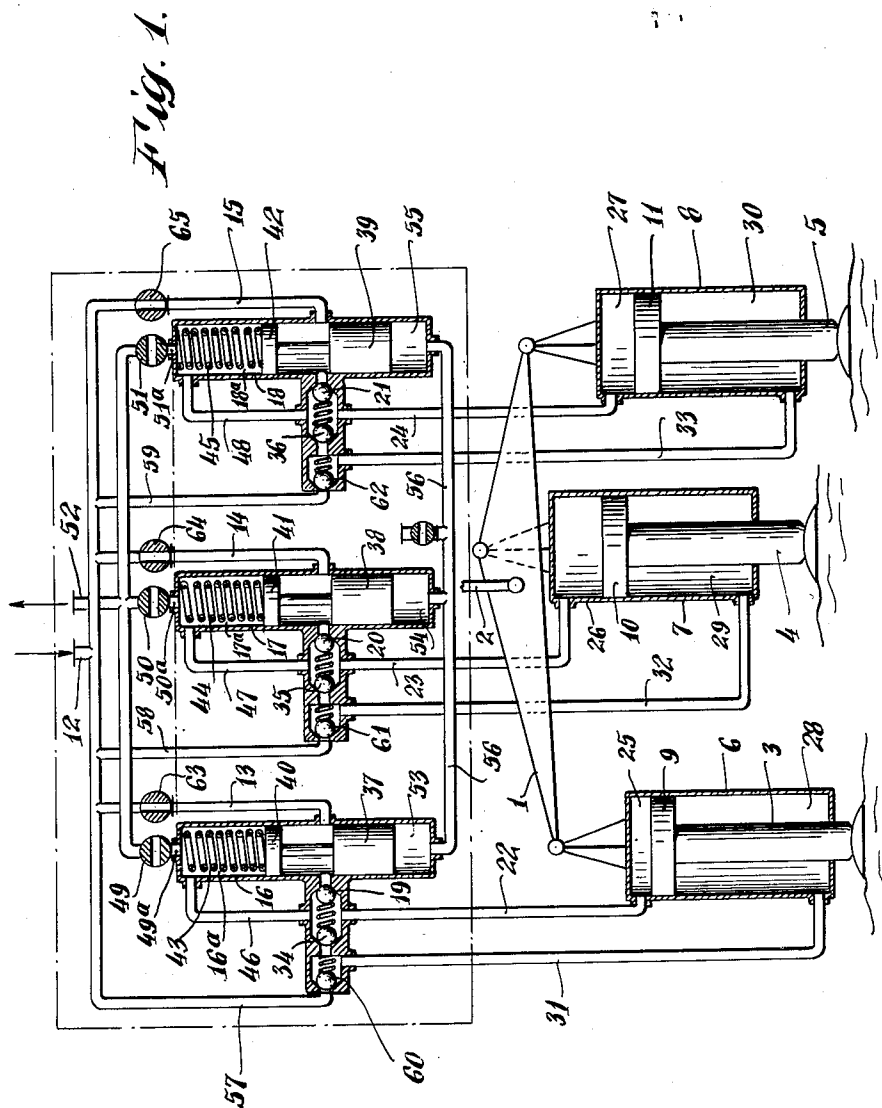
June 6, 1950

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 DEVICE FOR DISTRIBUTING PRESSURE LIQUID OVER
 A PLURALITY OF SUPPORTING POSTS

