United States Patent [19]

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[11] **3,746,307**

[45] **July 17, 1973**

[54] **LOAD LIFTING JACKS**

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[22] Filed: **June 23, 1971**

[21] Appl. No.: **155,736**

[52] **U.S. Cl.** **254/126**

[51] **Int. Cl.** **B66f 3/08,** B66f 3/36

[58] **Field of Search** ..... 254/126, 124, 8 R

[56] **References Cited**

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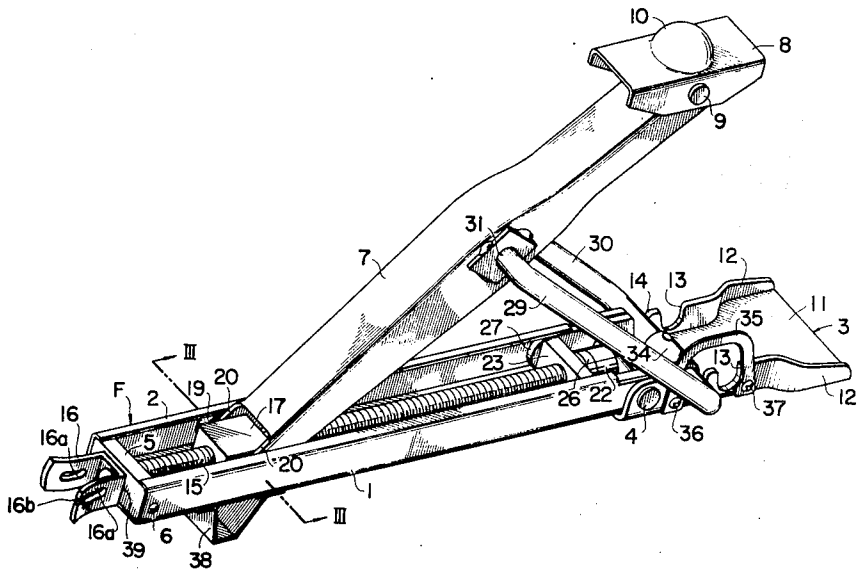
Primary Examiner—Othell M. Simpson

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[57] **ABSTRACT**

A load lifting jack comprising a pair of guide rails connected in parallel relation with each other by a pin and a connecting member at their both ends so that a rectangular frame is provided, a lifting arm carrying at its one end a load engaging head, a screw shaft rotatably supported within the frame, the screw shaft carrying thereon an internally threaded nut to which the lifting arm is pivoted at its one end, link members pivoted at their one ends with respect to the lifting arm at an intermediate position thereof, a base on which the pair of guide rails is pivotally mounted by the said pin, the base having one or more pairs of aligned notches on its flanged portions with which said one ends of the link members are selectively engageable, and a linking or supporting member which rotatably supports the screw shaft at its one end and inside of the frame but bears the thrust of the screw shaft.

