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ARCED-LIFT JACK

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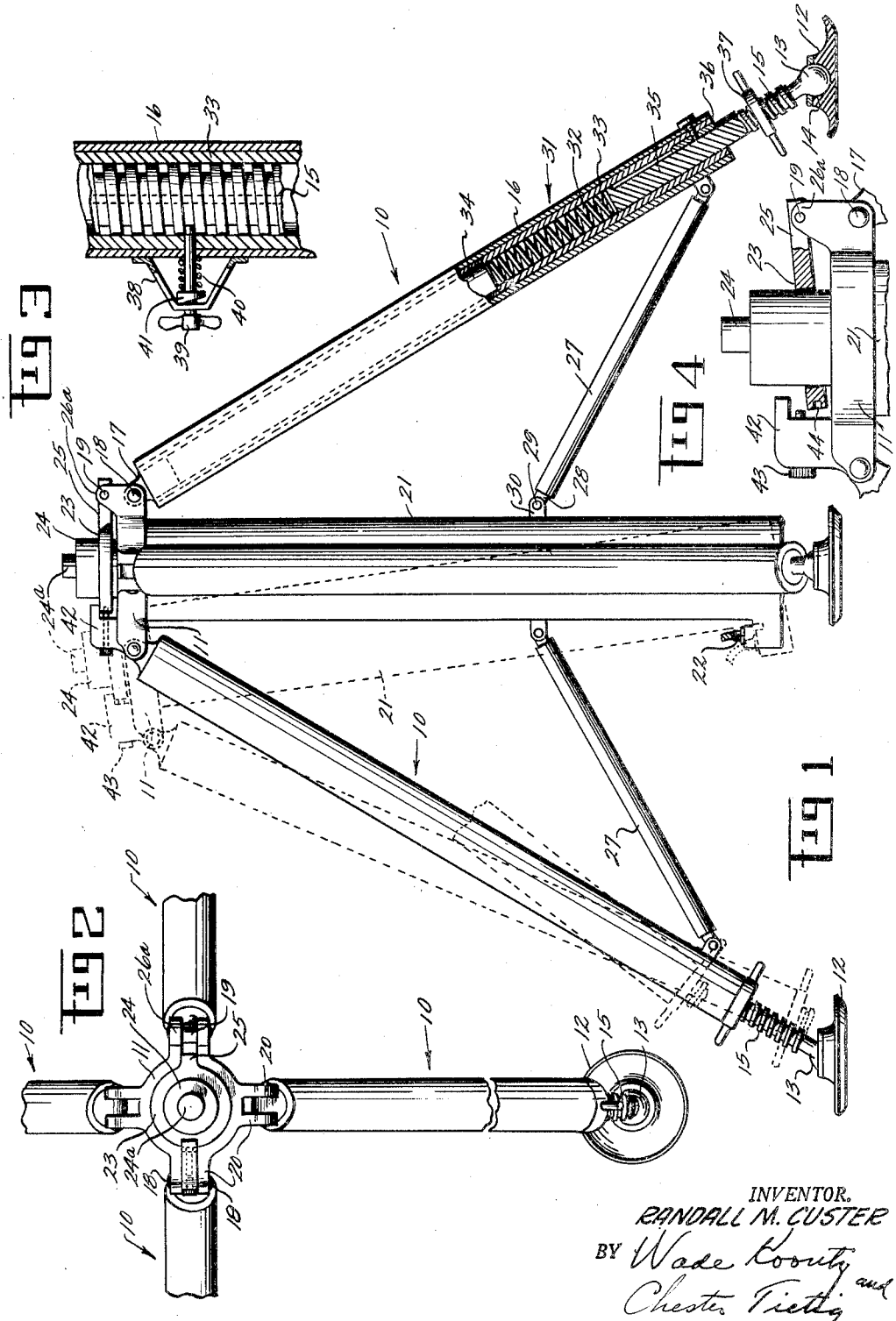


Fig 3

Fig 4

Fig 1

Fig 2

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ARCED-LIFT JACK

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5 Claims. (Cl. 254—93)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to a lifting jack, particularly of the kind intended for the servicing of airplanes. It differs from previously known jacks in that the jack point or lifting point normally describes an arc when the jack is operated to raise a load. Such a jack is useful to raise and shift simultaneously a load for the purpose of resting the load upon blocks or other support which may be outside the normal vertical axis of the jack or, in an extreme case, even outside its base line.

