March 8, 1949. A. W. HUNZ 2,463,772

LIFTING JACK

Filed Dec. 6, 1946 3 Sheets-Sheet 1

Fig. 1

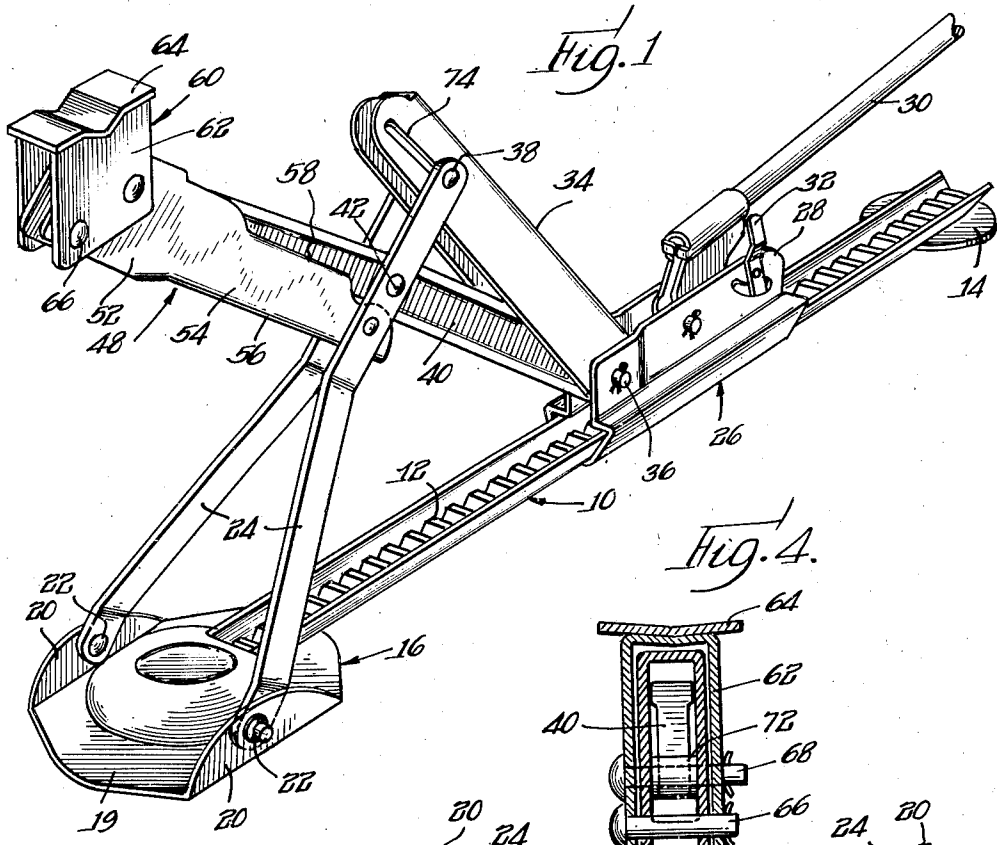
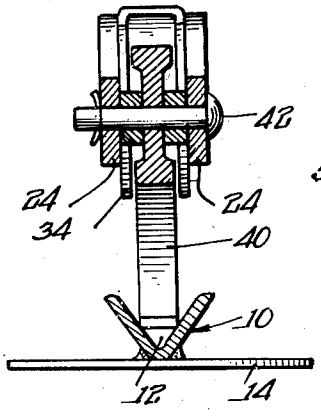


Fig. 4.

Fig. 5.



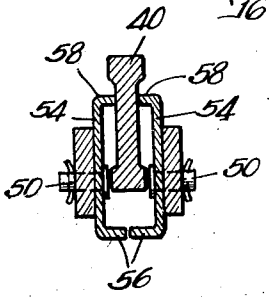


Fig. 6.

Inventor

Alphonse W. Hunz

By: Moore, Alston & Treyler

attys.

March 8, 1949. A. W. HUNZ 2,463,772

LIFTING JACK

Filed Dec. 6, 1946

3 Sheets-Sheet 2

Fig. 2.

