

LIFTING DEVICE FOR LIFTING LOADS

The present invention pertains to a hydraulic lifting device for lifting loads, in particular, a compact lifting device.

Lifting devices of this type are used for lifting comparatively heavy loads, e.g., machines and track vehicles. For example, such a lifting device makes it possible to lift loads of 10 t to 50 t.

A lifting device of the initially described type is for example disclosed in US 2,550,674 and comprises two hydraulic piston-cylinder units that are arranged parallel to the lifting direction and respectively contain a cylinder, in which a piston mounted on a piston rod is arranged in a displaceable fashion. Each piston rod extends out of the cylinder on the side that faces away from the piston and is supported on a support leg. The cylinders are rigidly connected to one another by means of a bridge on their ends that face the support legs. Additionally, each cylinder contains a guide sleeve in the axial end section that faces the support leg, wherein said guide sleeve is axially guided on the piston rod. In the known lifting device a vertical lifting plunger is attached to the bridge. In the known lifting device the axial guiding is provided on the one hand by the respective piston and on the other hand by the respective guide sleeve. Accordingly, the guiding effect depends on the lift.

DE 93 12 940 U1 discloses a compact hydraulic lifting device with a hydraulic piston-cylinder unit that is arranged parallel to the lifting direction. A piston is connected to a piston rod and arranged in a cylinder of this piston-cylinder unit in a displaceable fashion. The side of the piston rod which faces away from the piston extends out of the cylinder and is supported on a base

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plate that contains two support legs. A lifting bracket is welded onto the cylinder on the end that faces the base plate.

Other lifting devices are disclosed in US 2,163,959, in US 2,508,240, in US 3,047,269 and in EP 0 720 964 A1.

The present invention is based on the objective of disclosing an improved embodiment of a lifting device of the initially described type which, in particular, has a comparatively simple design and is suitable for lifting relatively heavy loads, and which additionally is qualified in particular for laterally lifting heavy loads comprising in addition an engagement for the lifting device, said engagement being arranged comparatively low.

According to the invention, this objective is attained with the object of the independent claim. Advantageous embodiments of the invention form the objects of the dependent claims.

The invention essentially proposes to provide two parallel hydraulic piston-cylinder units, the cylinders of which are connected to one another by a bridge, wherein the lifting bracket is or can be attached to this bridge. This design makes it possible to utilize the lifting device for lifting heavy loads, wherein the lifting device simultaneously has a compact design. In addition, a relatively wide and thusly stable ground support for the lifting device is achieved. In this respect, it is important to assign a separate support leg for vertically supporting the respective piston rod to each piston-cylinder unit. This improves the stabilizing support effect of the support legs.

In the lifting device according to the invention the lifting bracket qualifies the lifting device to laterally engage an engagement of a load, wherein said engagement is

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arranged extremely low, such that the load can be lifted laterally with the help of the lifting device according to the invention. In addition the attachment of the bridge to the guide sleeves results in an extremely safe and exact axial guidance of the bridge, this improves the support of tilting moments and improves the qualifying of the lifting device for laterally lifting of loads.

According to one advantageous additional development, the bridge can be arranged between the cylinders and mounted on opposing sides of the cylinders. This design makes it possible to position the lifting bracket closer to the cylinders. The lifting bracket can, in particular, practically be positioned on the bridge between the cylinders. This makes it possible to position the lifting device closer to the load to be lifted such that the occurring moments are reduced and the capacity of the lifting device is increased. In this respect, it is of particular importance that the friction between the cylinders and the piston rods can be reduced with this measure such that the power of such a lifting device can be increased. This simultaneously improves the stability of the lifting device.

According to one particularly advantageous additional development, the piston rod can be connected to the support leg and to the piston in a rotationally rigid fashion in at least one piston-cylinder unit, wherein the piston is arranged in the corresponding cylinder such that it is rotatable about the longitudinal cylinder axis, and wherein the support leg is designed in such a way that it is rotatable relative to the cylinder about the longitudinal cylinder axis. In this design, the ability to rotate the piston is utilized for realizing a pivoted adjustment of the support leg. Additional measures, in

particular, bearings or the like, are not required in this case such that the lifting device according to the invention is particularly compact and inexpensive. Pivoted support legs are particularly advantageous in instances in which no free space for the support legs that transversely protrude from the respective piston rod is provided on the load to be lifted. The lifting device consequently can be moved closer to the load to be lifted by pivoting away the support legs.