In the past when loads were to be raised and shifted, they were first jacked up and then levered over so that they would usually topple on to the supports previously arranged for them. Occasionally they could be levered over without any toppling, depending upon the weight of the load. In case of a very heavy load such as a building, horizontal jacks were used as well as vertical ones. Hinged jacks such as those of Wood, U. S. Patent No. 1,505,118 and Morgan 1,693,040 were known so that the load could be pushed to where it was wanted without leaving the jack point until it was about to be received on the new support. Tompkins, U. S. Patent No. 796,541 provided a shifting cylinder for power operation at the top of his hinged jack to avoid hand-levering of the load. No one however, to my knowledge, has made a jack which can follow the arcuate or shifting travel-path of the load.

One object of the invention is to provide a jack, the use of which will permit deviation from the normal vertical axis of the jack by the load, thereby eliminating the harmful effect of stresses on the jack supports or legs.

Another object is to provide a jack of the character described in which a high lift can be incorporated, thus reducing the numer of lifting stages.

Another object is to provide a multiple-legged jack that is self-leveling when not loaded.

Another object is to provide leg locks for the purpose of conferring rigidity on the jack after a lift has been completed. Other objects will be hereinafter apparent to those skilled in the art.

In the drawings:

Fig. 1 is an elevation, partly in section, showing my jack mounted for use. Dashed lines show the position of the jack point that may be occupied in respect to the vertical axis. The dashed lines of this figure show the jack axially;

Fig. 2 is a partial plan view of the jack opened and mounted as in Fig. 1;

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Fig. 3 is a detail, partly in section, of a lock which may be applied to one or more extensible legs of the jack; and

Fig. 4 is a detail, partly in section, of the top of the jack showing the action of the locking ring on the ram in case of hydraulic failure.

The jack comprises four equi-spaced legs 10 all being hingedly attached to a jack-point plate 11. Each leg rests upon a base 12. Each base 12 receives a ball 13 in a hemispherical depression 14. The ball 13 on two of the legs 10 constitutes the foot of a screw 15 which constitutes a leveling device for its leg 10. There is no screw 15 on the remaining legs 10, which are opposite each other. The mechanism for each screw-extensible leg is enclosed within an outer sleeve 16. Each leg 10 is connected by a lug 17 to one of four pivots 18 to the jack-point plate 11, each pivot extending through a clevis 20. The jack-point plate 11 has a hinge point 19 for the purpose of attaching a ram-locking ring 23.

A hydraulic cylinder 21 is the actuating element of the jack. It may however be replaced by a central lifting screw or a ratchet lift since these mechanisms are well known equivalents of a hydraulic cylinder in the art of jack building. The hydraulic cylinder has an internal ram 24 which may be lifted by pumping thereunder through an inlet 22 hydraulic fluid in appropriate amount. The top of the ram terminates in a tip 24*a* and extends through a ring 23 which is provided with a lug 25. The latter is attached by a pin 19 which extends through a clevis 26 which encloses a portion of the lug 25. It will be noted that this attachment connects the locking ring 23 with one of the legs 10 which contain a screw 15 and an internal sleeve 16. The object of the construction is to provide support against bending moments on the ram. Such support is also given by the ring 23.

Between each leg 10 and the central hydraulic cylinder 21 there is a strut 27 which terminates at each end in a flat lug 28. A pivot 29 secures the lug 28 through a clevis 30, thereby hingedly attaching the strut 27 to both the leg 10 and the hydraulic cylinder 21. The attachment point is higher on the cylinder than on the legs. The jack may be folded when not in use by first loosening one attachment point of each strut 27 by removing the pivot 29. The function of the struts 27 is to prevent slippage of the legs under load.

Two of the legs 10 on opposite sides of the jack are provided with internal spring pads 31 or their equivalent hydraulic pads. The spring pads 31 comprise a heavy coil spring 32 contained in an

inner sleeve 33 and held between solid rod-like stop members 34 and 35. The compression of one of the coil springs in one leg 10 and the corresponding lengthening of the spring in the opposite leg provides compensation in leg length for the inequality of lead caused by an arcuate lift. The legs 10 in which the spring pads 31 are housed can however be locked against further compression or shortening by a jam nut 37 on the screw 15. This nut 37 when screwed up to abut a shoulder 36 at the end of sleeves 16 and 33 will effectively lock the leg.