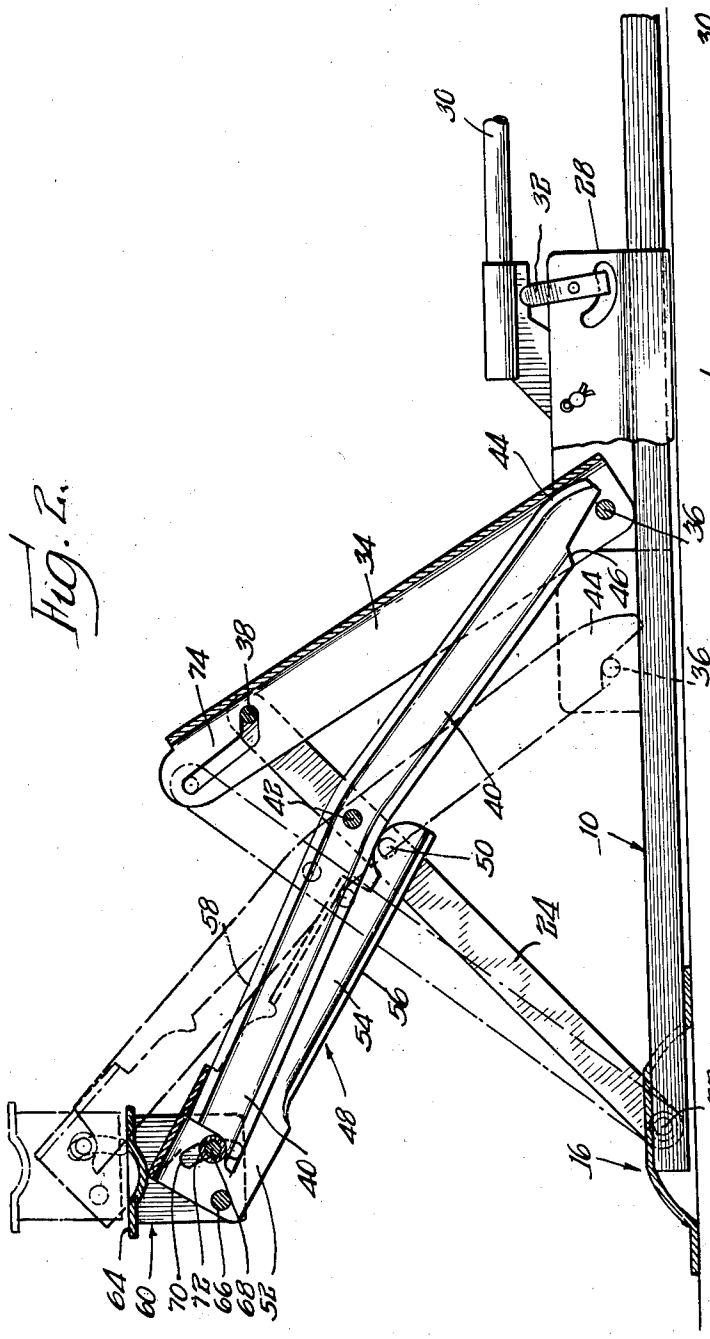
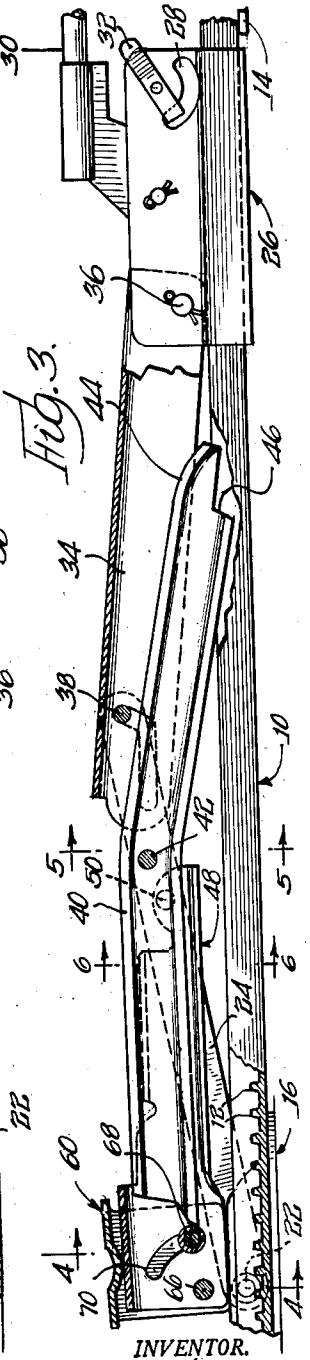


Fig. 3.