Another advantage is attained if the lifting bracket is realized in the form of a separate part and contains a hook for engaging the lifting bracket with the bridge. In this design, different lifting brackets that are adapted to different applications can be provided and attached to the bridge in dependence on the respective requirements.

This results in a particularly versatile lifting device. Since the lifting bracket is subjected to particularly high wear, its design in the form of a separate part makes it possible to easily exchange a damaged lifting bracket with a new lifting bracket.

Other important characteristics and advantages of the invention are disclosed in the dependent claims, the figures and the description of the figures.

It goes without saying that the aforementioned characteristics, as well as the characteristics discussed below, cannot only be used in the respectively described combination, but also in other combinations or individually without deviating from the scope of the present invention.

One preferred embodiment of the invention is illustrated in the figures and described in greater detail below,

wherein identical reference symbols refer to identical or functionally identical or similar parts.

The figures schematically show:

- Figure 1 a partially sectioned side view of a lifting device according to the invention in the lowered starting position;
- Figure 2 the segment of the lifting device according to Figure 1 which is situated near the ground, however, in a slightly raised lifting position;
- Figure 3 a top view sectioned along the line III in Figure 1;
- Figure 4 a front view of the segment situated near the ground in the viewing direction IV in Figure 3, and
- Figure 5 a section through the segment situated near the ground along the line V in Figure 3.

According to Figures 1-5, a hydraulic lifting device 1 according to the invention which, in particular, is realized in the form of a compact and preferably portable lifting device comprises two piston-cylinder units 2 that are arranged parallel referred to the lifting direction 3 symbolized by a double arrow. Each piston-cylinder unit 2 comprises a cylinder 4, in which a piston 5 is arranged such that it can be displaced in the lifting direction 3. The piston 5 is rigidly connected to the piston rod 6, in particular, in a rotationally rigid fashion. The side of the piston rod 6 which faces away from the piston 5 protrudes out of the cylinder 4 and is supported on a support leg 7. This support leg 7 preferably is connected to the piston rod 6 in a rotationally rigid fashion.

On its end that faces the support leg 7, the cylinder 4 contains a guide sleeve 8 that is axially guided on the piston rod 6. The radial play between the guide sleeve 8 and the piston rod 6 should be as small as possible so as to prevent the guide sleeve 8 from tilting relative to the piston rod 6. The cylinder 4 has a certain radial play relative to the piston rod 6 between this guide sleeve 8 and the cylinder end 9 that faces away from the support leg 7, i.e., a radial gap 10 is formed outside the guide sleeve 8 between the cylinder 4 and the piston rod 6. Any wall contact between the piston rod 6 and the cylinder 4 is prevented at this location in this fashion. The piston 5 preferably has a certain radial play referred to the cylinder 4 such that a relative tilting between the piston 5 and the cylinder 4 and the increased wear associated therewith can be prevented. Due to these measures, the cylinder 4 is exclusively guided by the guide sleeve 8 when the cylinder 4 is adjusted relative to the piston rod 6.

A hydraulic chamber 11 that communicates with a hydraulic connection 12 is formed in the cylinder 4 between the cylinder end 9 and the piston 5. In other embodiments, the hydraulic connection 12 may also be arranged at a different location.

According to Figures 3-5, a bridge 14 is arranged between the two cylinders 4 of the two piston-cylinder units 2, wherein said bridge extends transverse to the central longitudinal axes or longitudinal cylinder axes 13 of the cylinders 4 which are identified by the reference symbol 13. This bridge 14 is fixed to both cylinders 4 or their guide sleeves 8, in particular, by means of corresponding welding seams 15. A lifting bracket 16 is arranged on this bridge 14. It would also be possible to realize the guide sleeves 8 and the bridge 14 in the form of an integral casting.

According to Figure 5, the lifting bracket 16 is realized in the form of a L-shipped angle with a rear part 17 that extends parallel to the lifting direction 3 and a loading part 18 that transversely protrudes from the rear part 17. The end of the rear part 17 which faces away from the loading part 18 is provided with a hook 19 for engaging the lifting bracket 16 on the upper edge 20 of the bridge 14 which faces away from the support legs 7. For this purpose, a step 21 is arranged on the upper bridge edge 20. In the embodiment shown, the lifting bracket 16 is realized in the form of a separate part that can be engaged with and disengaged from the bridge 14 depending on the respective requirements. One particular advantage of this design can be seen in the fact that a worn out lifting bracket 16 can be very easily replaced with a new lifting bracket. In addition, it is possible to provide an assortment of different lifting brackets 16 for different applications. The bridge 14 may also be designed in such a way that the lifting bracket 16 can be attached to the bridge 14 at different lifting positions. For this purpose, the bridge 14 may, in particular, extend approximately to the upper ends of the cylinders 4.

