July 20, 1965 V. A. SIMMS 3,195,860

LIFTING DEVICE

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FIG. 1

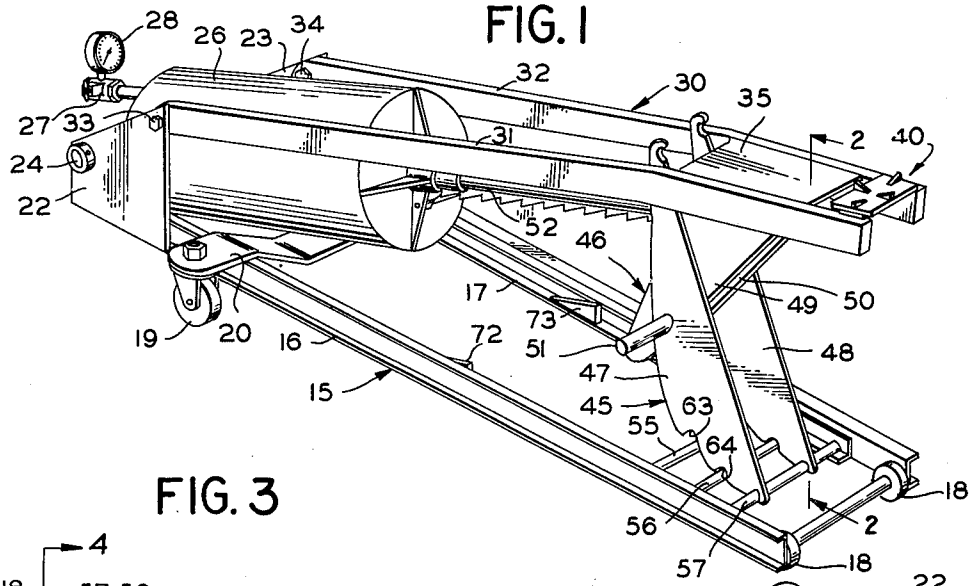


FIG. 3

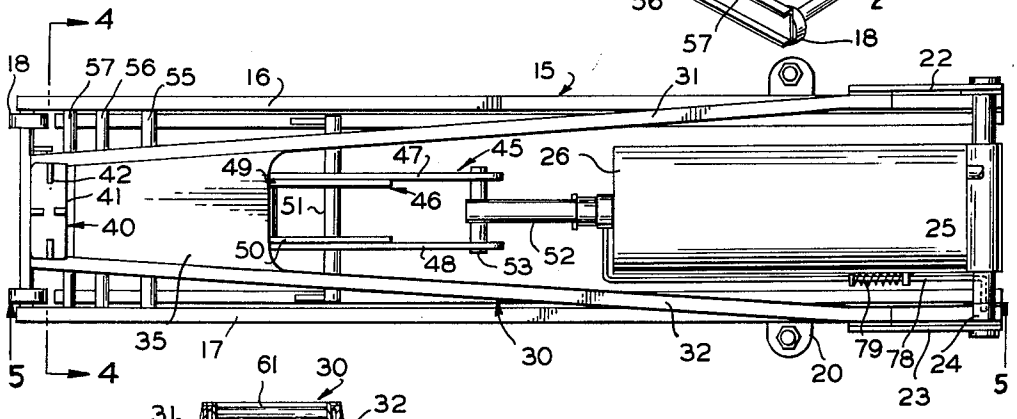
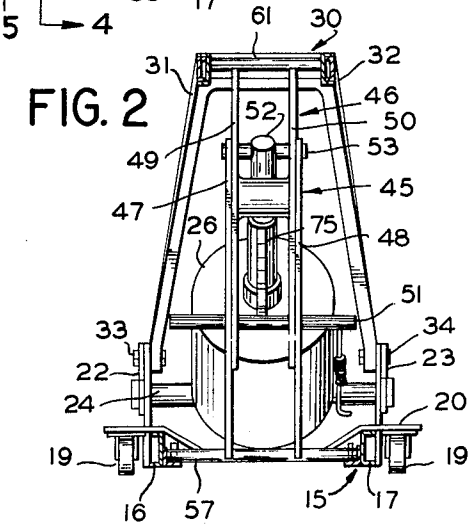


