

Feb. 1, 1944.

V. S. MAKAROFF

2,340,764

LIFTING DEVICE

Filed Nov. 30, 1940

2 Sheets-Sheet 1

Fig. 1

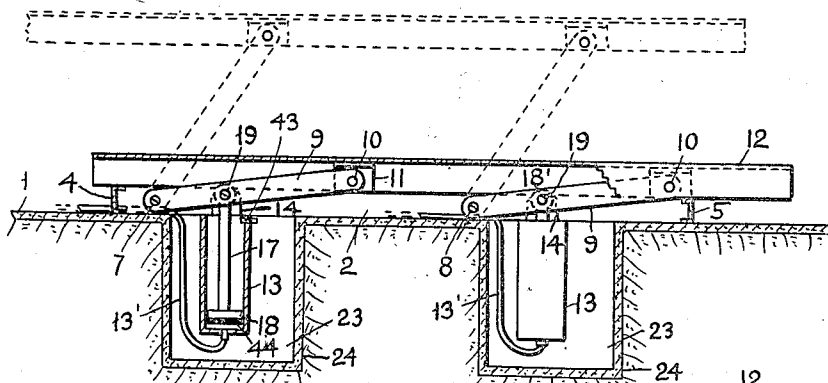


Fig. 2

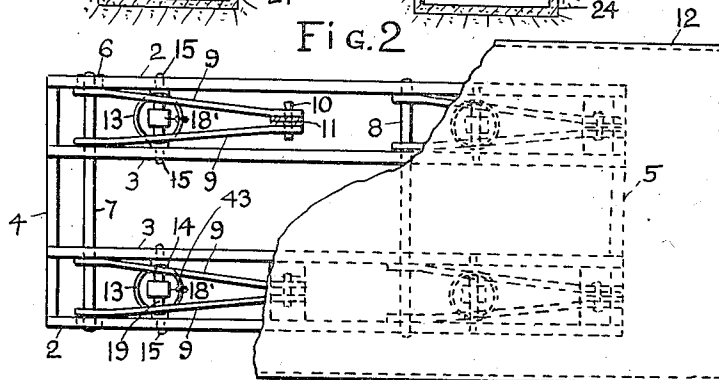


Fig. 3

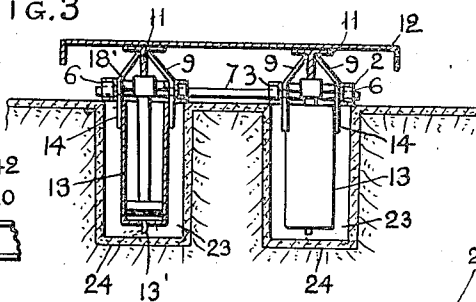


Fig. 13

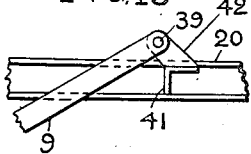


Fig. 11

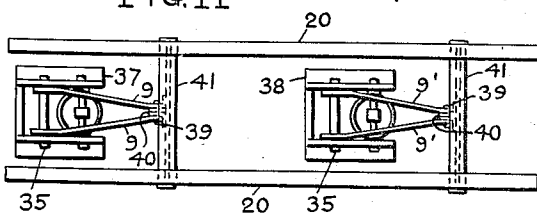
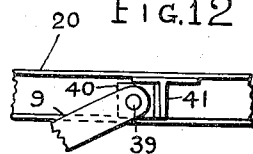