INVENTOR.

Alphonse W. Hunz

BY

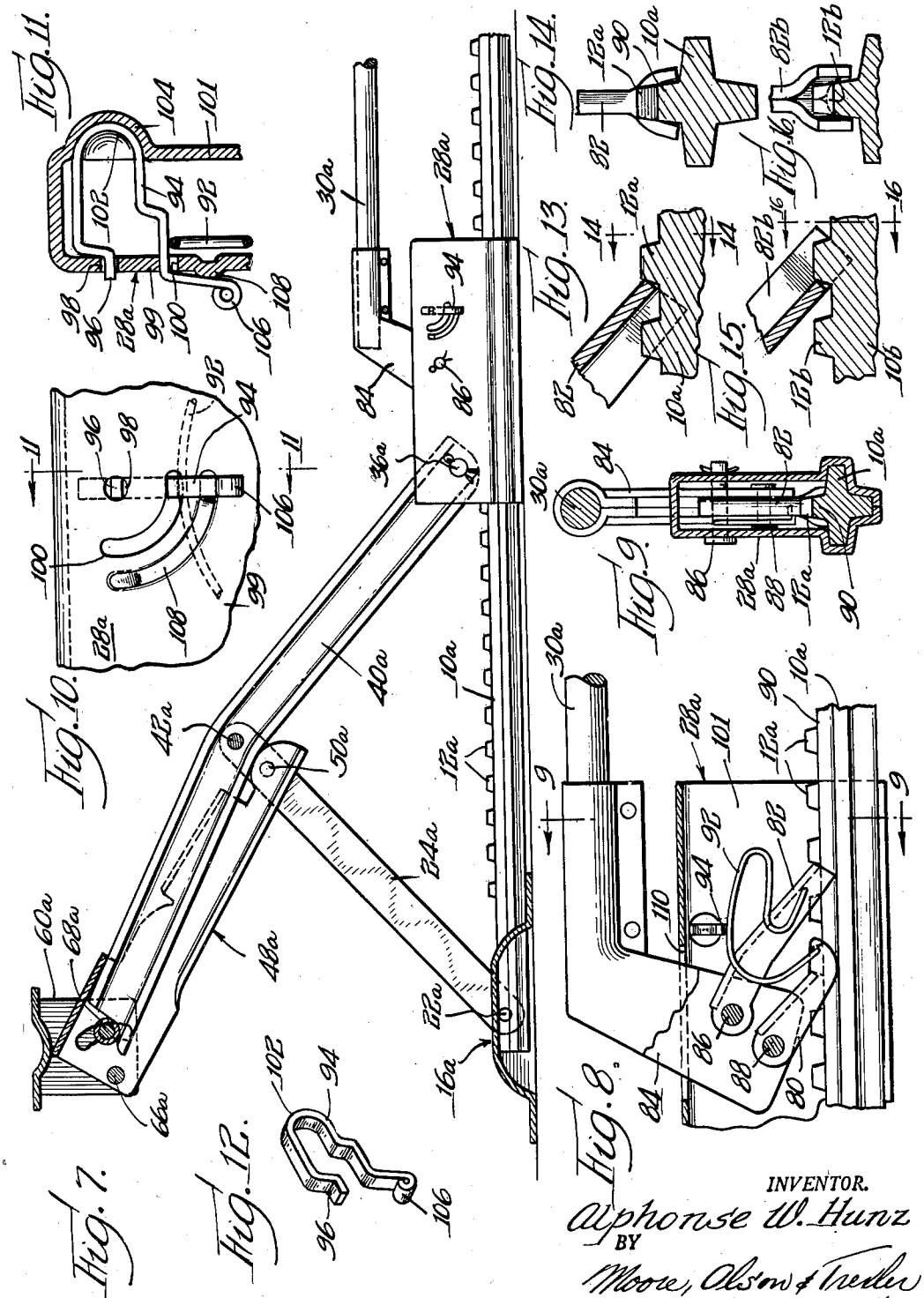
Moore, Olsen & Heller

attys.