FIG. 2



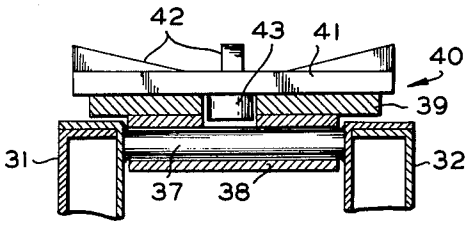


FIG. 4

INVENTOR.
VICTOR A. SIMMS
BY Jaussewitz & Carr
ATTORNEYS

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FIG. 5

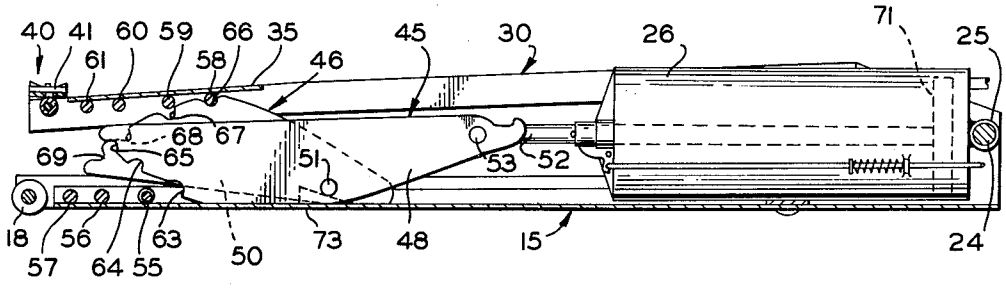


FIG. 6

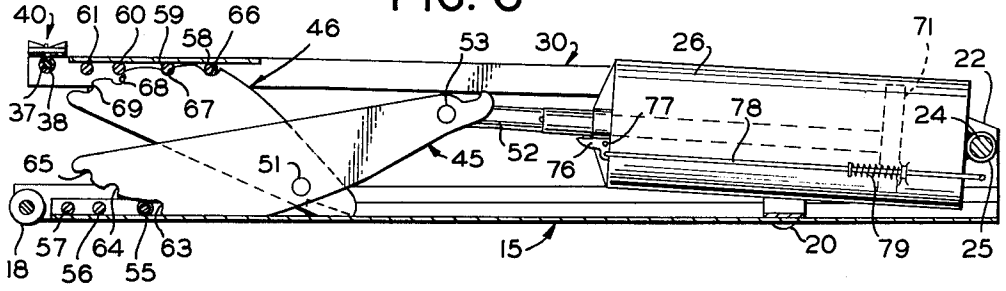
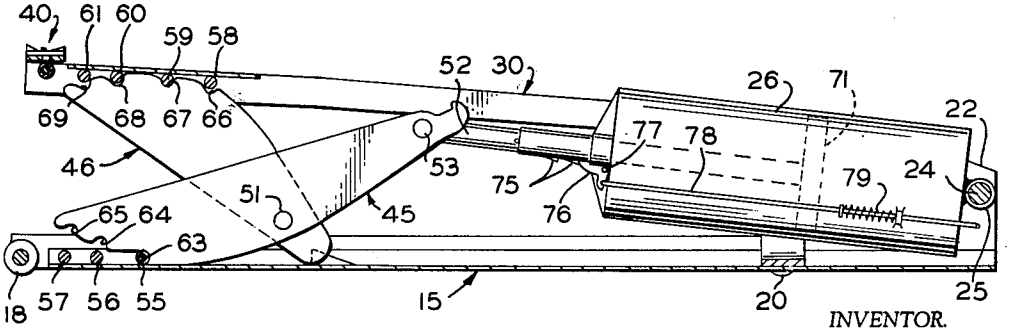