Fig. 12



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Fig. 4

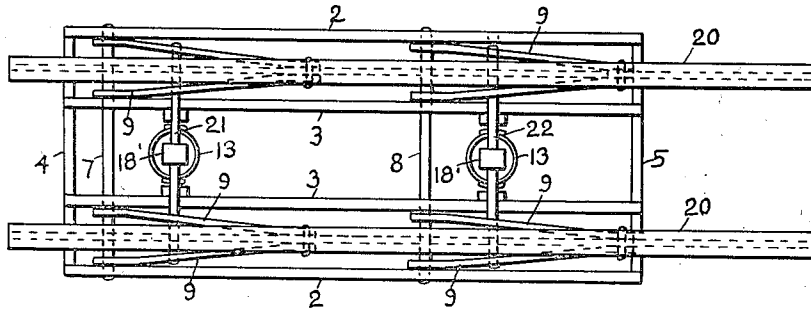


Fig. 5

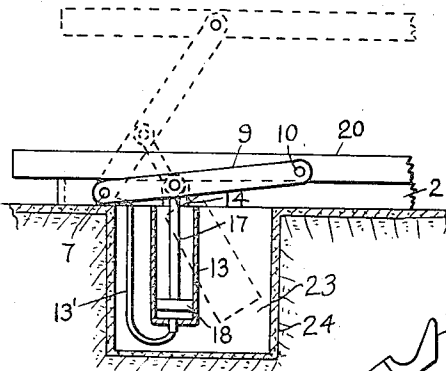


Fig. 6

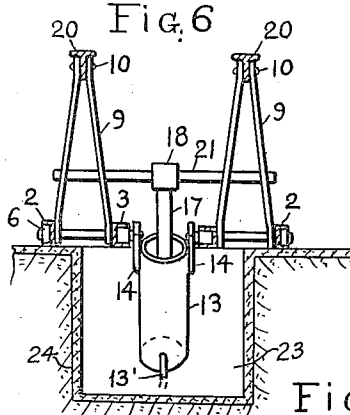


Fig. 9

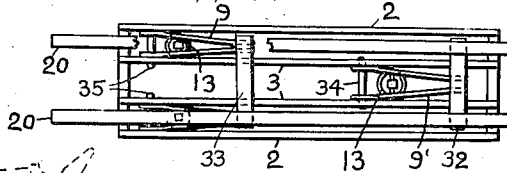


Fig. 7

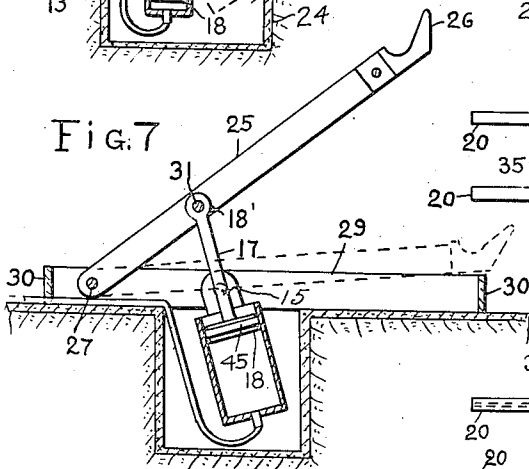


Fig. 10

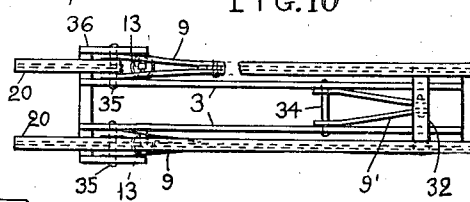
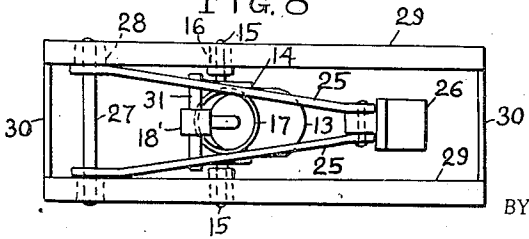


Fig. 8



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2,340,764

LIFTING DEVICE

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Application November 30, 1940, Serial No. 367,970

1 Claim. (Cl. 254—91)

My invention relates to lifting devices and has particular reference to devices for lifting relatively large objects such as automotive vehicles.

This is a continuation-in-part of my application Serial No. 292,397, filed August 29, 1939, patented May 21, 1941, as Patent No. 2,242,433.

In my foregoing patent application I have disclosed a lift employing arms having rails at the upper ends for lifting automotive vehicles, the lifting power being furnished by an air cylinder pivoted to the frame and operating a piston pivoted to an arm.

My present invention has for its object to provide a lifting device employing my type of air cylinder and which can be used for lifting not only automotive vehicles, but also various other objects, the device in one of its forms having a flat platform pivoted to the arms.

In one of the modified forms of my device, I employ cylinders placed between two arms, the piston transmitting pressure to the arms through a transverse shaft or beam.

In another modification I employ a single arm with a cylinder for raising such objects as automotive vehicles at one end only.

For a motive power I employ a cylinder having extensions or tongues at the open end provided with trunnions on which the cylinder is rotatively mounted. With this arrangement the pivoting point is always located between the piston and the piston rod pivoting point, the cylinder being therefore self-aligning with respect to the piston and piston rod.

