

DEVICE FOR LIFTING A TABLE

The present invention relates to a device for lifting a table.

An example of a known device is shown in Figure 5, and includes an expandible or stretchable assembly 2 comprising pivotable arms 3 each pivoted to one end of a frame 1 and further arms 4 each having a roller 41 slidable along a guide portion 11 of the frame 1. A table 5 is mounted on the stretchable assembly 2. A hydraulic cylinder 61, pivoted at its base end to the other end of the frame 1, has a piston rod 62 connected to the pivotable arms 3.

With the lifting device described above, the piston rod 62, when advanced or retracted, expands or collapses the stretchable assembly 2 to raise or lower the table 5. When lowering the table 5, the cylinder 61 slowly descends toward the frame 1 and a horizontal position while retracting the piston rod 62. Thus the device has the advantage that the distance between the lowermost position of the table 5 and the floor is small.

The force of the cylinder 61 required for raising the table 5 will be discussed. As seen in Figure 6,

the force F of the cylinder acting in the direction of advance of the piston rod 62 can be resolved into a force for turning the pivotable arms 3, namely a component F_1 acting in the direction of a tangent to the circular path of movement of the point 30 where the piston rod 62 is pivoted to the arms 3, and a force pushing the pivotable arms 3 toward their base ends, namely a component F_2 . As the piston rod 62 approaches a position parallel to the frame 1, a larger proportion of the cylinder force F acts to push the pivotable arms 3 towards the base ends, with the result that the force F of the cylinder 61 is not used effectively for turning the pivotable arms 3. Accordingly in order to obtain a sufficient component force F_1 for turning the pivotable arms 3 upwardly to raise the table 5 from its lowermost position, the cylinder 61 must be able to supply a force F which is considerably greater than the component F_1 . This invariably necessitates the use of a large cylinder, while a pedal-type pump 63 for feeding working oil to the cylinder 61 must be operated by a greater force.

The known lifting device is equipped with a hydraulic assembly 6 in which the above-mentioned pump 63 and an oil tank 66 are fixedly mounted on the frame 1 and are connected by pressure-resistant hoses to the hydraulic cylinder 61 attached to the frame 1 and the

pivotal arms 3. Because of this arrangement, the distance between the point where the cylinder 61 is attached to the frame 1 and the point where the cylinder is pivoted to the arms 3 varies with the size of the table lifting device, thus giving rise to the necessity of using hydraulic cylinders of different sizes for different lifting devices. For the manufacture of various table lifting devices, therefore, there is the need to prepare hydraulic assemblies of different sizes which can not be standardized and are expensive.

According to the present invention there is provided a device for lifting a table comprising at least one expandible assembly for supporting the table, the at least one expandible assembly including a first and a second arm which are pivotably interconnected to form a scissors linkage, said first arm being pivoted to a frame and extending in a substantially horizontal direction when the at least one expandible assembly is in a lowered condition, and a hydraulic assembly comprising a cylinder for advancing or retracting a piston rod projecting from the cylinder, the cylinder being rigidly fixed to the frame such that said piston rod extends in a substantially vertical direction and said piston rod having its

projecting end connected to a lower portion of the first arm by way of a link element, one region of the link element being pivotably connected to the projecting end of the piston rod and another region of the link element being pivotably connected to the lower portion of the first arm.

The present invention will now be described further by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a front view showing a first lifting device embodying this invention;

Fig. 2 is a view in section taken along the line II-II in Fig. 1;

Fig. 3 is a front view showing a hydraulic assembly of the lifting device as installed in place;

Fig. 4 is a front view showing another embodiment of lifting device;

Fig. 5 is a front view showing a conventional device; and

Fig. 6 is a diagram of the same to illustrate the force of a hydraulic cylinder as resolved into components.

With reference to Figs. 1 to 3, a lifting device includes a rectangular frame 1 made from channel members. Longitudinal channel members 12, 12 are opposed to each other with their channel portions facing each other as seen in Fig. 2 to provide guide portions 11, 11 in which rollers 41, 41 on the shiftable arms 4, 4 to be described later fit.

The frame 1 is provided at its four corners with front wheels 14 and rear wheels 10. An upwardly extending handle bar 15 is removably attached to a support plate 13 carrying the rear wheels 10, 10.

The frame 1 has a rear wall 16 formed with inwardly projecting brackets 17, 17 close to its opposite ends. A pair of arms 3, 3 pivotally movable in a vertical plane are pivoted at their lower ends to the brackets.

Each of shiftable arms 4, 4 having the same length as the pivotable arms 3, 3 intersects at its midportion the midportion of the corresponding one of the arms 3, 3. The arms 3 and 4 are connected together

by a pivot 21 at the intersection. The rollers 41, 41 on the lower ends of the shiftable arms 4, 4 are rollably fitted in the guide portions 11, 11 at opposite sides of the frame 1 respectively. The
5 resulting arrangement serves as a stretchable assembly 2 which is vertically expandable or collapsible.