FIG. 7



INVENTOR.
VICTOR A. SIMMS

BY Jamieson & Carr

ATTORNEYS

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LIFTING DEVICE

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FIG. 8

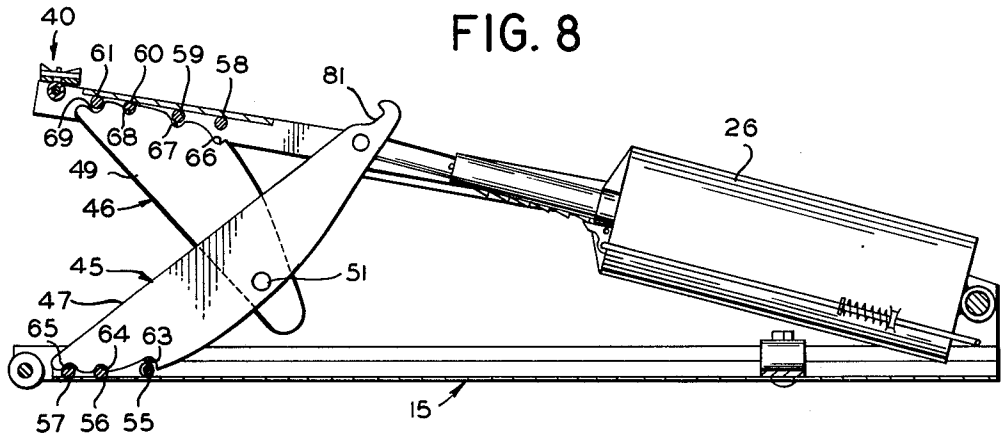
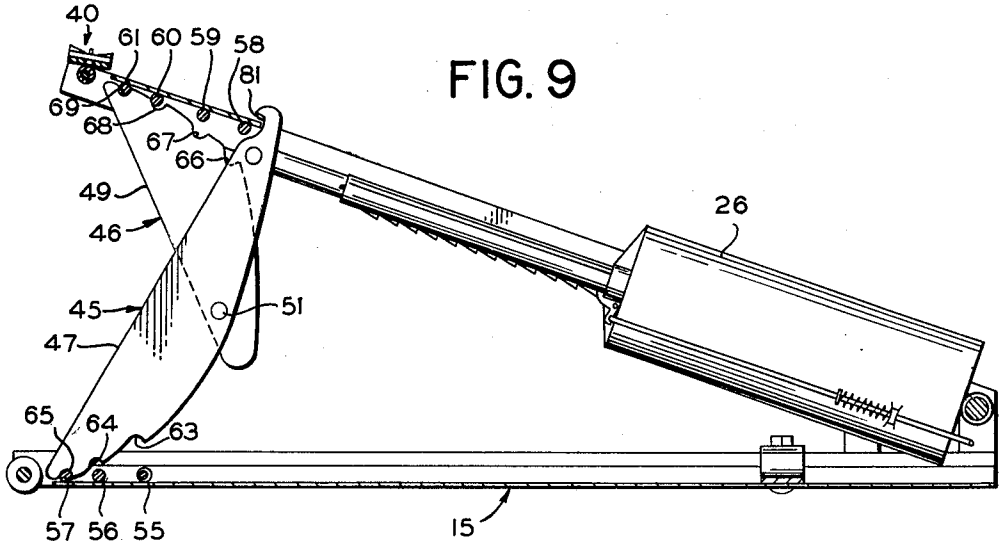


FIG. 9



INVENTOR.
VICTOR A. SIMMS

BY Jansenty & Carr

ATTORNEYS

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LIFTING DEVICE

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FIG. 10

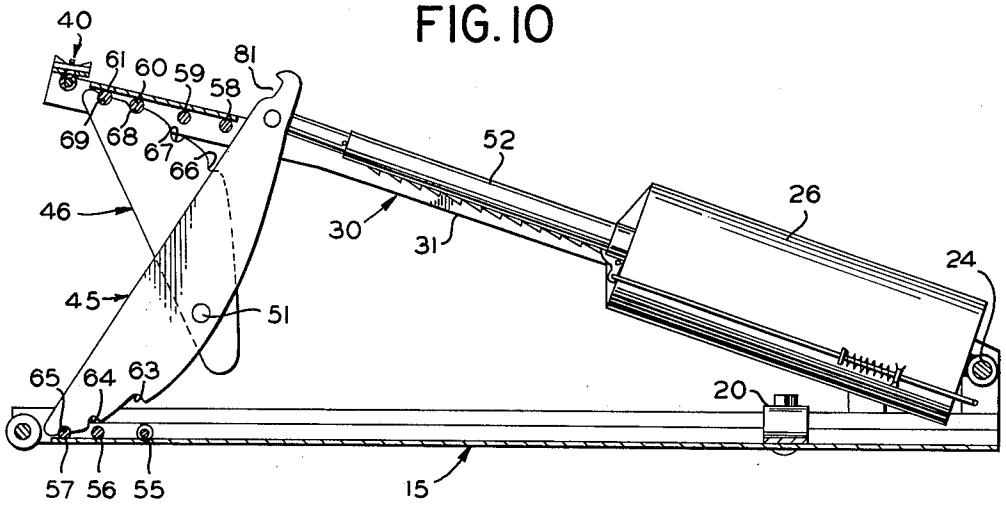
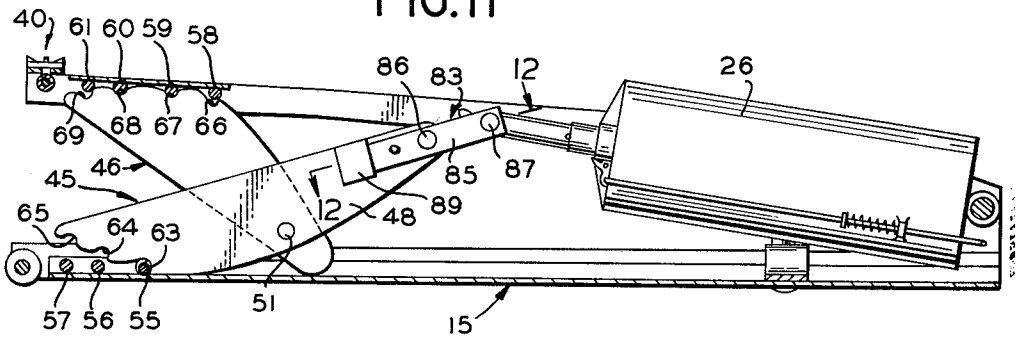