7 Claims, 5 Drawing Figures



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SHEET 1 OF 4

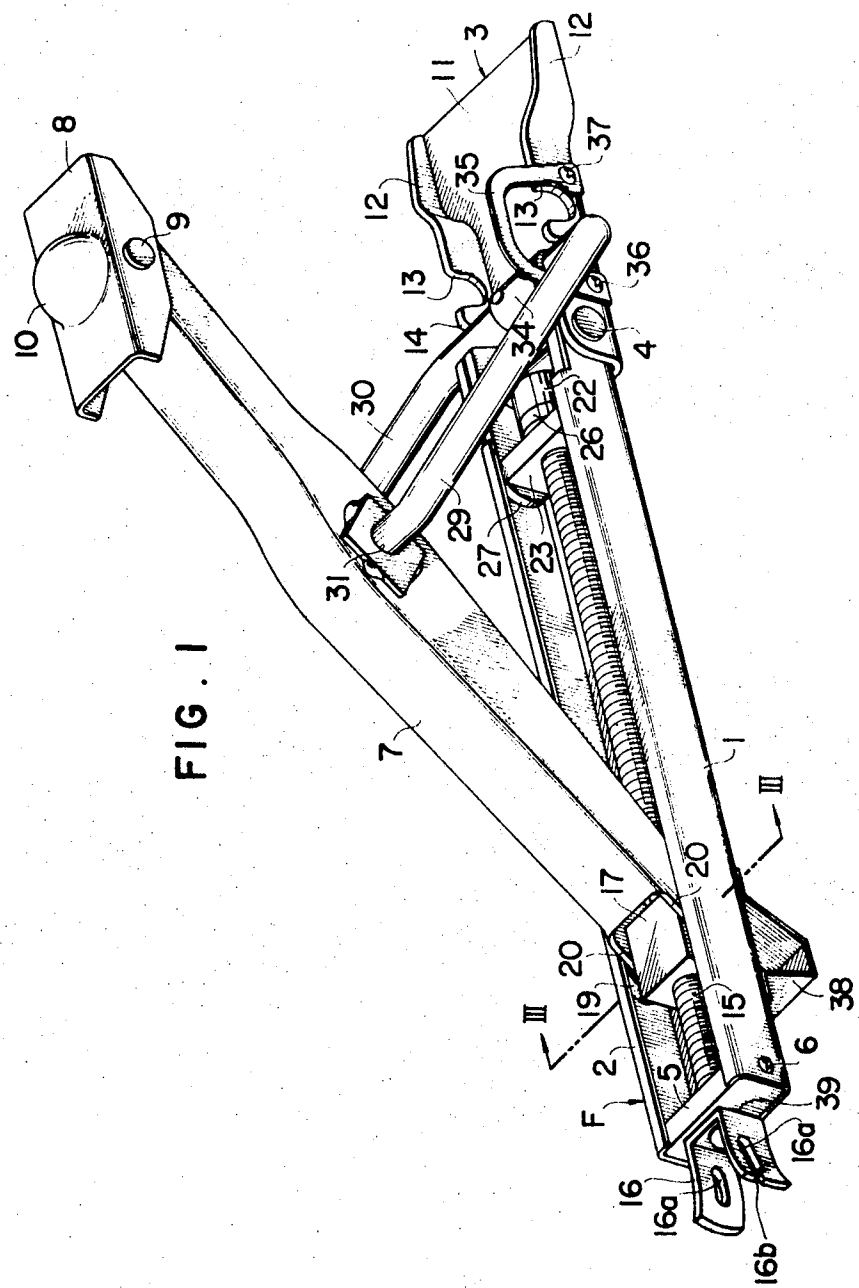


FIG. 1

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FIG. 2

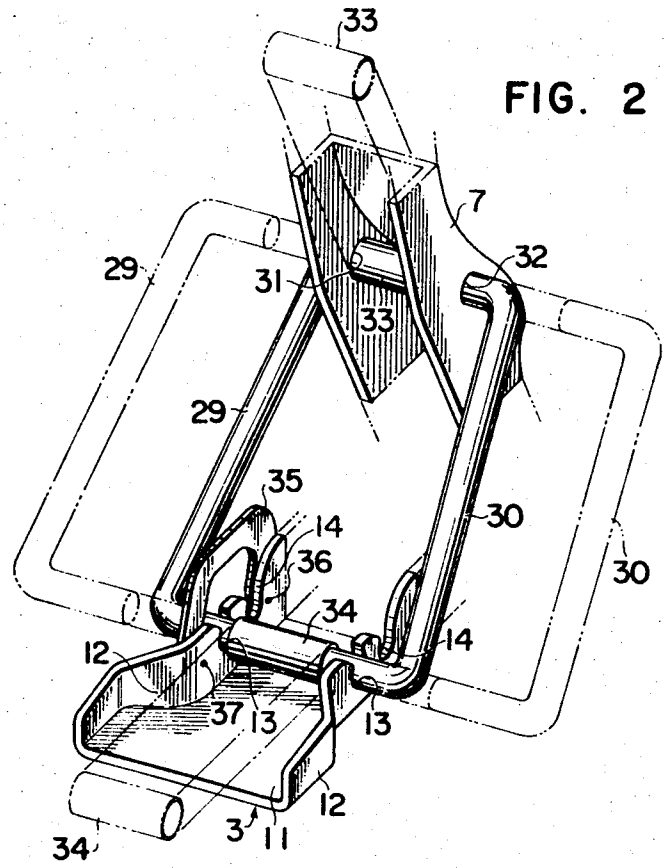
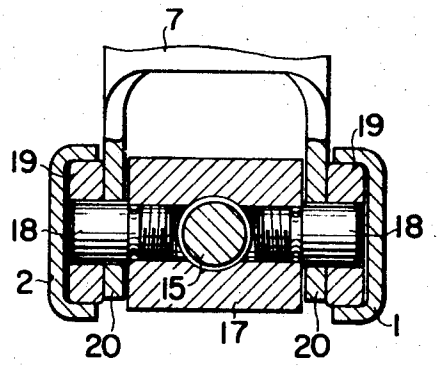


