

E. P. GRIME
LIFTING APPARATUS

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Fig. 1.

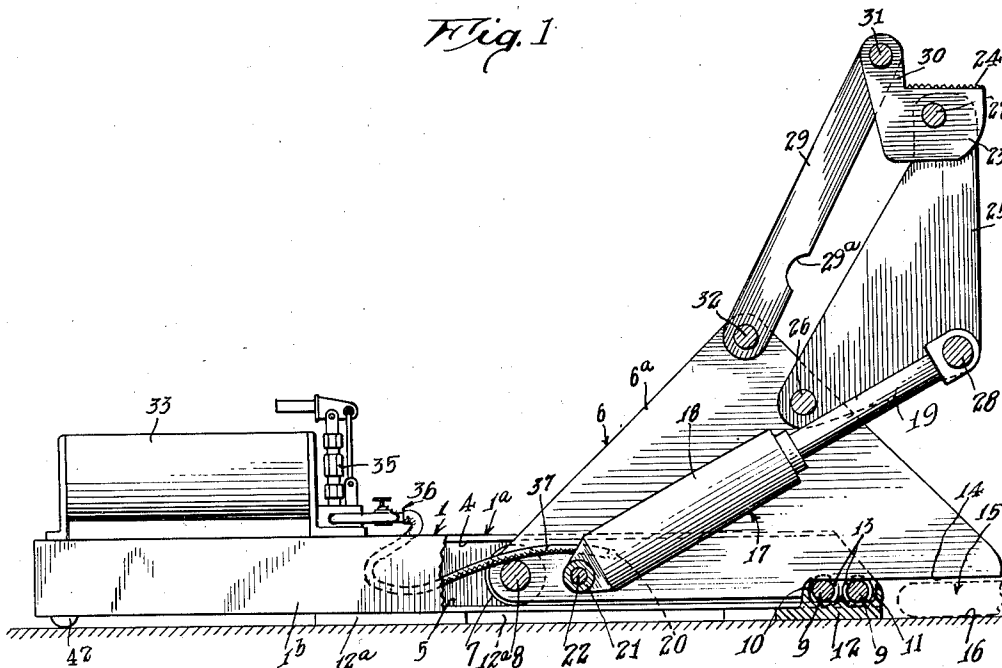
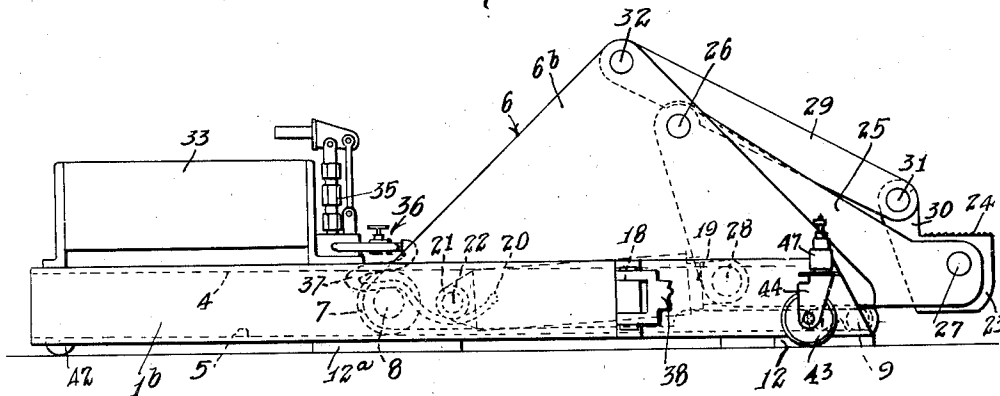