FIG. 11



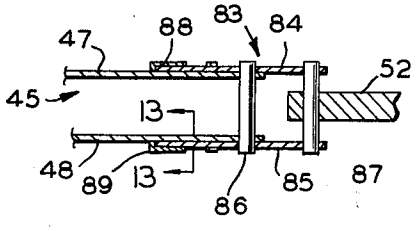


FIG. 12

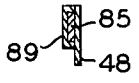


FIG. 13

INVENTOR.
VICTOR A. SIMMS

BY Jaeschke & Carr

ATTORNEYS

United States Patent Office 3,195,860 Patented July 20, 1965

3,195,860

LIFTING DEVICE

Victor A. Simms, Anaheim, Calif., assignor of fifteen percent to Gausewitz & Carr, Orange, Calif., a partnership

Filed Feb. 11, 1963, Ser. No. 257,489
14 Claims. (Cl. 254—2)

This invention pertains to a unit for imparting vertical motion and in particular to a device usable as a power operated jack for vehicles.

One widespread field of use for the device of this invention is as a jack for lifting automobiles, trucks or the like. The most commonly used commercial device of this type for repair shops or other establishments where vehicles must be serviced or inspectd has been the manually operated hydraulic jack. These devices are portable and have been acceptable for many purposes. Nevertheless, in the past there has been a need for a jack of greater load capacity than conventional designs and capable of imparting a larger mount of vertical movement. Also, over a period of time the manual operation necessary for hydraulic jacks becomes extremely tiring. Moreover, the conventional units have been relatively complicated and expensive from the service standpoint, and not entirely safe in the event of failure of some of the components.

The present invention overcomes the difficulties of the prior art and offers other advantages heretofore impossible with previously known lifting devices. The invention is adapted for power operation, in particular, for operation pneumatically. The lifting device of this invention includes a power cylinder that is connected to one element of a scissors linkage. The ends of the latter elements rock on transverse rods, progressively moving from one to the other as the piston rod is extended. This serves to raise the jack with adequate mechanical advantage through a long vertical stroke. The power cylinder is moved off of dead center by means of a cam arrangement associated with the fixed framework and the scissors linkage. This causes the vertical movement to commence gradually and reduces the initial load requirements on the cylinder.

Accordingly, it is an object of this invention to provide a lifting device capable of rapid movement through a relatively long stroke.

Another object of this invention is to provide a lifting device of greater capacity than conventional designs.

A further object of this invention is to provide a lifting device that is versatile, portable, readily used, and yet which can be operated entirely by power.

An additional object of this invention is to provide a lifting device incorporating safety features to prevent injury in the event of failure of almost any kind.

Yet another object of this invention is to provide a lifting device of relatively simple and low cost construction, of great durability, and which can be easily and quickly repaired.

These and other objects will become apparent from the following detailed description taken in connection with the accompanying drawing in which:

FIG. 1 is a perspective view of the lifting device of this invention in a raised position,

FIG. 2 is a transverse sectional view of the invention taken along line 2—2 of FIG. 1,

FIG. 3 is a top plan view of the invention in the retracted position.