FIG. 3



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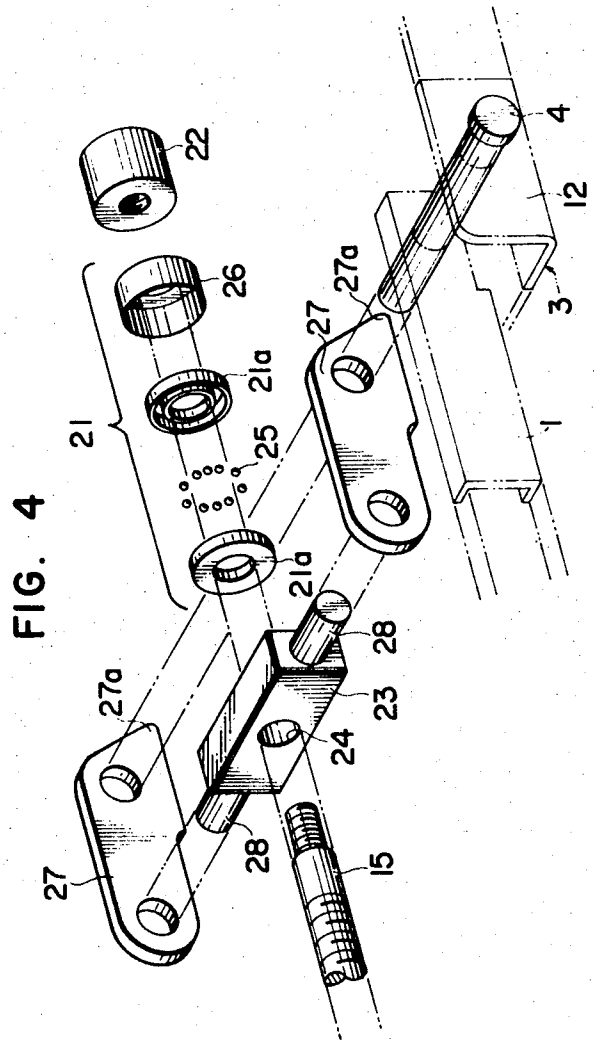