The rear part 17 of the lifting bracket 16 attached to the bridge 14 is supported on the bridge 14. According to Figure 3, the bridge 14 is arranged between the two cylinders 4 in such a way that it is fixed on opposing sides of the cylinders 4 or their guide sleeves 8. The position is also chosen in such a way that the rear part 17 of the lifting bracket 16 attached thereto only protrudes slightly over the cylinders 4 or their guide sleeves 8 in the direction of the loading part 18. In the embodiment shown in Figure 1, the position of the bridge 14 is chosen such that the rear part 17 does not protrude over the cylinders 4 or their guide sleeves 8 in the direction of the loading part 18. Due to this special arrangement of the bridge 14, the lifting device 1 with

its piston-cylinder units 2 can be moved very close to the load to be lifted. This makes it possible to prevent a high leverage and consequently high moments when the load is lifted.

The piston 5 is rotatably arranged in the cylinder 4. In addition, the support legs 7 are shaped in such a way that they are also pivoted about the longitudinal cylinder axis 13 when the bridge 14 is lowered. This pivoting motion is symbolized by a double arrow 22 in Figure 3. Since each support leg 7 is connected to the corresponding piston rod 6 in a rotationally rigid fashion and each piston rod is also coupled to the respective piston 5 in a rotationally rigid fashion, each support leg 7 can be pivoted relative to the cylinder 4 about the pivoting axis 13 together with the piston rod 6 and the piston 5. This design has the advantage that no additional bearings or the like need to be provided for realizing this pivoting motion of the support legs 7. One particular advantage of these pivoted support legs 7 is that the lifting bracket 16 can also be inserted into a bracket receptacle on the load to be lifted in instances in which no suitable receptacle or recess for the support legs 7 is provided on the load.

In one advantageous additional development, a top plate 23 is, in particular, welded to the cylinder ends 9 that face away from the support legs 7, wherein said top plate can be used for lifting a load in addition or as an alternative to the lifting bracket 16. The top plate 23 can also be realized such that it can be attached and detached. The top plate 23 may also have a shape that is adapted to a load to be lifted, e.g., a prismatic shape. In this case, it would also be conceivable to provide an assortment of different top plates 23 for different applications.

The lifting device 1 according to the invention functions as described below:

When the piston 5 is completely retracted into the cylinder 4, the lifting bracket 16 is at its lowest position, i.e., the loading part 18 of the lifting bracket 16 according to Figure 1, as well as the support legs 7, are in contact with the ground or a substructure that is not illustrated in greater detail. In this position, the lifting device 1 can be arranged on a load to be lifted in such a way that the loading part 18 of the lifting bracket 16 engages underneath the load. The support legs 7 may, if so required, be pivoted outward or rearward relative to the lifting bracket 16 for this purpose.

After positioning the lifting device 1, hydraulic pressure is applied to the piston-cylinder units. The two piston-cylinder units 2 preferably are hydraulically connected in parallel. The hydraulic pressure being built up in the hydraulic chamber 11 causes the cylinder 4 to move along the piston rod 6 in the lifting direction 3, wherein the lifting bracket 16 is raised by means of the bridge 14. Since the two piston-cylinder units 2 are hydraulically connected in parallel, the load is uniformly distributed over both support legs 7.

In addition, the load carried by the piston rods 6 is supported by the support legs 7 relatively direct and parallel to the lifting direction 3 such that bending loads or moments within the lifting device 1 are largely prevented. This results in a relatively stable lifting device 1, in which the safety is improved when lifting heavy loads.