Fig. 2



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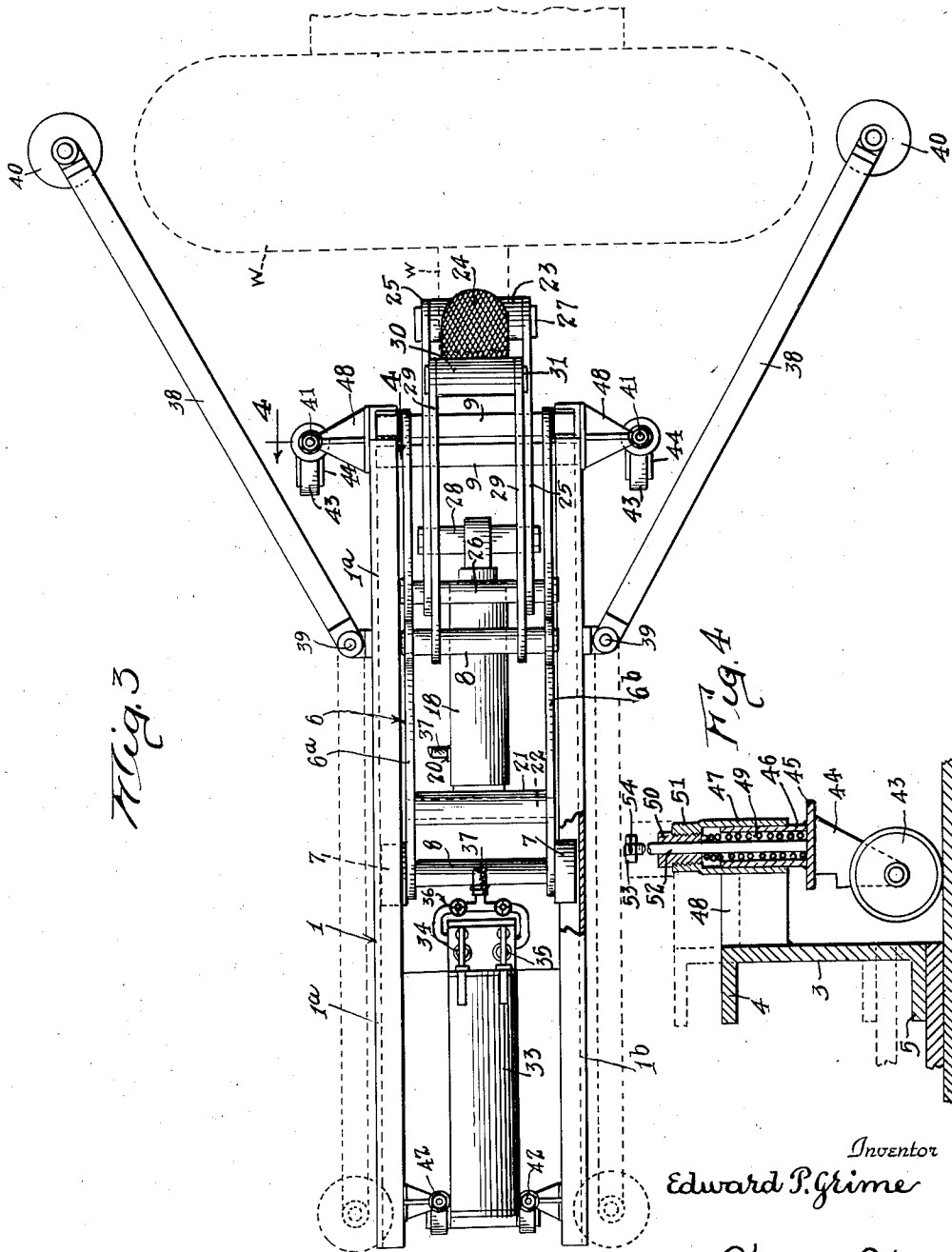


Fig. 3

Fig. 4

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LIFTING APPARATUS

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9 Claims. (Cl. 254—10)

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This invention relates to lifting apparatus of the general types popularly known as jacking apparatus or jacks, and while lifting apparatus embodying this invention is capable of uses in many situations for raising a load, in the present specification the invention is described as applied to a jack for application to the hub or outside arm of the landing wheel of an airplane. Used in this way, two of these jacks can be applied for lifting the landing wheels of an airplane off the ground, to raise the airplane body for servicing the landing wheels, and this jack is also very useful in lifting one of the landing wheels only, off of the ground, for facilitating changing its tire in case it has become flat.