FIG. 4 is an enlarged fragmentary transverse sectional view taken along line 4—4 of FIG. 3 illustrating the mounting of the lift pad,

FIG. 5 is a longitudinal sectional view taken along line 5—5 of FIG. 3, showing the invention in its lowered position,

FIGS. 6, 7, 8 and 9 are views similar to FIG. 5, but with the lifting device shown in progressive increments of movement to the fully elevated position.

FIG. 10 is a side elevational view of the invention, partially in section, illustrating a modification where the pivot point of the scissors linkage has been changed to achieve a greater mechanical advantage,

FIG. 11 is a side elevational view, partially in section, of a further modification of the invention in which one of the scissors elements is given an increased arm for increasing the mechanical advantage of the unit,

FIGURE 12 is a longitudinal sectional view taken along line 12—12 of FIG. 11 illustrating the manner in which the extension is attached to the scissors link, and

FIG. 13 is a transverse sectional view taken along line 13—13 of FIG. 12.

With reference to the drawing and in particular to FIGS. 1, 2, 3 and 4 the device of this invention includes a fixed base frame 15 having elongated parallel side rails 16 and 17. The frame 15 is supported on a pair of front wheels or rollers 18 and a pair of rear wheels 19. The latter elements preferably are of the caster type and may be mounted outboard of the side rails 15 and 16 on a transverse bar 20.

At the rear of the base 15 is a pair of upstanding brackets 22 and 23 that support a transversely extending shaft 24. The latter element is received within a sleeve 25 mounted on the end of a power cylinder 26. Preferably this cylinder is adapted for pneumatic operation, hence, being equipped with a control valve 27 at the inlet fitting as well as including a pressure gage 28.

Also, carried by brackets 22 and 23 is a movable frame unit 30. This includes side rails 31 and 32 which are connected to the brackets 22 and 23 by means of pivot pins 33 and 34. A transverse web 35 interconnects rails 31 and 32 adjacent the opposite ends of these elements.

At the distal end of rails 31 and 32 is a cross shaft 37 interconnecting these two members (see FIG. 4). A sleeve 38 receives the central portion of shaft 37 and on its upper surface carries a plate 39. The plate 39, therefore, is pivotal about shaft 37 through a limited distance defined by the clearance between the under surface of the plate 39 and the upper surfaces of the rails 31 and 32.

The support pad 40, which is adapted to engage the object to be lifted, is carried by the plate 39. The member 40 may include an additional plate element 41 provided with upwardly projecting lugs 42 to improve its ability to retain the item being lifted against lateral movement. A pin 43 depends from lower surface of plate 41 into a corresponding aperture in the plate 39. By this arrangement, therefore, the support 40 may assume a substantially horizontal position regardless of pivotal movement of the upper frame portion 30.

Vertical movement is imparted to the frame 30 and the support 40 by means of scissors links 45 and 46. The unit 45 may consist of a pair of closely spaced parallel plates 47 and 48, and the unit 46 similarly comprises plates 49 and 50. The latter members are mounted inside plates 47 and 48, and the scissors arms are pivotally connected together by means of transverse shaft 51. This shaft projects outwardly beyond the links 45 and 46. The piston rod 52 from the power cylinder 26 connects through pin 53 to the end of the scissors arm 45 adjacent the cylinder.

At the forward end of the base 15, opposite from the cylinder 26, are secured three parallel transverse rods 55, 56 and 57. Above these members on the movable frame 30 are four parallel cross rods 58, 59, 60 and 61. The scissors link assembly 45 is provided with an arcuate outer end having three notches 63, 64, and 65 for engagement with the cross rods 55, 56 and 57, as will be made more clear hereinafter. The other scissors link 46 also

has an arcuate end in which there are included notches **66**, **67**, **68** and **69** which are intended for association with the transverse rods **58**, **59**, **60** and **61**.

The lifting device of this invention is illustrated in its fully retracted position in FIG. 5. Here the rod **52** has been drawn inwardly with respect to the cylinder **26**. This causes pin **53** to pull the top end of element **45** to the right in the embodiment illustrated, and as a consequence the scissors element **45** at its other end is substantially fully received within the other link assembly **46**. In this position rod **58** rests within notch **66** within the scissors member **46**, which thereby supports the outer end of the movable frame **30** in the lowered position.

