

Dec. 2, 1969

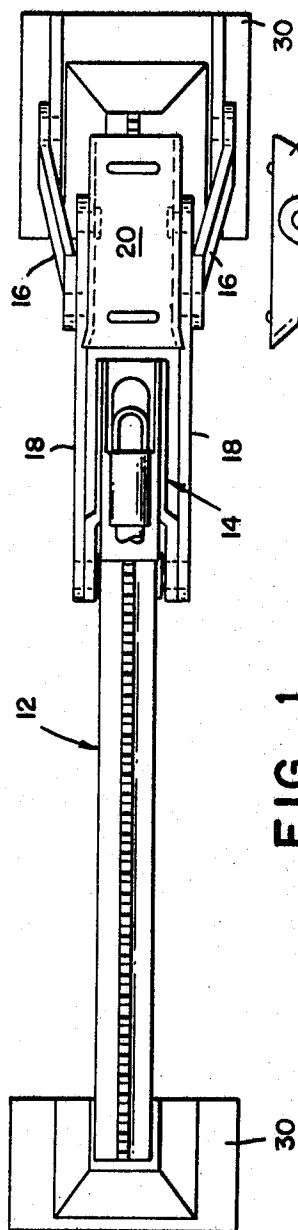
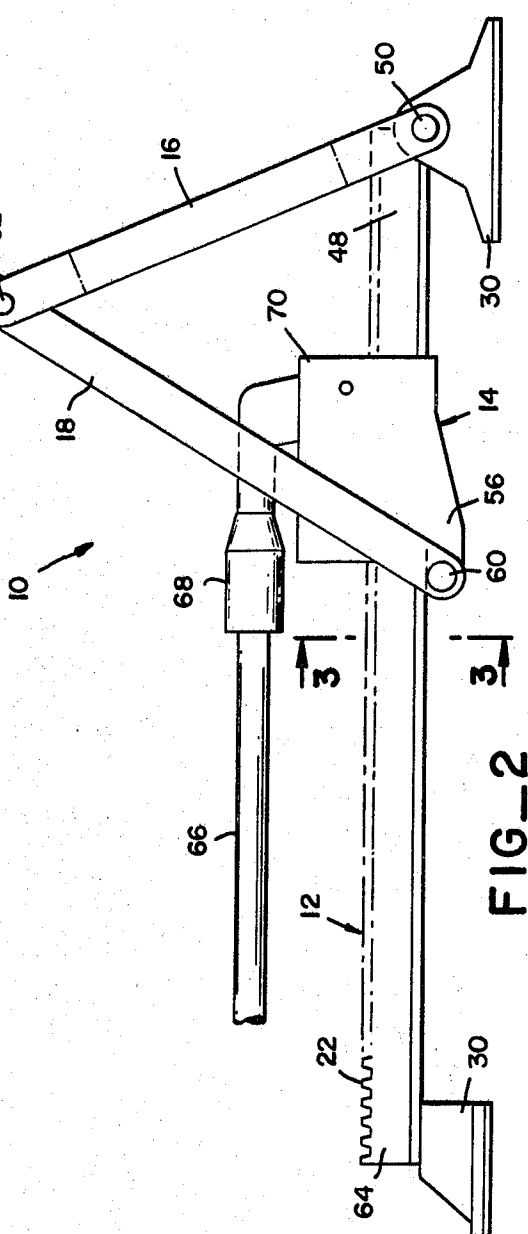
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3,481,581