One of the objects of this invention is to provide a lifting apparatus with simple construction, which is capable of lifting a load through a considerable height, although taking the same from a point quite near the ground.

Another object of the invention is to provide a lifting apparatus in which, as the load is raised, a carriage on the frame of the apparatus, that lifts the load, will move in automatically toward a point under the seat for the load on the lifting apparatus.

Portability in a lifting apparatus of this type is most advantageous, and for this reason one of the objects of the invention is to provide simple means including wheels or rollers on which the frame of the lifting apparatus can be trundled to any point desired, and at the same time, to mount these wheels on the frame in such a way that when the load is applied on the load-seat of the apparatus, the frame of the apparatus will descend to the ground level, and be supported directly on the ground.

In the present specification, the invention is described with a construction adapting it to be applied with the frame of the apparatus extending in a plane transverse to the plane of the wheel that is to be lifted; and one of the objects of the invention as applied to this special purpose, is to provide a construction which will enable the carriage on the jack frame, and which supports the load, to advance automatically as the load is lifted, so as to bring the carriage nearly or substantially under the point of application of the load thrust at the load-seat of the apparatus; also to construct the apparatus and particularly the carriage, in such a way that the presence of a flat tire on the wheel that is to be lifted, will not interfere in any way with the operation of the lifting apparatus.

Another object of the invention is to provide

the frame of the apparatus with simple means for increasing its stability under the action of the load, and to provide means whereby the point of application of the load thrust to the lifting apparatus, will be brought within the area encompassed by the points of support for the frame.

Another object of the invention is to provide lifting apparatus of this type with a carriage guided on the frame to advance automatically toward a position under the load when the load is lifted, and to provide such a carriage with fluid-operated lifting means to which an operating connection is maintained in any position the carriage may assume.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient lifting apparatus.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawings:

Fig. 1 is a view showing a portion of the apparatus in side elevation, a portion of the view being broken away so as to show the remainder of the apparatus as viewed in vertical longitudinal section. This view indicates the apparatus in its extended position, that is, in a relation which the parts of the apparatus will assume when supporting a load in an elevated position.

Fig. 2 is a side elevation of the apparatus illustrated in Fig. 1, and showing it in its folded or unextended position ready to take a load at a lower elevation, and raise it to a higher elevation such as illustrated in Fig. 1.

Fig. 3 is a plan view illustrating the lifting apparatus in a position of rest ready to take the load and lift it; in this view one of the landing wheels of an airplane is indicated in dotted outline, together with the hub or arm that projects over the load-seat on the apparatus. This view also illustrates frame extensions in a position to stabilize the apparatus and the action of the load. These extensions in Fig. 3 are illustrated as having a joint connection to the frame, which enables them to be folded against the side of the frame when not in use, and in this position they are indicated in dotted outline. In this view a portion of one of the side bars of the frame is broken away and shown in section, to illustrate more fully the means for guiding the

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rear end of the carriage on the frame of the apparatus.

Fig. 4 is a vertical section upon an enlarged scale, taken about on the line 4—4 of Fig. 3, and particularly illustrating the means for mounting the wheels on the frame, which enables the frame to descend relatively to the wheels under the action of the load. In this figure for the purpose of illustration, the bracket carrying the wheel, and the wheel itself, is shown in a different position from that in which it is illustrated in Fig. 3; in other words, in Fig. 4 the wheel is shown in a plane disposed substantially at right angles to the plane in which it is illustrated in Fig. 3.

In practicing the invention, I provide a frame 1, which is preferably constructed of two side bars 1a and 1b, which are disposed parallel with each other so as to form an elongated frame, and these two side bars are preferably formed of channel iron with vertical webs 3 and horizontal upper and lower flanges 4 and 5.