FIG. 4

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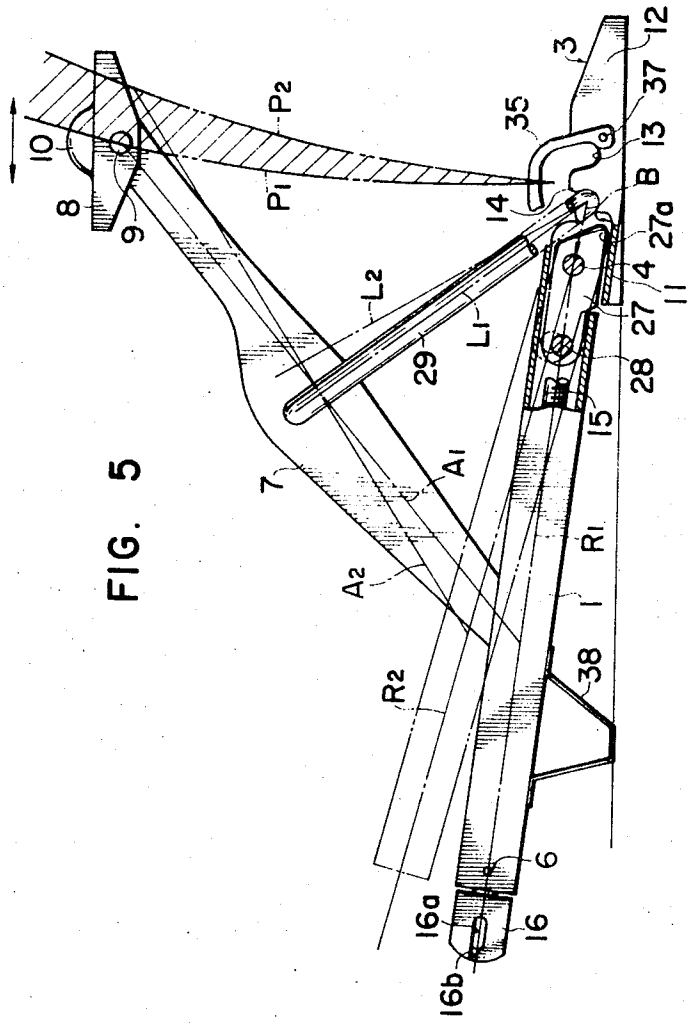


FIG. 5

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LOAD LIFTING JACKS

BACKGROUND OF THE INVENTION

This invention relates to a jack comprising a four sided linkage adaptable to be used for lifting the body of an automotive vehicle.

Multiple-lever mechanisms have been adapted to uses in jacks for lifting the body of an automotive vehicle. These mechanisms have been used extensively, but they involve some risk that, when used, displacement of the load during operation will cause the jack to incline or fall. When such a jack is operated against a load, a body portion with which the load engaging head of the jack engages usually travels in an arcuate path in an imaginary plane perpendicular to the horizontal. This arcuate movement of the body portion will in turn cause the load engaging head to displace horizontally. Due to the displacement of the load engaging head, the jack tends to incline relative to the ground or to fall down. This deficiency is considered a great disadvantage and short-coming in practice, in that it is often necessary for most applications to set the base of the jack at an eccentric position on the ground in anticipation of such displacement so that the possible inclination of the jack may be offset as the jack operates. It requires considerable skill to find a position on the ground of proper eccentricity at which to set the jack base.

It is a principal object of the present invention to provide a load lifting jack, the load engaging head of which may be shifted as the load shifts while the base remains stationary on the ground.

It is another object of the present invention to provide a load lifting jack in which the load engaging head may be moved upward or downward to engage the head with a body different heights rapidly when no load being applied to the jack. The improvement lies in so detaching the head from the associated power-pressure mechanism as to allow it to move up and down independently of that mechanism and very easily.

It is still another object of the present invention to provide a load lifting jack of lesser weight than comparable jacks which have been used heretofore.

It is still yet another object of the present invention to provide a load lifting jack in which a guide member is provided to safely and easily guide the ends of certain associated links for achieving rapid movement of a load engaging head.

It is further another object of the present invention to provide a load lifting jack which is easy to set and drive rapidly.

SUMMARY OF THE INVENTION

A load lifting jack comprises a pair of guide rails connected in parallel relation with each other by a pin and a connecting member, so that a rectangular form frame is provided, a lifting arm carrying at one end a load engaging head, a screw shaft rotatably supported within the frame, the screw shaft carrying thereon an internally threaded nut to which the lifting arm is pivoted at another end, a pair of link members each pivoted at one end with respect to the lifting arm at an intermediate position therealong, a base on which the pair of guide rails is pivotally mounted by said pin, the base having one or more pairs of laterally aligned notches on its flanged portions with which the other ends of the link members are selectively engageable, and a supporting member which rotatably supports the shaft at its one end and inside of the frame but bears the thrust of the screw shaft.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a jack according to the invention in a partially elevated position;