In operation of the lifting device of this invention, the device is maneuvered appropriately on the wheels **18** and **19** to position the lifting pad **40** beneath an object to be engaged and raised. This is accomplished readily with the inclusion of a suitable handle at the end of frame **15** adjacent the center wheel **19**. When this is done, air is admitted into the cylinder **26** driving the piston **71** to the left as the device is illustrated in FIGS. 5 through 9, and extending the piston rod **52**. This moves the pin **53** to the left which in turn tends to move the link **45** rectilinearly in that direction. As this translational movement of link **45** occurs, the outwardly projecting portions of the pivot pin **51** are caused to slide upwardly along the inclined planes formed by opposed wedge shaped cam members **72** and **73** carried by the side rails **16** and **17**. In this manner counterclockwise rotational movement is imparted to the link **45**.

This camming action is advantageous in enabling the jack to move smoothly from its retracted position to commence the vertical stroke. In view of the nearly horizontal alignment of pins **51**, **53** and **24**, the entire mechanism is close to a dead center position when retracted. The movement along the cams **72** and **73** raises the pivot point of the two scissors members, while the outer notched end of link **45** remains adjacent the frame **15**. As a result, the cams **72** and **73** help initiate rotational movement of the link **45**. Thus, the cams lift the linkage off of the approximately dead center position so that the cylinder **26** is free to pivot upwardly in a gradual manner and the scissors links can rotate smoothly.

Without the inclusion of the cams, the cylinder would meet with considerable resistance when initially pressurized. Then at the time that the dead center position was passed an abrupt movement of the linkage would take place. This would cause the lift pad **40** to move in an undesirably rapid and jerky manner. Such an effect is obviated by the use of the cam elements to shift the linkage into a normal rotative movement upon the initial extension of the piston rod.

The construction of the cam by the wedges **72** and **73** together with the outward projections of shaft **51** is a particularly simple and effective way of achieving the desired motion. However, it is obvious that the cam arrangement could be in some different form. For example, the follower could constitute a separate element on the scissors arms rather than an extension of the pivot pin **51**.

As the rod **52** is extended by movement of the piston **71** through its stroke, the linkage progressively will pass through the incremental positions illustrated in FIGS. 6, 7, 8 and 9. It can be seen that as the piston rod is extended, the ends of the scissors members **45** and **46** rock on the transverse rods located at the outer ends of the frames **15** and **30**. Thus, as shown in FIG. 6, member **46** has been pivoted clockwise so that notch **67** receives the transverse bar **59** of the frame **30**. This in turn raises the outer end of the pivotal frame **30** and hence lifts the pad **40**. At this position the notch **63** has approached the transverse pin **55** of the lower frame **15**, but has not yet engaged it. Upon further movement to the position of FIG. 7, notch **63** contacts the pin

55, while recess **68** of the link **46** now approaches the bar **60** of the frame **30**. As the scissors links are being opened up in this manner, the outer end of the movable frame **30** is being caused to move upwardly an additional amount, lifting the pad **40** with it.

In the position of FIG. 8 the links **45** and **46** have received additional rotation as they are pivoted progressively on the cross rods at the ends of the frames. In FIG. 9 the fully extended position is illustrated. Here the link **45** has been caused to move counterclockwise to a position where the outer notch **65** is brought into engagement with the outermost cross rod **57** of the frame **15**. At the same time counterclockwise movement of the link **46** has brought its notch **69** into contact with the outer rod **61** of the movable frame **30**. Here it can be seen that the scissors links **45** and **46** have been moved to a position approaching vertical alignment.

The cross bars and notches on the scissors links thus act as cooperable detents retaining the links against slippage and enabling the pivotal movement to take place. Other detent constructions are possible although the arrangement illustrated operates particularly advantageously.

In the extreme position of the lifting device of this invention shown in FIG. 9, it can be seen that the pad **40** has been moved through a vertical stroke of considerable magnitude. Simply by extending the piston rod **52** outwardly, the jack is caused to rise to what is a very high position for devices of this type. At the same time the movement is quite smooth as the scissors links rock on the cross rods carried by the frame members.

It may be observed that the cross rods are positioned longitudinally with respect to the frame members so that the transition from one rod to the next for the two links occurs alternately between the top and bottom portions of the linkage. In other words, as shown for example in FIG. 6 the bottom link **45** has been brought into contact with the cross rod **55** of the lower frame. The upper link **46**, however, is still slightly spaced from the next cross rod **68** of the upper frame segment. The engagement of the latter elements will take place slightly ahead of the forthcoming contact between the notch **64** of link **45** and the next cross rod **56**. Hence, the pivotal movement of the links is smooth and the load is raised continually and without jolts or interruptions.