March 8, 1949. A. W. HUNZ 2,463,772

LIFTING JACK

Filed Dec. 6, 1946 3 Sheets-Sheet 3



INVENTOR.
Alphonse W. Hunz
BY
Moore, Alston & Theuler
attys.

Patented Mar. 8, 1949 2,463,772

UNITED STATES PATENT OFFICE

2,463,772

LIFTING JACK

Alphonse W. Hunz, East Chicago, Ind.

Application December 6, 1946, Serial No. 714,379

10 Claims. (Cl. 254—110)

1

The present invention relates in general to mechanical lifting jacks of the type used in connection with automobiles and trucks, and in particular to lifting jacks of the low level type wherein a carriage is stepped along a horizontal rack bar by a pawl mechanism to elevate a lifting head connected to the bar and to the carriage through a system of levers.

An object of the invention is to provide a lifting jack of the type described wherein the various parts of the lever system are constructed to nest within each other so as to provide a very compact assembly when the jack is fully lowered.

Another object is the improved construction of the base and manner of attaching it to the horizontal rack bar, the base being attached to the bar without deformation of the latter so as to avoid any weakening thereof as in certain prior constructions.

Still another object is the provision of an improved and simplified means for maintaining the lifting head level for all operating positions of the jack.

An additional object is to improve the construction of the pawl and rack mechanism in a jack of the type described whereby longer life and more dependable service are obtained.

A further object of one embodiment of the invention is to provide novel means for causing the lifting head of the jack to move substantially in a direct vertical line.

A still further object of said one embodiment is to provide a lifting jack of the type described wherein the character of the lever system varies with the elevation of the lifting head to obtain more uniform lifting ratio whereby undue sacrifice of leverage at low elevations is avoided.

A further object of another embodiment of the invention is to provide a lifting jack of the type described wherein the mechanical advantage of the lever system varies with the elevation of the lifting head in a desired manner which provides fast operation at low elevations without sacrifice of leverage at high elevations.

Other objects and features of the invention will appear upon a perusal of the following specification taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a perspective view of a jack which is constructed in accordance with the principles of the invention, shown in partly elevated position;

Fig. 2 is a side elevational view of the jack shown in Fig. 1, with certain portions shown in section to reveal details of construction, and with the jack shown in its fully elevated position in dotted lines;

Fig. 3 is a side elevational view similar to Fig. 2, with the jack shown in its fully lowered position;

Fig. 4 is a transverse sectional view through the lifting head and base plate of the jack, taken along the line 4—4 in Fig. 3;

Fig. 5 is a transverse sectional view through part of the lever system and through the horizontal rack bar, taken along the line 5—5 in Fig. 3;

Fig. 6 is a transverse sectional view showing details of a portion of the lever system, taken along the line 6—6 in Fig. 3;

Fig. 7 is a side elevation of a modified form of the invention;

Fig. 8 is a fragmentary longitudinal section through the carriage mechanism of the embodiment shown in Fig. 7;

Fig. 9 is a transverse section on the line 9—9 in Fig. 8;

Fig. 10 is a fragmentary view in side elevation of a portion of the carriage mechanism;

Fig. 11 is a transverse section on the line 11—11 in Fig. 10;

Fig. 12 is a detail perspective view of a latch member employed in the carriage mechanism;

Fig. 13 is a fragmentary longitudinal section through a portion of a pawl and rack mechanism;

Fig. 14 is a transverse section through the structure shown in Fig. 13, taken along the line 14—14;

Fig. 15 is a sectional view similar to view 13, showing a modified form of pawl; and

Fig. 16 is a transverse section along the line 16—16 in Fig. 15.

2

The jack which is illustrated in Figs. 1 to 6, inclusive, comprises a horizontal bar 10 of V-shaped cross section having a series of spaced-apart rack teeth 12 formed along the bottom of the V, preferably by hot-rolling. A flat circular disk 14 is welded to the underside of the bar 10 at one end to space the bar from the ground and to distribute the weight carried by the jack over an appreciable area. The other end of the bar extends through a side opening in a flat-topped dome portion of a base plate 16 and is welded to the underside of the flat ceiling of the dome portion at 18 (Fig. 4). An annular flange portion 19 extends horizontally from the base of the dome portion and is turned upwardly along the sides to form parallel flanges 20 which serve to stiffen the base and to provide supports for pins 22 on which arms 24 of the lever system are pivoted at one end.