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2 Sheets-Sheet 1



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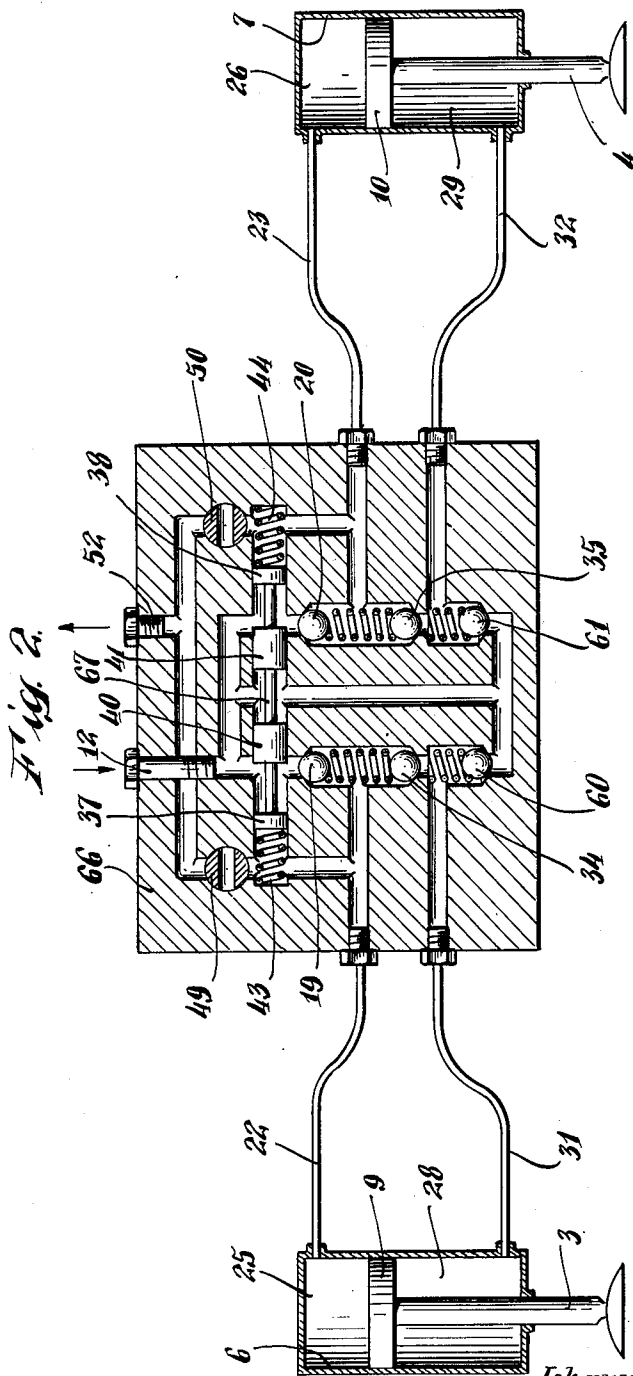
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UNITED STATES PATENT OFFICE

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DEVICE FOR DISTRIBUTING PRESSURE LIQUID OVER A PLURALITY OF SUPPORTING POSTS

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This invention relates to a device for distributing pressure liquid over a plurality of supporting posts attached to a body, for instance a vehicle provided with a crane, a ladder, a search light or the like, said posts being adapted to be projected by hydraulic means. It has for its object to control, through said device, the projection of the supporting posts during the positioning of said body in such a manner that the latter, irrespective of the levels of the bases to be engaged by said posts, automatically assumes a position wherein its center of gravity, if there are two posts, is situated in a predetermined vertical plane, say the vertical plane centrally between said posts, or if there are three or more posts, is situated in a predetermined vertical line relative to the posts. For example, when the vehicle serves to support a ladder adapted to be telescoped in the longitudinal central plane of the vehicle, it is essential for said plane to be truly vertical prior to the ladder being telescoped, as otherwise the vehicle might tilt. If the vehicle is provided with a slewing crane, it is necessary for the slewing axis to be accurately vertical in order that the load, irrespective of the condition of the surface of the road, can be slewed with a minimum of energy and without a tendency to slew back.

With this object in view, the invention consists in the provision of a liquid distributing device responsive to the pressures exerted by the weight of the body on the liquid in the cylinders of the supporting posts. To this end, the pressure liquid supply pipe of each of the said cylinders is provided with a stop valve and with a non-return valve. By means of said stop valves the distribution of the liquid supply is controlled during the positioning of the vehicle, i. e. during the projection of the supporting posts after these have engaged the ground. The non-return valves prevent the body from descending, i. e. from urging the posts inward by its gravity. In order that the distribution of the liquid may be controlled automatically, the stop valves may be coupled with one another in such a manner as to be adapted to be fully opened all together so that when one valve is moved in opening direction, at least one of the other valves are moved in closing direction. Furthermore, the position of each of said stop valves is additionally controlled by the pressure in the corresponding supporting post, in such manner that increase of said pressure tends to further, or to again, open the stop valve. The result of this arrangement and operation of the stop valves is that, when the

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body assumes an inclined position, so that the distributions of its weight over the posts differs from that in the desired position, pressure fluid is supplied only to the cylinders of these posts, which are to be projected further to bring the body into the desired position. If supporting posts and a distributing device according to this invention are provided to a road vehicle, then during the positioning of the vehicle the posts will automatically be projected in such manner that, irrespective of the curvature and the unevennesses of the road surface, the vehicle will assume a horizontal position.

In accordance with the invention, each stop valve may be loaded by a spring tending to open it, the result being that the said valves are prevented from lingering in a closed position when the supporting posts are projected in unloaded condition. If the said springs are adjustable, the distribution of the weight over the posts can be varied by modifying the initial tension of the springs.

A distributing device comprising two supporting posts may advantageously be provided with oppositely disposed stop valves interconnected by a rod. If two or more stop valves have to be coupled, a hydraulic coupling may be used, the coupling consisting of interconnected cylinders and pistons movable in the cylinders and rigidly connected to or themselves constituting the stop valves. In that case, the interconnected cylinder spaces have to be completely filled with liquid.