Another peculiarity of the lifting device 1 according to the invention can be seen in the ability of the lifting device 1 to raise a load on one side, namely such that the

load pivots about a pivoting axis that is situated distant from the lifting device 1. In this case, the lifting device 1 laterally engages on the load, i.e., the loading part 18 of the lifting bracket 16 extends parallel to the pivoting axis. In a conventional lifting device, the lifting bracket is raised parallel to the ground when the load is lifted or pivoted such that the load which is inclined relative to the ground due to the pivoting motion now only lies on the edge of the loading part of the lifting bracket which faces the pivoting axis. This may cause the load to slide off the lifting bracket. In the lifting device 1 according to the invention, the stroke of the two piston rods 6 may also differ when lifting or pivoting the load because the two piston-cylinder units 2 are hydraulically connected in parallel. Due to this measure, the loading part 18 of the lifting bracket 16 also flatly adjoins the load if the incline of the loading part 18 or the lifting bracket 16 relative to the ground changes when raising or pivoting the load. The piston-cylinder unit 2 situated farther from the pivoting axis has a greater stroke in this case such that the lifting device 1 is inclined relative to the vertical line. The support legs 7 are tilted during this process and ensure the required stability of the lifting device 1. These measures minimize the risk of the load sliding off the lifting bracket 16.

The lifting device 1 according to the invention has a relatively compact design and consequently can be realized in a comparatively light and, in particular, portable fashion. The lifting device 1 according to the invention makes it possible to lift relatively heavy loads of, for example, 10 t to 50 t.

CLAIMS

1. A hydraulic lifting device for lifting loads, in particular, a compact lifting device,
 - with two hydraulic piston-cylinder units (2) that are arranged parallel to the lifting direction (3) and respectively contain a cylinder (4), in which a piston (5) mounted on a piston rod (6) is arranged in a displaceable fashion,
 - wherein each piston rod (6) extends out of the cylinder (4) on the side that faces away from the piston (5) and is supported on a support leg (7),
 - wherein the cylinders (4) are rigidly connected to one another by means of a bridge (14) on their ends that face the support legs (7),
 - wherein each cylinder (4) contains a guide sleeve (8) in the axial end section that faces the support leg (7), wherein said guide sleeve is axially guided on the piston rod (6),characterized by the fact
 - that a lifting bracket (16) is or can be attached to said bridge (14),
 - that the bridge (14) is arranged on the guide sleeves (8).
2. The lifting device according to Claim 1, characterized by the fact that the bridge (14) is arranged between the cylinders (4) and attached to opposing sides of the cylinders (4).

3. The lifting device according to Claim 2, characterized by the fact
 - that the lifting bracket (16) is realized in a L-shaped fashion and comprises a rear part (17) that extends parallel to the lifting direction (3) and a loading part (18) that transversely protrudes from the rear part,
 - wherein the rear part (17) is or can be attached to the bridge (14), and
 - wherein the bridge (14) is arranged on the cylinders (4) in such a way that the bridge (14) and the rear part (17) of the lifting bracket (16) attached thereon are situated between the cylinders (4), namely such that the rear part (17) only protrudes, if at all, slightly beyond the cylinder (4) in the direction of the loading part (18).
4. The lifting device according to one of Claims 1 to 3, characterized by the fact
 - that the piston rod (6) of at least one piston-cylinder unit (2) is connected to the support leg (7) and to the piston (5) in a rotationally rigid fashion, by the fact
 - that the piston (5) is arranged in the corresponding cylinder (4) such that it is rotatable about the longitudinal cylinder axis (13), and by the fact
 - that the support leg (7) is arranged such that it is rotatable relative to the cylinder (4) about the longitudinal cylinder axis (13).
5. The lifting device according to one of Claims 1 to 4, characterized by the fact that the lifting bracket (16) is realized in the form of a separate part and contains a

hook (19) for engaging the lifting bracket (16) with the bridge (14).

6. The lifting device according to one of Claims 1 to 5, characterized by the fact that the guide sleeves (8) and the bridge (14) are realized in the form of an integral casting.
7. The lifting device according to one of the Claims 1 to 6, characterized by the fact that each cylinder (4) has a radial gap (10) between the cylinder (4) and the piston rod (6), namely in the region between the guide sleeve (8) and the cylinder end (9) facing away from the guide sleeve.
8. The lifting device according to one of Claims 1 to 7, characterized by the fact that each piston (5) is arranged in the corresponding cylinder (4) with radial play.
9. The lifting device according to one of Claims 1 to 8, characterized by the fact that both cylinders (4) carry a top plate (23) for supporting a load to be lifted on their cylinder ends (9) that face away from the support legs (7).
10. The lifting device according to one of Claims 1 to 9, characterized by the fact that the two hydraulic piston-cylinder units (2) are hydraulically connected in parallel.