A table 5 mounted on the stretchable assembly 2 is rectangular and approximately identical with the frame 1 in width and length. The table 5 has
10 at its rear end side portions downwardly projecting brackets 51, 51 to which the shiftable arms 4, 4 are pivoted at the upper ends thereof. The table 5 bears on rollers 31, 31 mounted on the upper ends of the pivotable arms 3, 3.

15 A support piece 32 downwardly extends from each of the pivotable arms 3, 3 approximately midway between the pivot 21 and the lower end of the arm 3 as seen in Fig. 3. A hydraulic assembly 6 fixedly mounted on the frame 1 and positioned close to its rear wall 16
20 is coupled to the support pieces 32.

The hydraulic assembly 6 comprises a cylinder 61, a hydraulic pump 63 and an oil tank 66 disposed on a base plate 7 and assembled into a unit. The cylinder 61 has a piston rod 62 vertically projectable from and
25 retractable into the cylinder and is liquid-tightly

covered with a case 65. The oil tank 66 is provided between and defined by the inner surface of the case 65 and the cylinder 61. Lateral bars 18, 18 attached to a rear bottom portion of the frame 1 fixedly support an upper portion of the case 65 therebetween.

The cylinder 61, the case 65 and hydraulic pump 63 are fixedly arranged on the base plate 7 which is internally formed with oil channels 71, 72.

The oil tank 66 is in communication with the pump 63 via the oil channel 72 which is provided with a check valve (not shown) for permitting the passage of oil only from the tank 66 to the pump 63. The cylinder 61 communicates with the pump 63 through the oil channel 71 provided with a check valve (not shown) for permitting the flow of oil only from the pump 63 to the cylinder 61.

As shown in Figs. 2 and 3, the piston rod 62 is fixed at its forward end to a lateral rod 81 with a pair of links 82, 82 pivoted to opposite ends of the rod 81. The lower ends of the links 82, 82 are pivoted as at 83 to the support pieces 32 of the pivotable arms 3, 3 to provide a link assembly 8. The pump 63 is coupled to a pedal 60 and a plunger 64 which is biased upward by a spring 68. When the plunger 64 is forced down by the pedal 60 against the action of the spring

68, the working oil in the pump 63 flows into the cylinder 61 and raises the piston rod 62, turning the pivotable arms 3 upward about the pivoted points 33.

The base plate 7 has another oil channel 73 for holding the cylinder 61 in communication with the oil tank 66 by way of a valve (not shown), which is openable by a lowering pedal 74 disposed to the rear of the base plate 7 to return the oil from the cylinder 61 to the oil tank 66 and lower the piston rod 62, whereby the pivotable arms 3, 3 can be turned downward.

The pivots 83 are so arranged that when the piston rod 62 is in its uppermost and lowermost positions during the above operation, the positions of the pivots 83 are on the same vertical line 84 shown in Fig. 3 and are upwardly and downwardly away from a horizontal line 19 through the lower end pivoted points 33 of the arms 3, 3 by the same distance.

The table 5 is lifted by operating the pedal 60 of the hydraulic assembly 6 and thereby progressively raising the piston rod 62 of the cylinder 61.

The pivotable arms 3, 3 coupled to the piston rod 62 by the link assembly 8 are upwardly turned about the base end pivoted point 33 so that the shiftable arms 4, 4 pivoted to the arms 3, 3 midway thereof are shifted with the lower end rollers 41, 41 rolling along

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the guide portions 11, 11 of the frame 1, thus
expanding the stretchable assembly 2 upward to lift the
table 5 on the assembly 2. When the hydraulic assembly
6 is operated with the table 5 positioned in its lower-
5 most position, the piston rod 62 pushes up the pivotable
arms 3 in an approximately horizontal position against
the downward component of the load acting on the arms 3.
Consequently the pushing force of the piston 62 can be
used effectively. This permits the use of a small
10 cylinder, while the pump 63 for feeding the working oil
to the cylinder 61 is operable with ease.

As seen in Fig. 3, the downward force F_3
acting on the pivotable arms 3 can be resolved into a
component F_5 acting in a tangent direction to turn the
15 pivotable arms 3 downward and a component F_4 pushing the
arms 3 toward the base ends of the arms 3. With the
upward turn of the arms 3, the proportion of the
component pushing the arms 3 towards their base ends
increases and consequently reducing the component needed
20 for turning the arms 3 to render the pump 63 operable
progressively more easily.