These flanges 4 and 5 are adapted to constitute a guide for a carriage 6 that is preferably composed of two side plates 6a and 6b corresponding to the two side bars of the frame, and located just inside their inboard edges. These side plates 6a and 6b are preferably substantially of triangular form, and at the rear end of the carriage 6 I provide guide rollers 7 that roll on the bottom flange 5, being located on the outer sides of the side plates 6a and 6b and carried on the ends of a transverse tie rod or shaft 8 that connects the two side plates.

At the forward end of the frame 1 I also provide means for guiding and supporting the forward end of the carriage 6, and this guiding means preferably includes one or more transverse rollers 9 that are mounted to rotate freely in sockets 10 and 11 that are formed on the upper side of foot plates 12 that are welded to the under sides of the side bars 1a and 1b at their forward ends. These rollers have circumferential grooves 13 in them, that receive the lower edges 14 of the forward end of the side plates 6a and 6b. This keeps the rollers in position, and these edges 14 are of course elevated by reason of the presence of the rollers, so as to form a clearance space 15 between the ground line 16, and the edges 14. This space is provided to give clearance for a flat tire on a landing wheel when the jack is used to jack up such a wheel for servicing its tire.

Mounted on the carriage and preferably centrally between the side plates 6a and 6b, I provide power-actuated means 17 which preferably consists of a fluid-operated cylinder 18 having a piston rod or plunger 19 that can be extended from the cylinder when the operating fluid is admitted through a connection located at the point 20 near the inner end of this cylinder. The inner end of the cylinder is provided with an integral transverse sleeve 21 that is mounted for rotation on the horizontal axis of a transverse tie bar 22 connecting the side plates 6a and 6b. The forward end of the plunger 19 is connected to a block or a load-seat 23, and has a horizontal face 24 to be placed under the point of application of the load, for example, under the outboard arm w of the landing wheel W indicated in dotted lines in Fig. 3. The face 24 should be knurled to prevent its slipping.

Means is provided for effecting this connection, which will enable the load-seat to be lifted, and at the same time maintain its seat face 24 in a

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substantially horizontal plane. For this purpose I prefer to employ a lever plate 25 which is of substantially triangular form as shown. There is, of course, one of these lever plates 25 at each side, and each of these lever plates is mounted for rotation on a transverse tie bar 26 that connects the side plates 6a and 6b. The upper ends of the lever plates 25 are attached by a common pivot pin 27 to the load-seat 23. The forward end of the plunger 19 is also attached by a transverse pivot pin or wrist-pin 28 to the lever plates 25.

In order to maintain the load-seat 23 with its seat face 24 in its horizontal position during all the swinging movement of the levers 25, I prefer to provide a parallel moving connection which, in the present instance, includes a link 29, the longitudinal axis of which is parallel to the line that connects the axes of the two pins 26 and 27. In order to give this link 29 the desired length, and also at the same time, to give the load-seat 23 the form of a "chair," I provide the rear side of the load-seat with an upwardly extending neck 30, and the upper ends of the links 29 are pivotally attached to the upper end of this neck by a common pivot pin 31. The lower ends of the links 29 are pivotally supported on a transverse tie rod 32 that connects the side plates 6a and 6b of the carriage at the upper apex of these plates.

Fig. 2 illustrates the relative position of the parts of the lifting mechanism of the jacks when they are in their position of rest, at which time the lifting face or seat face 24 of the jack, will be in a depressed position and quite close to the ground line 16, close enough to enable the face to be thrust under the projecting arm or hub w. In the present drawing, the link 29 is formed with a clearance socket 29a to permit the link to clear the upper side of the tie bar or tie pin 26 (see Fig. 2).