FIG. 1 is a fragmentary perspective view explodedly illustrating in phantom some parts of the jack according to the invention;

FIG. 3 is a vertical section, taken along the line III—III of FIG. 1;

FIG. 4 is a fragmentary perspective exploded view particularly showing the thrust bearing of the screw shaft; and

FIG. 5 is a side elevation of the jack according to the invention and showing its operation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1, and 3-5, the jack comprises a pair of parallel guide rails 1 and 2 each having a U-shaped cross-section. The guide rails are held together at the left-hand ends in FIG. 1 by the connecting member 5 connected thereto by means of screws 6 and at the right-hand ends by the pin 4 both extremities of which protrude beyond the flanges 12 of the base 3 and have enlarged portions to prevent it from falling out. This permits the guide rails to be tightly fastened together and still be free to swing on the base 3 by waY of the protrusions of pin 4. The right-hand ends of the guide rails are held in their positions by the cooperation of the linking member 23 and the flanges 12 of the base, so that they have a slight frictional engagement with internal surfaces of the flanges. In this construction, a rectangular frame F formed of the guide rails 1 and 2, the connecting member 5 and the pin 4 is so provided that the open topped portions of the cross-sectionally U-shaped guide rails face each other. A lifting arm 7 is provided to move between the fully collapsed position in which the arm occupies the substantially horizontal position (not shown) and an elevated position in which the arm is substantially vertical as shown in FIG. 1. The lifting arm 7 pivotally carries at its free end a load engaging head 8 by means of pin 9. A dome-like projection 10 is formed in the surface of the head 8 to mate with a corresponding recess (not shown) of a load when in use it is moved against the load. The lifting arm 7 is formed of heavy gauge sheet metal and is broader at the center, where the bending stresses are largest, than at the ends.

The jack base 3 pivotally connected to the guide rails as above described consists of a horizontal base plate 11 and a pair of substantially vertical flanges 12 at opposite sides of the base plate 11 and formed integrally therewith. Two pairs of laterally-aligned notches 13 and 14 are spaced along the upper portion of each flange. A screw shaft 15 protrudes beyond the connecting member 5 through its bore 39 in which the screw shaft is free to rotate. A rotary driving head 16 is fast at one end of the screw shaft 15 and outside of the frame F, where it can be manually rotated by means of the usual driving handle (not shown). An internally screw threaded nut 17 (FIG. 3) is carried on the screw shaft 15 and two pins 18 are so screwed into opposite sides of nut 17 as to extend horizontally therefrom, per-

pendicularly to the axis of the screw shaft **15.** Two rollers **19** of plastic material in this instance are rotatably mounted on the respective pins **18** and are retained within the corresponding U shaped guide rails **1** and **2** by the inwardly extending flange portions thereof. The lower end of the lifting arm **7** remote from the load engaging head **8** consists of two forked side walls **20** which are pivotally mounted on the pins **18,** between the nut **17** and the rollers **19** respectively.

A thrust bearing **21** (FIG. **4**) is carried on the screw shaft **15** at its end opposite head **16,** to facillitate smooth rotation of the screw shaft **15** when it is operated against a load in use. As specifically shown in FIG. **4,** an end of the screw shaft **15** protrudes beyond the linking member **23** through its bore **24** in which the end of the shaft **15** is free to rotate. At that extremity of the screw shaft **15** is fastened a nut **22,** for resisting thrust load applied across the thrust bearing **21** interposed between the linking member **23** and the nut **22** on the shaft **15.** The thrust bearing **21** consists of a pair of races **21a** and a set of balls **25** interposed therebetween. A cover **26** is provided to cover the races when the thrust bearing is installed. Two links **27** formed of heavy gauge sheet metal connect the linking member **23** and the base **3** by way of the pins **28** and by way of the other pin **4** put in cooperating holes at both ends of the links respectively, the pins **28** extending horizontally in opposite directions from the linking member **23.** It will be noted that the both links **27** are secured within the space of the corresponding guide rails **1** and **2** as shown in FIG. **1** and transmit the thrust load from the linking member **23** to the pin **4** when the screw shaft **15** is rotated in use. This construction is effective to enable reduction of the thickness of the sheet metal of the guide rails below thicknesses which would otherwise be thought necessary. The links **27** are formed with noses **27a** as shown in FIG. **4** at ends thereof remote from the linking member **23.** These noses rest on the base plate **11,** and will function as a stops, when clockwise rotation occurs as shown in FIG. **5.**