My invention is more fully described in the accompanying specification and drawings, in which:

Fig. 1 is a sectional elevational view of one form of my lifting device;

Fig. 2 is a top plan view of the same partly in section;

Fig. 3 is an end view of the same partly in section;

Fig. 4 is a top plan view of a modified device;

Fig. 5 is a fractional elevational view of the same;

Fig. 6 is a sectional end view of the same;

Fig. 7 is a sectional elevational view of another modification;

Fig. 8 is a top plan view of the same;

Figs. 9, 10 and 11 are plan views of three modifications;

Fig. 12 is a detail view of a modification shown in Fig. 11;

Fig. 13 is a detail view of another modification.

My lifting device, as shown in Figs. 1, 2 and 3, consists of a frame forming a base of the device and placed on the floor 1. The frame is formed of two pairs of longitudinally extending beams 2 and 3 joined together at the ends with cross-beams 4 and 5. The beams 2 and 3 have bearings 6 for rear and front shafts 7 and 8 support-

ing lower ends of arms made of beams or bars 9. The upper ends of the bars are drawn together and are pivoted at 10 to brackets 11 supporting a lifting platform 12.

Each pair of beams or bars 9 represents a lifting arm and is provided with a motor for raising the same. The motor may be made in the form of an air cylinder with a piston as shown in the drawings. The cylinder 13 has an open upper end and closed lower end and is provided with tongues or ears 14 extending upward from the open end. The tongues mount trunnions 15 at their ends, the trunnions being journaled in the frame beams 2 and 3. A rod 17 is rigidly connected to the piston 18 and has a bearing 18' forming a pivotal connection with a shaft 19 fitted in the intermediate portions of the beams 9 of the lifting arms. Compressed air or other fluid under pressure is admitted into the cylinder 13 by a flexible pipe 13' for raising the piston, thereby raising the corresponding arm. Every arm may be provided with a motor as shown in the drawings, although, of course, two or even one motor may be employed, in view of the fact that the rear and front arms are connected together with the respective shafts 7 and 8, the upper ends of the arms 9 being all connected by the platform 12, so that the lifting force developed by any one cylinder is equally distributed to all the other arms.

A modified construction is shown in Figs. 4, 5 and 6. The arms are pivoted at the top to rails 20 for lifting automotive vehicles by their axles. The rear arms are connected together by a shaft 21 passing through the intermediate portions of the beams 9, the front arms being connected by a similar shaft 22. The two shafts are pivoted in the middle to the upper ends 18' of piston rods 17 extending from the pistons 18 in the cylinders 13. Compressed air is admitted by flexible pipes 13'. With the central arrangement of the cylinders the lifting force is more uniformly distributed to the two lifting rails 20. Pits 23 are provided for the cylinders, their walls being lined with cement or concrete 24.

Another modification is shown in Figs. 7 and 8. A single lifting arm is provided formed of two beams 25 rigidly connected together at the top to a lifting hook 26, which may be used for lifting an axle of an automotive vehicle. The lower ends of the beams are connected to a shaft 27 journaled in bearings 28 in the beams 29 forming a base. The beams 29 are joined at the ends with cross-beams 30 into a rectangular frame. A shaft 31 is supported in the intermediate portions of the beams 25, its middle portion being journaled in a bearing 18' of a piston rod 17 extending from a piston 18 in the cylinder 13. The latter is also preferably of a self-aligning type, having tongues 14 with trunnions 15 journaled in bearings 16 supported on the beams 25.

Another modification is shown in Fig. 9, representing a lifting device with two rails 20 supported on two rear arms formed of bars 9 and one front arm formed of bars 9'. The arms are operated by air cylinders 13 with pistons, the upper ends of the arms being pivoted to beams 32 and 33 supporting the rails 20.

It should be noted that the lift will operate satisfactorily even without the front cylinder for the arm 9'—9' at the front, as shown in Fig. 10. The three-arm support for the rails 20 as shown in Figs. 9 and 10 has an advantage in that the operation of the side cylinders 13 is synchronized, since one rail cannot be raised ahead of the other, because of the connecting equalizing bars 32 and 33. For this reason, the common shaft 7, Fig. 4, may be replaced by separate short shafts 35, Figs. 9 and 10.

It is understood that the terms "rear arms" and "front arm" or "front arms" are used in a relative sense, and it is evident that one rear arm may be also used with two front arms, and any one or more of the arms may be provided with a lifting motor or motors in any practical combination of these elements.