The rack bar 10 supports a carriage, or pawl mechanism, 26 which may be of the type shown and described in my prior Patent 2,361,690, dated October 31, 1944. The carriage includes a housing 28 which is free to slide longitudinally along the rack bar 10 under the influence of pawls contained withing the housing and actuated by an operating handle 30. A latch 32 controls the direction of movement of the carriage along the

rack bar in response to the operation of the handle 30.

A lever arm 34 formed of sheet metal and having a U-shaped cross section, is pivotally attached at one end to the housing 28 by means of a pin 36. The arms 24 are pivotally and slidably secured to the other end of the lever arm 34 by means of a pin 38. A lever arm 40, having an I-shaped cross section, extends between and is pivotally attached near its midpoint to an intermediate point on the arms 24 by a pin 42. One end of the lever arm 40 extends within the lever arm 34 and is formed to an arcuate shape, as at 44 (Fig. 2), so as to permit this end of the lever arm to slide freely along the underside of the web portion of the lever arm 34. The lowermost portion of the lever arm 40 is cut away at this same end to form a shoulder 46 which at times bears against the pivot pin 36, as will be more fully described hereinafter.

A fourth arm 48 of the lever system is pivoted at one end to the arms 24 by pivot pins 50 and rests on the upper surface of the lever arm 40 at its other end. The arm member 48 is formed of sheet metal and includes an end portion 52 of U-shaped cross section, the two flanges of which are extended longitudinally to form a pair of arms 54 extending along opposite sides of the lever arm 40. The lower and upper edges of the arms 54 are formed inwardly to provide stiffening flanges 56 and 58. The upper flanges of the arms 54 also serve to position the lever arm 48 relative to the lever arm 40, the inner edges of the flanges 58 being spaced apart a distance sufficient to enable them to slide freely over the web portion of the lever arm 40. Thus the arm 48 is slidable longitudinally on the lever arm 40, and also may be angularly shifted with respect to the lever arm to a limited extent.

A lifting head 60, comprising a U-shaped body portion 62 having a platform 64 welded thereon, is pivoted at the end of the arm 48 on a pin 66. A second pin 68 passes through the lifting head 60 and arcuate slots such as 70 in the arm 48 (Fig. 2). The central portion of the pin 68 is encompassed by a sleeve 72 which bears against the end of the lever arm 40, which end is formed to a contour such that the lifting head 60 is maintained in a level position for all operating positions of the jack.

Referring now particularly to Figs. 2 and 3, when the carriage 26 is advanced towards the base plate 16 by the operation of the pawl mechanism, the pin 38 joining the arms 24 and 34 is gradually elevated. The lifting head 60 continues to rest on the base plate 16 until the lever arm 40 has been pivoted counter-clockwise by the elevation of pin 42 sufficiently to cause the rounded portion 44 thereof to bear against the underside of the web portion of the arm 34. From this point on, the lever arm 40 pivots in the reverse direction, or clockwise as viewed in Figs. 2 and 3, about the pin 42 as the carriage 26 moves towards the left of the figure. It will be noted that the rounded end portion 44 of the lever arm 40 initially bears against the lever arm 34 at a point near the center thereof. As the elevation of the jack progresses, the end of the lever arm 40 gradually slides along the arm 34 toward the pivot pin 36. During this portion of the operation of the jack the mechanical advantage is maintained at a substantially uniform, high value and the lifting head 60 moves in a substantially rectilinear, vertical path.

When the movement of the carriage 26 has progressed to the point where the shoulder 46 formed in the end of the lever arm 40 abuts the pivot pin 36, the character of the lever system is changed, the lever arm 34 thereafter playing a relatively insignificant part in the operation of the lever system. This change in the character of the lever system takes place at a time when the leverage afforded by the lever arm no longer is required to maintain the high mechanical advantage of the jack 34. The lever arm 34 is provided with slots such as 74 in which the pivot pin 38 slides during the time that the lever arm 34 is ineffective. Elevation of the lifting head 60 continues straight upwardly. The jack has been shown in its fully elevated position, with the shoulder 46 bearing on the pivot pin 36 and with the pivot pin 38 disposed at the upper end of the slot 74, in the broken-line representation in Fig. 2.