In order that the invention may be more fully understood, reference is made to the accompanying diagrammatic drawing in which Figs. 1 and 2 illustrate two embodiments thereof with three and with two supporting posts, respectively.

In Fig. 1, the numeral 1 designates the base, shown in perspective view, of a body such as a slewing crane, whose center of gravity is located somewhere in the line 2 drawn at right angles to said base.

The line 2 is, for instance, the slewing axis of the crane, and the same should be accurately vertical prior to the crane being used. To this end, the base 1 is supported by three posts 3, 4 and 5, which are adapted to be hydraulically projected and each provided with a cylinder 6, 7 and 8, respectively, working in which is a piston 9, 10 and 11, respectively. With a view to projecting said posts, pressure liquid from a main 12 can be supplied, through pipes 13, 14, 15, respectively, stop valves 16, 17, 18, respectively, non-return valves 19, 20, 21, respectively; and pipes 22, 23, 24, respectively, to the cylinder spaces 25,

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26, 27, respectively, above the piston of the corresponding supporting post. The liquid in the cylinder space below the piston of each supporting post is capable, during the projection of the post, to flow to the cylinder space above the piston, through pipes 31, 32, 33, respectively, and non-return valves 34, 35, 36, respectively.

The stop valves 16, 17, 18 are provided with piston valves 37, 38, 39, respectively, secured to actuating pistons 40, 41, 42, respectively. These pistons are loaded by springs 43, 44, 45, respectively. The spaces above said pistons communicate, through pipes 46, 47, 48, respectively, with the pipes 22, 23, 24, respectively, and thereby with the cylinder spaces 25, 26, 27, respectively. By means of pipes 49a, 50a, 51a provided with cocks 49, 50, 51, respectively, the spaces 16a, 17a, 18a above the actuating pistons 40, 41, 42, are connected with a common liquid discharge pipe 52. The spaces 53, 54, 55 below the piston valves 37, 38, 39, respectively, communicate with a common pipe 56, which is completely filled with liquid. Thus, the spaces 53, 54, 55 and the pipe 56 together form a space filled with liquid, so that the piston valves 37, 38, 39 are hydraulically coupled with one another.

In this arrangement, and with a view to retracting a supporting post, liquid from the main 12 can be supplied to the cylinder spaces 28, 29, 30 by means of pipes 57, 58, 59, respectively, non-return valves 60, 61, 62, respectively, and pipes 31, 32, 33, respectively. The supply pipes 13, 14, 15 should then be closed by cocks 63, 64, 65, respectively, and the cocks 49, 50, 51, respectively should then be opened. The cocks 49, 50, 51, 63, 64, 65 are interconnected by a rod in such a manner, that when the rod is operated to open cocks 49, 50 and 51, it at the same time closes cocks 63, 64 and 65, and vice versa.

The retraction of the posts could also be brought about by other means, for instance, by suitable springs.

The described device operates as follows:

If, with the various elements assuming the positions illustrated, pressure liquid is supplied by pipe 12, the cylinder spaces 25, 26, 27 will receive liquid through pipes 13, 14, 15, respectively, valves 16, 17, 18, respectively, non-return valves 19, 20, 21, respectively, and pipes 22, 23, 24, respectively. The liquid from spaces 28, 29, 30 is pressed through pipes 31, 32, 33 and pipes 22, 23, 24 into the cylinder spaces 25, 26, 27 resp., so that only a relatively small amount of liquid has to be supplied through the main pipe 12. The supporting posts will thereby be projected. If, now, base 1 is downwardly inclined say towards post 3, the latter will offer, due to the shifting of the center of gravity of the element affixed to the body 1 towards the post 3, greater resistance to its projection than the other two posts, so that during a short period the liquid which, due to the parallel connection of the motors to a common source, seeks the path of least resistance will flow exclusively to the said other posts, whereby the base will somewhat further be inclined downwardly towards post 3. Consequently, the liquid pressure in cylinder space 25, pipes 22 and 46, and the space above the actuating piston 40 will increase and exceed those above the actuating pistons 41, 42, of the stop valves individual to the other posts, the result being that piston valve 37 is urged down and the piston valves 38, 39 are moved upward, so that the supply pipes 14, 23 and 15, 24 of posts 4, 5, respectively, are closed and pressure liquid is supplied to post 3, only.