The inwardly-bent ends of a pair of links **29** and **30** (FIG. **2**) are pivotally mounted in aligned bores **31** and **32** centrally along the lifting arm **7.** The other ends of the links are also inwardly bent for engagement with the pairs of notches **13** and **14** on the flanges **12** of the base **3.** Both links are held together at their bent ends by sleeves **33** and **34.** This construction permits the links to be tightly fastened together and still be free to swing on the lifting arm **7.** In FIG. **2,** an exploded view of the links and sleeves is shown in phantom. It will be noted that the sleeve **33** is of a larger external diameter than the internal diameter of bores **31** and **32** of the lifting arm in which the links are free to swing. The length of the sleeve **33** is so designed as to be identical with the width of internal space of the lifting arm **7** so that the links integral therewith do not in use shift laterally across the axis of the lifting arm **7.** On one of the flanges **12** of the jack base **3** there is fastened, by means of screws **36** and **37,** a guide member **35** arcuately shaped so as to form a guide way slot in cooperation with the upper portion of the flange **12,** to limit possible movement of the lower bent portions of the links as they are transferred from one pair of notches to another. This construction necessitates less movement of the nut **17** than would be the case if, the jack head **8** could not be first moved to nearly the desired height by moving the lower bent portions to a position nearer or more removed from the nut. This is true of the lowering motion of the jack head **8,** too.

Referring again to the driving head **16** at the end of the screw shaft **15,** it is seen that there are two leafs divergently spread from the end of the screw shaft. Each of the leafs has a hole **16*a*** of elliptical form, and both are in alignment with each other. Either one of the holes further has a narrow biased open-ended slot **16*b*** extending forwardly from its hole **16*a***, as shown in FIGS. **1** and **5.** When the screw shaft **15** is in use driven, the head of the driving handle (not shown), somewhat like a cross, is engaged with one of the driving head **16** with its branches first being put in the hole having no slot while the stem of the handle is in angled relation to the axis of the screw shaft **7.** The stem is then aligned with the axis of the screw shaft so that the other branch of the handle head will enter into the hole through the slot. Having set the other branch in the hole, the operator then can rotate the handle in the desired direction, the head **8** being lifted up against the load, or lowered. The narrowness of the slot suffices to prevent the handle head from falling out during the operation.

When lifting a load, the screw shaft **15** is rotated in a direction to cause the nut **17** to advance to the right in FIG. **1.** In lowering the jack, the reverse of the above action takes place. That is to say, after revolution of the screw shaft **15** in the opposite direction until no load is received by the load engaging head **8,** the lower bent portions are moved to the outer pair of notches **13,** if the case may be, to cause the lifting arm **1** to return to its lower position whereby rapid collapse may be effected.

The bed **38** fast on the under surface of the guide rails is effective to further tighten the guide rails to each other and position the driving head **16** within convenient reach of the operator.

The device is in principle recognized as a four-sided linkage or quadric crank chain consisting of four links. The desired mechanical movement of the device is derived by the use of combination of proportioned levers and connecting links. The geometry of this linkage is characterized by the lines B, R1, A1 and L1 as indicated by dot-and-dash linework in FIG. **5.** It should be noted that the line B which extends from the pin **4** to the axis of one of pairs of the notches **13** or **14,** is always held stationary.