The jack disclosed in Figs. 1–6 is so constituted that the character of the lever system is altered for elevations below a predetermined level to prevent undue loss of mechanical advantage at low elevations. This feature is advantageous where, for example, the jack is being applied to the axle of a vehicle to lift the total weight, sprung and unsprung, of the vehicle.

Furthermore, a low level type of jack has been provided which is very compact when fully lowered, mainly by reason of the unique form and relation between the various lever arms which enables them to nest snugly within one another.

The improved manner of attaching the horizontal rack bar to the base plate results in a stronger and more economical construction than that previously used as there is no need to deform the rack bar.

A very simple means for maintaining the load lifting head in a level position for all operating positions of the jack has been provided by forming the end of the load lifting lever in the manner shown. This leveling arrangement results in a strong and durable structure which requires a minimum number of elements and occupies little space.

It should be noted that when the shoulder 46 of lever 40 is engaged with the pin 36, the jack will operate in such manner that the head 60 moves vertically at a progressively decreasing rate as its elevation increases; that is to say, there is some increase of mechanical advantage throughout this portion of the travel of the lifting head.

In lifting the sprung weight of automobiles or trucks by application of the lifting force to the frame of the vehicle, the load varies with the elevation of the lifting head of the jack due to the fact that the weight gradually is shifted from the springs of the vehicle to the jack. Under such circumstances it is desirable that the jack have a mechanical advantage which varies progressively with the elevation thereof, whereby it may be operated rapidly at the lower elevations where only a small lifting force is required and yet remains easy to operate at the high elevations due to the increased mechanical advantage obtained at such elevations. The lever system of the jack disclosed in Fig. 7 provides such a progressive variation in mechanical advantage with elevation of the lifting head.

Referring now to Fig. 7, the jack therein illustrated is similar to the jack shown in Figs. 1 and 2, corresponding parts being designated by similar reference numerals. In this instance, however, the lever arm 40*a* is pivotally mounted

on the pin 36a carried by the carriage 28a. The lifting head 60a is coupled to the levers 40a and 48a in substantially the same manner as in the above described embodiment, and the arms 24a likewise are pivotally connected at 42a and 50a to the levers 40a and 48a. The lever arm 34 of Figs. 1 and 2 is omitted in the case of the embodiment shown in Fig. 7.

With the present arrangement of parts the mechanical advantage of the lever is substantially less when the lifting head 60a is in its lowermost position than it is when the head 60a approaches its upper limiting position. Conversely the vertical movement of the lifting head 60a is the greatest, for a given advance of the carriage 28a when the head 60a is in its lowermost position. This affords rapid lifting action during the time when the weight of the vehicle is being transferred from the springs of the vehicle to the jack, and slower lift with increasing mechanical advantage as the springs are relieved of such weight.

The pawl and rack mechanism for advancing the carriage 28a and elevating the lifting head 60a may be of any desired type, but I prefer to employ a mechanism such as shown in detail in Figs. 8 to 14, inclusive. In the present instance the rack bar 10a is star-shaped in cross section, as shown in Fig. 14, and is provided with rack teeth 12a preferably of frusto-conical configuration or any similar shape to afford convex surfaces adapted to be engaged by the pawls 80 and 82, Fig. 8. These pawls are pivotally mounted on a bell crank lever 84 which is pivoted on a pin 86 extended between the side walls of the carriage housing 28a. The upper arm of the bell crank 84 is provided with a laterally extending socket in which the operating handle 30a of the jack is received.

The pawl 80 is pivotally mounted on a pin 88 carried by the lower end of the bell crank 84. The pawl 82 is pivoted on the pin 86 which serves as the fulcrum for the lever 84. The rack bar 10a has on its upper surface a central ridge 90 from which the rack teeth 12a project upwardly. The pawls 80 and 82 preferably are formed with bifurcated extremities adapted to embrace the ridge 90 for maintaining the pawls aligned with the teeth 12a. Thus, as shown in Figs. 9, 13 and 14, the pawl 82 is of substantially U-shaped cross-section at its lower end, the legs of the U extending downwardly on either side of the ridge 90. A similar construction may be adopted for the pawl 80. An alternative construction of the pawls is illustrated in Figs. 15 and 16. As there shown, each pawl as 82b has a bifurcated lower end, the legs of the bifurcation extending in substantially the same direction as the body of the pawl. In this instance the lower edge of the bifurcated portion is adapted to engage the rack teeth 12b.