A modified lift is shown in Fig. 10. The lifting force is furnished by the rear cylinders only, there being no cylinder under the front arm. A simplified frame has inner beams 3 and short outer beams 36.

Another modification is shown in Figs. 11 and 12. The base is divided into two portions, 37 and 38, each portion supporting a shaft 35 of the arms 9—9 and 9'—9'. The upper ends of the arms are pivoted at 39 to brackets 40 attached to cross beams 41 supporting rails 20.

In certain applications (Fig. 13) it is desirable to raise the pivoting shafts or pins 39 above the rails 20, mounting them on brackets 42 on top of the cross-beams 41. Such an arrangement provides for an increased initial angle of the arms 9 and 9', thereby rendering the parallelogram structure more rigid at the beginning of the lift. Otherwise, especially when raising a vehicle by its wheels ("drive-on type"), any lack of synchronism in raising front and rear arms will produce heavy longitudinal or buckling strains on the structure.

It will be understood that in any of the above constructions, if more than one motor is used, the fluid supply lines to the individual motors may be connected to the fluid supply source in such way that fluid under pressure is supplied to all the motors simultaneously.

In order to limit the upward movement of the piston, the cylinder may be provided with a projection 43 at the inner wall, as shown in Figs. 1 and 2.

It will be noted that in the above construction, no guiding device is provided between the open end of the cylinder and the piston rod. Heretofore, in constructions of this kind, such a guiding device was deemed necessary, attention being called, for example, to Meyers Patent No. 1,488,267, dated March 25, 1924.

I have discovered that the cylinder and piston rod will inherently tend to assume substantially true alignment without requiring any special guiding devices between the open end of the cylinder and the piston rod, provided the proper relationships between the piston rod and the cylinder pivot points and the piston and cylinder are observed. For example, as shown in Fig. 7 of the drawings, this self-centering or self-aligning action is obtained when the piston

18 and the piston rod pivot 31 are located on opposite sides of the cylinder pivot 15.

This principle does not depend upon any non-yielding telescoping or guiding engagement between piston and cylinder walls. In fact, it is desirable to permit slight canting or relative angular movement between the axes of the piston rod and of the cylinder. With a rigid connection between the piston rod 17 and piston 18, this canting or tilting must take place between the piston and cylinder. As shown diagrammatically in the drawings, a resilient washer 44, Figs. 1 and 3, is attached to the piston 18, or a resilient ring 45 may be provided at the piston 18, Fig. 7, for flexible engagement with the cylinder wall 13 to insure a fluid tight seal at all times.

As above stated, the load applied to the lift together with the fluid pressure normally acting between piston and cylinder always tend to place the piston rod and cylinder in aligned relation. However, I have found from actual tests that under certain conditions the cylinder 13 may sag somewhat, i. e., may depart somewhat from its central or aligned position with respect to the piston rod. This effect is most noticeable under a light load and with the cylinder and piston inclined somewhat from the vertical, as shown, for example, in Fig. 7. This slight sagging is due to the dead weight of the cylinder and piston acting transversely to the forces exerted by the fluid pressure on the piston and has no detrimental effect whatsoever on the normal operation of the lift.

The present invention gives rise to a number of important advantages. The elimination of the guiding devices between the piston rod and the open end of the cylinder not only lessens the cost of construction but greatly improves the operation of the lift. The elimination of these guiding devices permits complete freedom of self-aligning action. The relative position of the several parts is then determined solely by the application of gravitational and fluid pressure forces. The absence of the guiding devices eliminates all possibility of binding due to the tendency of the cylinder to sag, or due to any misalignment in the guiding devices themselves.

It is understood that my lifting device may be further modified without departing from the spirit of the invention, as set forth in the appended claim.

I claim as my invention:

A lifting device comprising a frame forming a base, front and rear arms pivotally mounted on the frame along its middle axis, each arm being formed of two beams converging at one end so as to form an approximately triangular shape, cross-bars pivotally connected to the upper ends of the arms, two rails rigidly supported at the outer ends of the cross-bars adapted to move in a parallel relation with the base for supporting a load, cylinders pivotally supported at their upper ends on the base under the arms and extending below the base, pistons slidably fitted in the cylinders operatively connected to the middle portions of the arms, and means to admit a fluid under pressure into the cylinders for raising the arms with the rails the pistons being free to have angular motion with respect to the cylinders, each cylinder with the piston being positioned between the beams of the respective arm.

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