The operating fluid for actuating the plunger 19 may be supplied to the cylinder 18 by any means, including a hose leading from the fluid supply or reservoir, but I prefer to supply the operating fluid from a reservoir or tank 33, under pressure from either one of two pumps 34 and 35. These pumps are located alongside of each other on the frame (see Fig. 3), and their plungers are preferably of different diameters so that one of them can be used at first for commencing the lifting of the load when the jack is in its position of rest shown in Fig. 2. This will require less pressure in the cylinder 18, because there is a relatively greater lever arm between the pivots 26 and 28 than when the upward movement has nearly reached its maximum. The pump with the smaller diameter of piston would be used at that time. Each of these pumps is provided with an outlet connection at the side as indicated at 36, from which a hose 37 leads over to one side of the cylinder, for example, at the connection 20 already referred to. These connections and hose are omitted in Fig. 3, although they are illustrated in Figs. 1 and 2.

The hose 37 is, of course, long enough to enable it to maintain its connection to the inner end of the cylinder 18, even when the carriage is moved out to its extended position as indicated in Fig. 1; in other words, this hose accommodates itself to the travel of the carriage 6 in and out in the operation of the jack, and it should be noted that by reason of the parallel movement of the connection including the lever plates 25 and the links 29 cooperating with the traveling carriage, the load-seat or block 23 will move up in a straight line,

In order to steady this jacking apparatus, I prefer to provide the frame 1 with extensions 38 (see Fig. 3), which are preferably pivoted to the outer sides of the frame bar 1a and 1b on suitable vertical pins 39. When the jack is run in under the arm w to lift the wheel, these extensions 38 should extend forward so that feet 40 attached to their forward ends, will rest upon the ground at points beyond the load-seat 23 with respect to the rear end of the jack. In the present instance, these feet 40 are located substantially in the medial plane of the wheel, and this arrangement provides a three-point support for the jack upon the ground, of substantially triangular form, and within this area and near its middle, the line of vertical thrust of the load on the jack is located.

When the extensions 38 are not being used in this way, they are folded back in the position in which they are indicated in dotted lines in Fig. 3.

This jack is made portable by providing four supporting wheels at separated points, that is to say, at two points 41 at the forward end of the jack, and at two points 42 near the rear end of the jack. The manner of mounting the wheels at all of these points, is substantially the same, and is illustrated in detail in Fig. 4. The construction is such that when there is no load on the jack, the wheels will support the jack frame at a sufficient distance above the ground to enable the jack to be trundled about and brought up and set in position for lifting the load.

Referring now to Fig. 4, the wheel 43 is mounted as a caster wheel, being carried on a downwardly extending wheel bracket 44 formed integral with a disc-form head 45. This head 45 is provided with an integral sleeve 46 that telescopes inside of a sleeve-form guide 47, and this guide is carried at the outer end of a bracket 48 that is welded to the outer side of the web 3 of the adjacent side bar 1a or 1b.

Resilient means is provided for normally holding the frame in an elevated position, and this preferably consists of a coil spring 49 that is carried within the sleeve 46. The lower end of the spring thrusts against the upper face of the disc head 45, and the upper end thrusts against the screw cap 50 attached to a socket head 51 welded onto the upper end of the guide sleeve 47. In order to limit the upward movement of the frame by the springs 49, each wheel assembly includes a stem 52 that extends up from the center of the disc head 45 and passes through the screw cap 50 so as to extend a short distance above the same, where it is provided with a nut 53 that is held in a fixed position on the stem 52, by a check nut or a split pin 54. In the operation of the jack of course when the load is exerting its force on the load-seat, the springs 49 will all be compressed, and the jack frame 1 will move down to the ground level where the foot plate 12 and a similar rear foot plate 12a will rest upon the ground.

The jack frame will be provided at a suitable point with a handle (not illustrated) for trundling it into position.

Many other embodiments of the invention may be resorted to without departing from the spirit of the invention.