A leaf spring 92 is anchored at opposite ends thereof in the pawls 80 and 82 and is bent into a predetermined shape for enabling the pawls to function in the well known manner to step the carriage 28a along the rack bar 10a when the operating handle 30a is reciprocated. In accordance with conventional practice, the spring 92 is placed under stress by a latch member 94 when the carriage 28a is to be advanced forwardly along the rack bar 10a. When the carriage 28a is to be retracted rearwardly, the latch 94 is moved to its release position, whereupon the pawls 80 and 82 function in a reverse manner for stepping

the carriage 28a rearwardly along the rack bar 10a.

As one of the features of the present invention I provide a latch member 94 as shown in Fig. 12 formed from a strip of resilient material. The upper end 96 of member 94 is inserted in an aperture 98, Figs. 10 and 11, in a side wall 99 of the carriage housing 28a. The member 94 extends from the upper end 96 thereof laterally to the opposite side 101 of the housing 28a and is looped back, passing laterally through an arcuate slot 100 in the wall 99. The bight 102 of member 94 is received interiorly of a boss 104 protruding outwardly from the wall 101. The outer end of the member 94 which protrudes from the slot 100 is bent downwardly and curled to provide a handle 106 whereby the member 94 may be grasped. The handle 106 is maintained outwardly of the wall 99 by an arcuate bead 108 against which the bent-down portion of the member 94 bears.

The star-shaped bar 10a with the convex teeth 12a thereon is readily formed by rolling and affords a sturdy construction. It may be secured to the base plate 16a by being welded thereto as in the case of the embodiment shown in Figs. 1 and 2. The construction of the pawls 80 and 82 as herein shown insures that they will positively and firmly grip the rack teeth. The resilient cam or latch member 94 acting in conjunction with the spring 92 has been found to increase the useful life of the spring 92 as compared with a rigid latch member.

The lower portion of the carriage housing 28a is formed around the rack bar 10a as shown in Fig. 9, so that the carriage is constrained to slide along the bar 10a without undesirable rocking movement thereof. The bell crank lever 84 works in a slot 110, Fig. 8, extending along the upper edge of the housing 28a, the ends of the slot serving to limit the back and forth motion of the lever about its pivot for preventing distortion of the spring 92.

While certain selected embodiments of the invention have been shown by way of illustration, other embodiments may be constructed without departing from the invention in its broader aspects, and therefore the aim of the appended claims is to include all such modifications as fall within the true spirit and scope of the invention.

The invention is hereby claimed as follows:

1. A lifting jack comprising a base including a horizontally extending bar, a carriage slidable along said bar to raise and lower the jack, a system of levers pivoted on each other and on said base and carriage, a load-lifting head pivotally connected to one of said levers, another of said levers terminating in a cam surface adjacent said head, and a cam follower on said head engaging said cam surface.

2. A lifting jack comprising a base including a horizontally extending bar, a carriage slidable along said bar to raise and lower the jack, a first lever pivoted at one end on said base, a second lever pivoted at one end on said carriage, said levers being pivotally attached to each other at their other ends, a third lever pivoted between its ends on said first lever, a load-lifting head supported by said last lever at one end thereof, the other end of said last lever slidably engaging the underside of said second lever, and means for preventing sliding of said last lever along the second lever after a predetermined elevation is reached, whereby the character of the key lever system is altered for further elevation of the jack

to obtain a desired change in mechanical advantage.

3. A lifting jack comprising a base including a horizontally extending bar, a carriage slidable along said bar to raise and lower the jack, a first lever pivoted at one end on said base, a second lever pivoted at one end on said carriage, said levers being pivotally attached to each other at their other ends, a third lever pivoted near its midpoint on said first lever, and a load-lifting head supported by said last lever at an end thereof which is disposed approximately vertically above the lower pivotal axis of said first lever, the other end of said last lever slidably engaging the underside of said second lever, and means preventing sliding of the last lever along the second lever when a certain elevation is reached, whereby the character of the lever system is altered for further elevation of the jack to obtain a desired change in mechanical advantage.