The arcuate movement of the jack takes place so as to follow the inherent tendency of the load to move in an arc. For example, in changing a tire on a heavy bombing plane, this jack is placed under the wing close to the fuselage. When a lifting force is applied to the jack, the direction of arc will be toward the fuselage. Therefore, a leg containing a spring pad 31 should be placed in the direction in which the load will move when raised. The spring pad 31 in that leg will be compressed while the spring pad in the opposite leg will become correspondingly lengthened. When the load is to be held in position for any considerable length of time, the jam nuts 37 will be secured against the shoulders 36. When lowering the load, the hydraulic cylinder 21 will be emptied of hydraulic fluid in the conventional manner.

Referring to Fig. 3, an equivalent of the jam nuts 37 as locking means is illustrated. In this form a support 38 for a thumb revoluble pin 39 is welded to the sleeve 16. The pin 39 is arranged normally to project through sleeves 16 and 33 to the bottom of the thread of screw 15 to lock the latter. A collar 41 which has one plane and one inclined surface is tight on thumb-revoluble pin 39. Rotating pin 39 a quarter turn will disengage the thicker side of collar 41 from contact with the support 38. A coil spring 40 which encircles pin 39 is normally in compression, tending to urge collar 41 into contact with the inner surface of support 38. The collar 48 is wider than support 38, hence, when the thicker edge is turned a quarter turn, that edge will project beyond support 38. The compressed spring 40 will then push the inner end of pin 39 out of engagement with the thread of screw 15.

Referring to Fig. 4 the ram locking ring 23 is shown in a downwardly angled position instead of the horizontal position shown in Fig. 1. In the position shown in Fig. 4, the ring 23 will hold the ram after the hydraulic mechanism has failed. It will seize the ram in case of failure if it were in the position shown in Fig. 4 at the start of the lift. In order to allow the ram to descend without interference from the ring 23, the latter is held against a stop 42 by a screw 43 which extends through the stop 42 and can enter a hole 44 in the ring 23.

The invention claimed is:

1. In a lifting jack, a central lifting device, at least four legs arranged in a circumference about said lifting device, and yieldable pads in two opposite legs thereof, all of said legs being hingedly attached to said lifting deivce at substantially the top of said device and a screw in each pad-containing leg for adjusting the direction to which the jack can tilt during lifting.

2. In a lifting jack, a central lifting device, at least four legs arranged in a circumference about said lifting device and substantially concentric thereto, yieldable pads in two of said legs, the legs having said pads being oppositely disposed on opposite sides of said lifting device screw means in each pad-containing leg for adjusting the initial position of said pad and means on said legs for locking said legs against compression stresses tending to shorten the legs.

3. In a lifting jack capable of an arcuate lift, a central hydraulic cylinder, four legs hingedly attached to said cylinder substantially at the top thereof, spring pads in two of said legs and screw means in each pad-containing leg for adjusting the initial inclination of the jack and struts connecting substantially the lower ends of said legs with said central hydraulic cylinder at points higher than those at which the struts are connected to the legs.

4. In a lifting jack capable of an arcuate lift, a central vertical hydraulic cylinder, four legs hingedly attached to said cylinder substantially at the top thereof, a strut connecting the lower part of each leg with a point substantially intermediate of the height of said hydraulic cylinder, a compressible coil spring in each of two of said legs, said springs being contained in oppositely disposed legs, means in said legs and in contact with said springs for compressing the latter when the jack is under load and means for maintaining the length of the spring-provided legs, said means being adjustable while the jack is under load.

5. In a lifting jack capable of an arcuate lift, a central vertical hydraulic cylinder, a top plate on said cylinder, four legs hingedly attached at equal space intervals thereto, a raised point on said plate, a ring hingedly attached to said point so that said ring lies over said plate, means on the opposite side of said plate for optionally supporting the ring in a horizontal position or allowing it to rest on said plate at an angle thereto, and a hydraulic piston upwardly extensible from said hydraulic cylinder through said ring whereby, when support is withdrawn from one side of said ring, the ring will assume a cocked position about the piston to prevent lowering of the load supported by said piston.

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