Furthermore since the pivots 83 for connecting
the pivotable arms 3 to the link assembly 8 are set to
position on the same vertical line 84 when the piston
25 rod 62 is in its uppermost and lowermost positions,

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this minimizes the range of swing of the links 32 which shift about the lateral rod 81 of the link assembly 8 with the circular arc motion of the pivots 83. Consequently the upward force of the piston rod 62 can be effectively converted to a force for turning the pivotable arms 3, while the force acting to laterally deviate the piston rod 62 can be minimized.

The table 5 is lowered by forcing down the lowering pedal 74 of the hydraulic assembly 6 and thereby returning the oil from the cylinder 61 to the oil tank 66 to lower the piston rod 62 and downwardly collapse the stretchable assembly 2.

The cylinder 61 of the hydraulic assembly 6 may be slightly inclined forward or rearward relative to the frame 1 so as to position the piston rod 62 at right angles with the arms 3 when starting lifting the table and to give an increased raising force.

Fig. 4 shows another embodiment of the invention in which the upper ends of the pivotable arm 3 and the shiftable arm 4 of the stretchable assembly 2 are pivoted to the base ends of pantograph arms 23, 22 intersecting each other at their midportions. The arms 22, 23 are pivoted to each other at the intersection to provide a stretchable assembly 25. A table 5 is mounted on the assembly 25 and can be raised by

a stroke of the same cylinder as above to an uppermost position which is about twice as high as that of the table 5 on the single stretchable assembly 2.

5 The frame 1 of the device has a post 9 extending from one end thereof and having an upper portion bent toward a position above the table 5. The forward end of the post 9 has an engaging member 91, such as a magnet, hook or the like, for suspending a workpiece 92 placed on the table 5.

10 The engaging member 91 is used, for example, for assembling two workpieces 92 and 93, such as a male die and a female die in combination. For this purpose, one workpiece 92 is placed on the table 5, raised and suspended from the engaging member 91. The table 5 is
15 then lowered. The other workpiece 93 is thereafter placed on the table 5, raised and fitted to the suspended workpiece 92 from below.

The hydraulic assembly 6 comprises a cylinder 61, hydraulic pump 63 and hydraulic tank 66 arranged on a
20 base plate 7 and assembled into a unit, which is fixedly mounted on the frame 1 with its piston rod 62 adapted to push up the arms 3 on the pivoted side approximately vertically. Accordingly the hydraulic unit 6 is mountable in place irrespective of the size of the frame

1, namely of the size of the table lifting device.

For this reason, there is no need to use a hydraulic pump and cylinder of particular size for each of table lifting devices provided in several different sizes.

5 Thus standardized hydraulic units are usable for such lifting devices of varying sizes.

The piston rod 62 of the unitary hydraulic assembly 6 fixed to the frame 1 is adapted to project or retract from the cylinder substantially vertically to cause
10 the force of the piston rod to act effectively on the pivotable arms 3 to turn the arms 3. This makes it possible to use a small cylinder and renders the pump 63 easily operable for feeding the working oil to the cylinder.

15 Because hydraulic units of the same standardized size are usable for table lifting devices which differ in overall size, the devices are suited to mass production and can be manufactured at reduced costs.

When the device is provided with a post 9
20 equipped with an engaging member 91, a workpiece 92 on the table 5 can be suspended temporarily from the engaging member 91. The device is then convenient for assembling two workpieces 92 and 93. The present device therefore has various advantages.



CLAIMS:

1. A device for lifting a table comprising at least one expandible assembly for supporting the table, the at least one expandible assembly including a first and a second arm which are pivotably interconnected to form a scissors linkage, said first arm being pivoted to a frame and extending in a substantially horizontal direction when the at least one expandible assembly is in a lowered condition, and a hydraulic assembly comprising a cylinder for advancing or retracting a piston rod projecting from the cylinder, the cylinder being rigidly fixed to the frame such that said piston rod extends in a substantially vertical direction and said piston rod having its projecting end connected to a lower portion of the first arm by way of a link element, one region of the link element being pivotably connected to the projecting end of the piston rod and another region of the link element being pivotably connected to the lower portion of the first arm.

2. A device as claimed in claim 1, wherein the hydraulic assembly further comprises an oil tank and a pump for feeding working oil from the oil tank to the cylinder, and wherein the hydraulic assembly is mounted on a base plate which is fixed to the frame.



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3. A device as claimed in claim 2, wherein the cylinder is surrounded by a case, and the oil tank is formed between the cylinder and the case.

4. A device as claimed in any one of claims
5 1 to 3, including a table supported on the at least one expandible assembly and wherein the frame has a post equipped with an engaging member for detachably suspending a workpiece placed on the table.

5. A device for lifting a table, substantially
10 as herein described with reference to Figures 1 to 3, or Figure 4, of the accompanying drawings.

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