4. A lifting jack comprising a base including a horizontally extending bar, a carriage slidable along said bar to raise and lower the jack, a first lever pivoted at one end on said base, a second lever pivoted at one end on said carriage, said levers being pivotally attached to each other at their other ends, a third lever pivoted between its ends on said first lever, one end of said third lever slidably engaging the underside of said second lever, a fourth lever pivoted at one end on said first lever and supported at its other end by the other end of said third lever, and a lifting head jointly supported by said third and fourth levers at their adjacent ends in such manner that the relative movement therebetween maintains the lifting head level during raising or lowering thereof.

5. A lifting jack comprising a base including a horizontally extending bar, a carriage slidable along said bar to raise and lower the jack, a first arm of U-shaped cross section pivoted at one end to said carriage, a second arm pivoted at one end to said base and slidably secured at its other end in a longitudinally extending slot in the other end of said first arm, a lever pivoted between its ends on said second arm, one end of said lever extending into said first arm to engage the underside of the web portion thereof, a third arm supported at one end by the other end of said lever and pivoted at its other end on said second arm, and a lifting head pivoted on said last arm and engaging said lever, the portion of said lever which is engaged by the lifting head being formed to maintain the head level in all operative positions of the jack.

6. A lifting jack comprising a horizontally extending rack bar of star-shaped cross section having convex-shaped teeth, a base plate having a central flat topped dome portion, an annular flange extending horizontally from the base of the dome portion, and parallel upturned flanges formed on opposite sides of the base plate, one end of said bar extending over said annular flange, through an opening in the side of the dome portion, and being welded to the dome ceiling along the upper edges of the bar, a carriage slidable along said bar and including a pawl mechanism adapted to cooperate with said rack teeth, and a lifting head adapted to be raised and lowered upon movement of said carriage along said bar through a lever system which is pivoted to the upturned flanges of said base plate and to said carriage.

7. A lifting jack comprising a horizontally extending rack bar of star-shaped cross section having convex-shaped teeth, a base plate having a central flat topped dome portion, an annular flange extending horizontally from the base of the dome portion, and parallel upturned flanges formed on opposite sides of the base plate, one end of said bar extending over said annular flange, through an opening in the side of the dome portion, and being welded to the dome ceiling along the upper edge of the bar, a carriage slidable along said bar and including a pawl mechanism adapted to cooperate with said rack teeth, a first arm pivoted at one end on said carriage, a second arm pivoted at one end on the upturned flanges of said base and slidably secured at its other end in a longitudinally extending slot in the other end of said first arm, a lever pivoted between its ends on said second arm and slidably engaging the underside of said first arm at one end, and a load-lifting head supported by said lever at its other end.

8. A lifting jack comprising a base including a horizontally extending bar, a carriage slidable along said bar to raise and lower the jack, a system of levers pivoted on each other and on said base and carriage, a load-lifting head supported by said lever system so as to move vertically at a substantially constant rate with increasing elevation of the lifting head, said head being pivotally connected to one of said levers, another of said levers terminating in a cam surface adjacent said head, and a cam follower on said head engaging said cam surface.

9. A lifting jack comprising a base including a horizontally extending bar, a carriage slidable along said bar to raise and lower the jack, a system of levers pivoted on each other and on said base and carriage, a load-lifting head supported by said lever system so as to move vertically at a rate which progressively decreases with increasing elevation of the lifting head, said head being pivotally connected to one of said levers, another of said levers terminating in a cam surface adjacent said head, and a cam follower on said head engaging said cam surface.

10. In a lifting jack, a rack bar having a longitudinally extending central ridge and rack teeth projecting from said ridge, a carriage slidable along said rack bar and including a pair of pawls adapted to cooperate with said rack teeth, each of said pawls having a bifurcated end for straddling said ridge and engaging said teeth successively, a lifting head, and a lever system actuated by said carriage for raising and lowering said lifting head.

ALPHONSE W. HUNZ.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,093,269	Hindman	Apr. 14, 1914
2,099,903	Nilson	Nov. 23, 1937
2,361,690	Hunz	Oct. 31, 1944