The linkage possesses sufficient mechanical advantage which, together with the use of a pneumatic cylinder, allows this jack to raise massive loads. Virtually every service establishment today is provided with a source of compressed air used for numerous other purposes. Hence, there is no problem of availability of a pressurized fluid for operating the cylinder **26**. The operator of the unit simply will connect the shop air supply to the inlet fitting and by manipulating the valve **27** can raise the jack to any desired height. Naturally, the jack can be stopped at any of the positions illustrated in FIGS. 5, 6, 7 and 8, or any other position intermediate those illustrated. Thus, even though the lifting device of this invention is fully portable, it provides a fast acting power operated unit that can cope with any situation that may be encountered in normal use.

As a safety precaution, a locking means is included to prevent sudden collapse of the jack under load in the event of loss of pressurized fluid from the interior of the cylinder **26**. This is accomplished in a simple manner by the inclusion of ratchet teeth **75** extending longitudinally of the piston rod **52**. A pawl **76** is pivotally connected to cylinder by means of pin **77**. Rod **78** is loaded by spring **79** biasing the pawl against the ratchet teeth. Hence, the ratchet automatically locks the piston rod against inward movement as the rod is extended. Retraction of the piston rod is permitted merely by manually pulling on the rod **78** so as to hold the pawl **76** away from the ratchet teeth **75**.

A further safety provision is included to prevent any

possible injury from over pressurization of the cylinder 26 or failure of the parts to withstand the pressures required. This will preclude movement of the linkage substantially beyond the position of FIG. 9 regardless of what may occur to the cylinder 26. This is a simple construction involving the inclusion of a notch 81 in the upper end of the scissors link 45. This notch will engage the web 35 adjacent the cross rod 58 in the event of any tendency to move beyond the position of FIG. 9. This will lock the linkage against further rotation, limiting the amount of travel allowed.

In some instances, it may be desired to reduce the amount of vertical movement of the jack in return for a greater amount of lifting force. One means for accomplishing this is illustrated in FIG. 10. Here the pin 51 pivotally interconnecting the links 45 and 46 is shifted to a lower position than previously with respect to the link 46. In the illustration of FIG. 10 the prior location of the pin 51 is shown in phantom. This movement of the linkage pivot point adds to the lever arm of the linkage and increases its lifting force.

Another means of adding to the lifting force without necessarily reducing the vertical stroke is illustrated in FIGS. 11, 12 and 13. Here the effective length of the link 45 is increased by an extension 83 at the end of the link. This element includes a pair of bars 84 and 85 that connect to the plates 49 and 50 by means of pin 86. At the outer ends of the bars they are joined by pin 87 to the end of rod 52. Receptacle elements 88 and 89 carried by the plates 49 and 50 engage the opposite ends of the members 84 and 85 and secure them against rotation. This provides a readily installed and removed extension for the link 46 so that when desired a greater mechanical advantage is realized by the linkage.

From the foregoing it can be seen that I have provided an improved lifting device of relatively simple construction, capable of a large amount of vertical travel and which can exert a high lifting force. The unit is maneuverable, yet adapted for complete power operation. It has practically no parts that can wear out so that it is quite durable and can be serviced easily. Thus, any repairs which may be necessary are of low cost and the jack will be out of service for only a short time.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

I claim:

1. A lifting device comprising
a duality of arms,
means pivotally interconnecting said arms,
a base engaged by one end of one of said arms,
a movable element engaged by one end of the other of said arms,
and means for rotating said arms about said ends and said pivotal interconnecting means
for separating said ends of said arms and thereby moving said movable element,
said base and said one end of said arm including cooperable means for allowing said one end of said one arm upon said rotation of said arms to progessively rock relative to said base about a plurality of axes progressively spaced from the said rotating means, said movable element and said one end of said other arm including cooperable means for allowing said one end of said other arm upon said rotation of said arms to progressively rock relative to said movable element about a plurality of axes progressively spaced from the said rotating means.