It will be seen that if guide rails **1** and **2** were held stationary (not practically possible of course) in use at the position R1 as shown in FIG. **5** and the screw shaft **15** were turned, then the head **8** would travel in a path P1. Further, it will be seen that if guide rails were held stationary at the position R2, and the shaft **15** were turned, then the head **8** would travel in another path P2. The links **29** will swing from the position L1 to the position L2 as the guide rails swing from the position R1 to the position R2. Therefore, the linkage of the jack always permits the load engaging head **8** to shift to and fro as indicated by the double arrow in FIG. **5,** as the load shifts in the horizontal, within the angular range indicated by the oblique shade in the view. Any fears that the jack base **3** may slide along the ground or that the jack may fall will thus be largely alleviated. The base plate **11** of the jack base **3,** in cooperation with the noses **27a** of the links **27,** prevents the load engaging head **8** from shifting beyond the path P2 to the right. The path P2 should be so calculated that the vertical center line of the load engaging head **8** will not in any

event shift to the right beyond the right hand edge of the base 3. This is effective to prevent the jack from falling and to provide a better seat of the base on the ground.

The jack according to this invention allows the load to occupy any position within the angular range while maintaining the better seat of the base on the ground.

What is claimed is:

1. In combination in a load lifting jack, a pair of guide rails, means connecting said guide rails in parallel relation with each other to provide a rectangular frame, an elongated lifting arm having a load engaging head at one end thereof, a screw shaft rotatably supported within the frame, an internally threaded nut on said screw shaft, means pivotally mounting the other end of said lifting arm on said nut, link members each pivotally connected at one end with said lifting arm at an intermediate position therealong, a base, means pivotally mounting said pair of guide rails with said base, said base having flanged portions with notches spaced along the lengths thereof for selectively receiving the other ends of said link members, a linking member rotatably supporting the screw shaft at its one end thereof and inside of said frame, and means supporting said linking member in relation to said base and in thrust-receiving relation to said screw shaft.

2. A jack according to claim 1, further comprising a guide member fixed with one of said flanged portions and, together with the notched parts of said flanged portions, providing a guide way confining the other end of one of said link members and thereby guiding the lower ends of said link members to selected ones of said notches.

3. A jack according to claim 1, wherein said means pivotally mounting the other end of said lifting arm on said nut includes two pins extending horizontally from opposite sides of said nut, perpendicular to the axis of the screw shaft, and further comprising rollers of plastic material rotatable on said two pins and within said guide rails.

4. A jack according to claim 3 wherein said guide rails are U-shaped in cross-section, the said rollers being retained within both guide rails respectively by their upright walls so that the internally threaded nut may be moved in a path provided by the guide rails when the screw shaft is turned.

5. A jack according to claim 1, wherein one end of said screw shaft protrudes beyond said linking member, wherein said means pivotally mounting said guide rails with said base comprises a pivot pin extending between said rails and in pivotal engagement with said base, and wherein said means supporting said linking member includes a thrust bearing, a nut fast on the protruding end of said screw shaft, said thrust bearing being disposed between said linking member and said nut, two pins extending horizontally from opposite sides of said linking member, perpendicular to the axis of said screw shaft, and two links each connected at one end to the linking member by one of said pins and at the other end to said pivot pin.

6. A jack according to claim 5, wherein each of said links has at its said other end a nose disposed to rest on said base and stop further relative motion between said rails and said base in one angular direction when the guide rails pivot upwardly about said pivot pin by a predetermined angular amount in said direction.

7. A jack according to claim 1, wherein said means connecting said guide rails includes a connecting member fixed between said rails at one end of said rails, the other end of said screw shaft protruding beyond said connecting member, and further comprising a driving head fast at said other end of said shaft, said head having diverging outwardly-spreading leafs each with a hole therethrough and at least one of which further has a narrow open-ended slot merging with the hole therethrough, whereby a branch of a driving handle may be entered into and drawn from the hole through the slot.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,746,307 Dated July 17, 1973

Inventor(s) Shinichiro Yamazaki

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet insert -- [30] Foreign Application Priority Data

July 3, 1970 Japan----------45-58618 and 45-58619
July 3, 1970 Japan----------45-67042 --.

Signed and sealed this 8th day of January 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

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