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Owing thereto, base 1, which had a downward inclination towards said post 3, will be moved into normal position by the further projection of said post. As soon as base 1 assumes its normal, for instance horizontal, position, equilibrium between the stop valves 16, 17 and 18 is restored, so that all said valves 16, 17 and 18 are fully open again and base 1 is raised equally by each of cylinders 6, 7 and 8. If the supply of liquid is cut off, base 1, supported by the posts, is held in adjusted position, owing to the presence of the non-return valves 19, 20, 21 and 34, 35, 36.

If the springs 43, 44, 45 are made adjustable, their initial tensions can be adjusted in accordance with the desired distribution of the load over the supporting posts, in such manner that all liquid supply pipes will be opened simultaneously only when the body to be positioned assumes the desired position.

The device shown in Fig. 2 serves to control only two supporting posts. It comprises substantially the same elements and operates in substantially the same manner as the device illustrated in Fig. 1. In view thereof, the same reference numerals are used, as far as possible, as in Fig. 1 to designate corresponding parts. In this embodiment, all elements are accommodated in a common casing 66. The actuating piston valves 37, 38 and the piston valves 40, 41 are interconnected by a common rod 67 so as to form a rigid unit. The cocks 63, 64, 65 shown in Fig. 1 are dispensed with. The initial tensions of the springs loading the non-return valves 19, 34, 60 and 20, 35, 61 are so determined that, when the cocks 49, 50 are open, the non-return valves 60, 61 are lifted and the posts 3, 4 raised. This simplified device, which is especially suitable for a crane truck having a non-slewing jib and provided with supporting posts on opposite sides, works as follows: In the illustrated position the cocks 49 and 50 are closed and the posts 3 and 4 are stationary, since the spaces completely filled with liquid and constituted by the cylinder spaces 25, 26 the pipes 22, 23 and the passages in casing 66 connected to said pipes are closed by the check valves 19, 34 and 20, 35. If the posts 3 and 4 have to be projected liquid is supplied through passage 12. This liquid passes the check valves 19 and 20 and is led through pipes 22, 23 to the cylinder spaces 25, 26. If the counter-pressure of the posts 3 and 4 is equal the pressure operating on piston 37 is equal to that operating on piston 38, so that the valve device 40, 41 remains in its central position. However, as soon as the counter-action of one of the posts exceeds that of the other, for instance due to a shifting of the center of gravity of the element supported by said posts, the pressure in one cylinder space 25 or 26, one pipe 22 or 23 and the passages in the casing 66 connected to said pipe exceeds that in the corresponding other cylinder space, pipe and passages. The result thereof is that the valves 40, 41 are shifted to one side and thereby close the supply passage leading to the cylinder space in which the pressure is the lowest. Consequently liquid will be supplied only to the most heavily loaded post, so that only this post continues to move and the element supported by the posts will restore its required position.

The mutual dependence of the stop valves, which in the described devices is obtained by a liquid body, and by a rod, respectively, can also be realised by means of a plate centrally supported by a ball joint, or by means of a balancing device.

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What I claim is:

1. In combination a body having a plurality of supporting posts adapted to be hydraulically extended and retracted and a device for distributing liquid under pressure over said supporting posts, each of which is provided with and driven by a motor comprising a cylinder and differential piston, said distributing device being connected to a main supply conduit, a main discharge conduit and pairs of conduits leading to cylinder spaces above and below the pistons and comprising a plurality of similar control sets, each including a stop valve, a plurality of non-return valves and at least one cock, each control set connecting the main supply conduit both through said stop valve and one of said non-return valves to the conduit leading to the working space having the largest cross sectional area of the corresponding cylinder and through a second non-return valve to the conduit leading to the other cylinder space and also connecting the main discharge conduit both through said cock to the conduit leading to the first mentioned cylinder space and through said cock and a third non-return valve to the other cylinder space, the first and the third non-return valves opening in the direction of the first mentioned cylinder space and the second non-return valve opening in the direction of the other cylinder space, said stop-valve being controlled by a piston exposed to the liquid pressure obtaining in the first mentioned cylinder space and tending to move said valve in opening direction, and all stop-valves of the distributing device being positively coupled to one

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another in such a manner that the movement of a stop-valve in one direction entails movement of at least one of the other stop-valves in the opposite direction.

2. A combination according to claim 1 comprising in addition springs loading said stop-valves, the spring of each stop-valve tending to move the latter in opening direction.

3. A combination according to claim 1 adapted to control two supporting posts, wherein the stop-valves are oppositely disposed and the positive coupling between said stop-valves consists of a rigid rod.

4. A combination according to claim 1 in which the positive coupling between the stop-valves consists of a hydraulic system completely filled with liquid and comprising a cylinder for each stop-valve and a piston located therein, said piston being positively connected to the corresponding stop-valve and the working spaces of all cylinders being interconnected.

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