2. A lifting device comprising
a duality of arms,
means pivotally interconnecting said arms,
a base engaged by one end of one of said arms,
a movable element engaged by one end of the other of arms,
and means engaging the opposite end of one of said arms for pivoting said arms about said first mentioned ends and said pivotal connection,
for thereby moving said movable element,
said base and said one end of said one arm including cooperable means for allowing said one end of said one arm to rock relative to said base upon said pivoting of said arms, said one end of said other arm and said movable element having cooperable means for allowing said one end of said other arm to rock relative to said movable element upon said pivoting of said arms.

3. A lifting device comprising
a duality of arms,
means pivotally interconnecting said arms inwardly of one end of each of said arms,
whereby said ends are movable toward and away from each other about said pivotal interconnection,
a plurality of relatively fixed spaced detents pivotally engageable by said end of one of said arms,
a movable member,
a plurality of spaced detents on said movable member engageable by said end of the other of said arms,
and means for rotating said arms about said pivotal interconnection and said ends thereof,
for separating and moving together said ends.

4. A device as recited in claim 3 in which said means for pivoting said arms includes
a power actuated member engaging the opposite end of one of said arms.

5. A lifting device comprising
a relatively fixed base,
a plurality of spaced detents on said base,
a movable member,
a plurality of spaced detents on said movable member,
a duality of arms,
means pivotally interconnecting said arms inwardly of of one end of each of said arms,
said one end of one arm having a plurality of recesses therein for progressive engagement with said detents on said base,
said one end of the other of said arms having a plurality of recesses therein for progressive engagement with said detents on the other said arms,
and means for pivoting said arms about said pivotal interconnection for effecting said progressive engagement with said detents with said ends of said arms
thereby moving said movable member relative said base.

6. A device as recited in claim 5 in which
said means for pivoting said arms includes a power actuated member pivotally engaging the opposite end of one of said arms,
and in which said movable member is pivotally connected to said base.

7. A lifting device comprising
a relatively fixed base,
a duality of arms,
means pivotally interconnecting said arms inwardly of one end of each of said arms,
said base and said one end of one of said arms having cooperable detent means whereby said one arm is pivotal about said one end thereof with a rocking motion relative to said base,
a movable member,
means pivotally interconnecting said movable member and said base at a location remote from said detent means,
said movable member and said one end of the other of said arms having cooperable detent means whereby said other arm is pivotal about said one end there-

of with a rocking motion relative to said movable member,
and means for effecting said pivotal movement of said arms
for thereby moving said movable member.

8. A device as recited in claim **7** in which
the opposite end of said one arm projects beyond said means pivotally interconnecting said arms,
and said means for effecting said pivotal movement of said arms includes a power cylinder pivotally connected to said base,
said cylinder having a reciprocative actuating rod pivotally engaging said opposite end of said one arm.

9. A device as recited in claim **8** including in addition
cooperable cam means on said base and said one arm operable upon initial movement of said rod from a retracted position toward an extended position
for lifting said one arm and imparting pivotal movement thereto.

10. A lifting device comprising
an elongated base,
a plurality of transverse bars carried by said base,
a movable member pivotally connected to said base at a location remote from said bars,
a plurality of transverse bars carried by said pivotal member adjacent said bars of said base,
a duality of arms,
each of said arms having an arcuate end,
said end of the first of said arms having a plurality of notches therein for progressive engagement with said bars on said base,
said end of the second of said arms having a plurality of notches therein for progressive engagement with said bars on said movable member,
means pivotally interconnecting said bars inwardly of said ends,
a power cylinder pivotally carried by said base,

said cylinder having an extensible rod substantially normal to the plane of said bars,
said rod pivotally engaging the opposite end of said first arm,
whereby upon the extension of said rod said arms are pivoted about said interconnecting means and said notches progressively engage said bars at said arcuate ends thereof.

11. A device as recited in claim **10** in which
said power cylinder includes releasable ratchet means for precluding inward movement of said rod.

12. A device as recited in claim **10** including in addition
cooperative cam means on said first arm and said base for lifting said first arm and effecting said pivotal movement of said arms upon movement of said rod from said retracted position thereof.

13. A device as recited in claim **12** in which
said cam means includes an inclined plane on said base inclined upwardly toward said bars,
and a follower means on said first arm for engagement with said inclined plane.

14. A device as recited in claim **13** in which
said means for interconnecting said arms includes a pivot shaft,
said pivot shaft projecting outwardly from said arms for engagement with said inclined plane.

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DONLEY J. STOCKING, *Primary Examiner.*