What I claim is:

1. In lifting apparatus, the combination of a frame, a carriage guided for movement on the frame, a load-seat for engaging under the load that is to be lifted, power-actuated means mounted on the carriage, connected with the carriage and the load-seat for lifting the load, all of said parts cooperating to advance the carriage

on the frame toward a point under the load when the load is lifted, and means at the forward end of the frame below the load-seat for supporting the forward end of the carriage.

2. Lifting apparatus according to claim 1, in which the means at the forward end of the frame for supporting the forward end of the carriage, includes a roller with the lower edge of the carriage rolling on the upper side of the roller and supported by the roller in an elevated position above the ground level.

3. Lifting apparatus according to claim 1, in which the power-actuated means mounted on the carriage, includes a hydraulic cylinder; and including a reservoir supported on the frame, for the operating liquid for the cylinder, a pump for pumping the operating liquid from the reservoir to the said hydraulic cylinder, with means including a hose connection for conducting the liquid from the pump to the cylinder, and maintaining the connection to the cylinder in any position that said carriage may assume.

4. In lifting apparatus, the combination of an elongated frame, a carriage including a pair of side members disposed in a substantially vertical plane, transverse tie bars connecting said side members to form a carriage, means for guiding said side members to move forward and back longitudinally along said frame, a hydraulic cylinder located between said side members with a transverse bar connecting said side members and pivotally supporting the said cylinder adjacent its inner end, a lifting lever pivotally supported on each of said side members, said cylinder having a plunger pivotally connected with said side levers for swinging the same upwardly on their pivotal support, a load-seat pivotally carried on said side levers, and means for supplying operating fluid to the hydraulic cylinder, all of said parts cooperating to raise the load on the load-seat and advance the carriage into a position under the load-seat as the load-seat becomes more and more elevated.

5. In a lifting apparatus, the combination of a frame, a carriage guided for movement on the frame, a load seat for engaging under the load that is to be lifted, a power actuated means mounted on the carriage connected with the carriage and the load seat for lifting the load, the said parts cooperating to advance the carriage on the frame toward a point under the load when the load is lifted, and means for supporting the frame to provide a three point support therefor including frame projections extending forward from the frame and resting upon the ground at points beyond the location of the load seat, and means at the forward end of the frame below the load seat for supporting the forward end of the carriage.

6. In a lifting apparatus, the combination of a frame, a carriage guided for movement on the frame, a load seat for engaging under the load that is to be lifted, a power actuated means mounted on the carriage connected with the carriage and the load seat for lifting the load, the said parts cooperating to advance the carriage on the frame toward a point under the load when the load is lifted, means for supporting the frame to provide a three point support therefor including frame projections extending forward from the frame and resting upon the ground at points beyond the location of the load seat, said frame projections being pivotally mounted on the frame to swing about substantially vertical axes to and from load supporting position, and means at the

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forward end of the frame below the load seat for supporting the forward end of the carriage.

7. A lifting apparatus comprising: a carriage structure; a load lifting element; parallel lever means linking said load lifting element and carriage; a power unit connected between said lever means and carriage to elevate said load lifting element; a frame structure for supporting said carriage structure, said frame structure adapted to occupy a fixed position during operation of said load lifting element, there being roller elements between said structures to permit movement of said carriage structure relative to said frame structure under said load lifting element as said load lifting element is raised.

8. A lifting apparatus as set forth in claim 7 in which: said carriage structure is substantially triangular in form and the lever means are connected thereto adjacent the apex of said structure; and said lifting element is movable between a position forwardly of said carriage below its apex to a position above said carriage structure.

9. A lifting apparatus comprising: a carriage structure; a load lifting element; parallel lever means linking said lifting element and carriage; a power unit connected between said lever means and carriage to elevate said lifting element; said load lifting element being movable from a posi-

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tion forwardly of said carriage structure to a position above said carriage structure; a frame structure for supporting said carriage structure; roller elements carried by the forward extremity of said frame structure, and other rollers carried by said carriage structure to permit forward movement of said carriage structure under the load lifting element as said element is raised.

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