LIFTING JACK

Filed Aug. 24, 1967

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

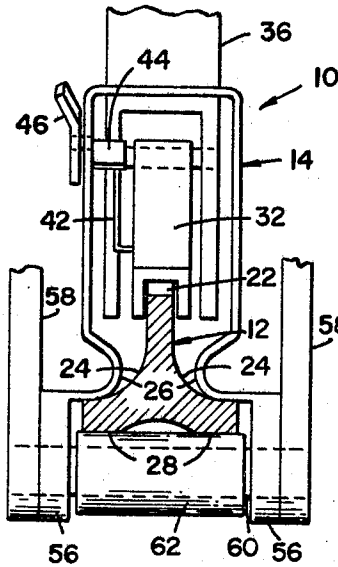


FIG_3

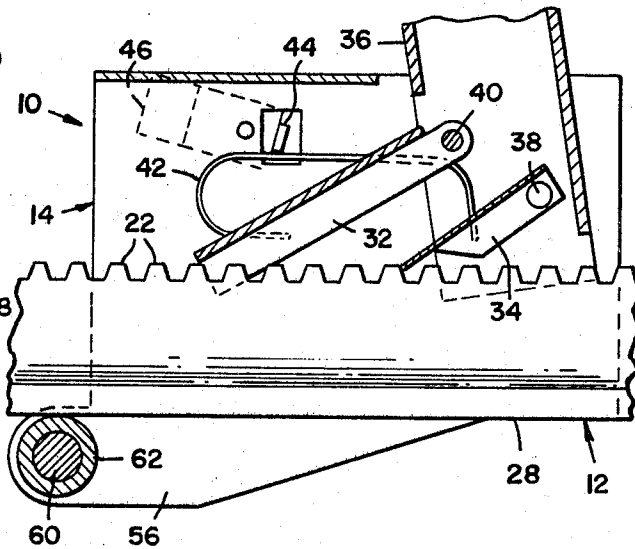


FIG_4

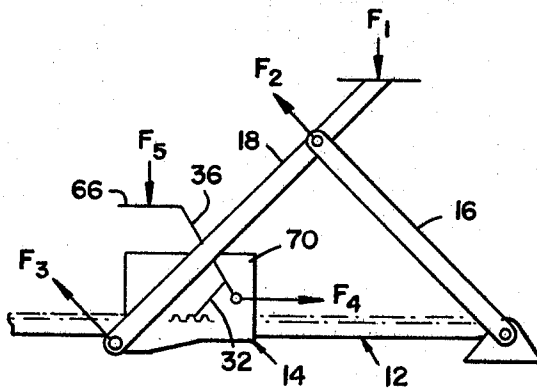


FIG_5

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LIFTING JACK

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12 Claims

ABSTRACT OF THE DISCLOSURE

An improved lifting jack of the type having a horizontal rack and a carriage mounted on the rack for movement incrementally along the same wherein a lever arm, whose lower end is connected to the carriage and whose upper end has weight-supporting means thereon, will be moved in a direction to elevate the weight-supporting means as the carriage moves forwardly toward one end of the rack. The lower end of the lever arm is coupled to the rear end of the carriage with reference to the direction of forward movement of the carriage. Means coupled with the lower end of the lever arm and the carriage engages the underside of the rack as the carriage moves along the same.

This invention relates to improvements in lifting jacks and, more particularly, to a jack of the type having a horizontal rack and generally known as a low-profile jack.

The present invention is directed to a lifting jack of the type described wherein certain components of the jack are arranged relative to each other to provide greater efficiency in lifting a given weight and to provide a longer operating life for the jack. The structure of this type of jack includes a rack adapted to be disposed in a horizontal position, a carriage mounted on the rack for reciprocation and having dog or pawl means engageable with the teeth of the rack for incrementally moving the carriage along the rack, and a pair of lever arms pivotally connected to the rack and the carriage respectively, to cause weight supporting means on the upper end of one of the lever arms to be raised to elevate a load as the carriage moves toward one end of the rack.

Specifically, the invention centers around the location at which the one lever arm is connected at its lower end to the carriage, and the use of bearing structure to transfer a part of the load to the rack rather than have the carriage sustain all of the load as in prior structures. This connection is made at the bottom of the carriage and at its rear end with reference to its forward direction of movement so that the bearing structure can be coupled to the lower end of the lever for shiftable engagement with the underside of the rack.

Lifting jacks of the type having horizontally disposed racks have been used in the past, but the lever arm having the weight-supporting means thereon has always been attached to the carriage at the forward end thereof with reference to its direction of movement for elevating the weight-supporting means. Since the pawl or dog structure on the carriage effectively applies a force to the carriage generally to the rear of the connection of the lever arm to the carriage, the lever arm is, in effect, pushed upwardly by the carriage as the latter moves forwardly along the rack.

Several problems encountered with prior jacks of this type include burring of the teeth on the rack and the relatively high input force which must be manually applied to cause the carriage to raise the weight supporting means. When the teeth of the rack become burred, the jack itself becomes inefficient due to the slipping of the pawls on the burred teeth. The burring of the teeth results from excessive force applied thereto by the pawls since con-

siderable force is required to "push" the lever arm upwardly. This applied force must be also exerted on the teeth since the teeth form the fulcrum for the pawl structure. Unless the material forming the teeth is of high quality and strength, the rack becomes completely ineffective after only a relatively few uses.

An extremely important feature of this invention is the way in which pressure on the teeth of the rack is minimized so as to prevent the teeth from becoming burred. This is accomplished by having the rack itself absorb some the load applied by the lever arm due to the weight at its upper end. To provide for this, bearing structure, such as a roller, is attached to the lower end of the lever arm and shiftable engages the underside of the rack for movement along the same with the carriage. Since the lower end of the lever arm tends to rotate upwardly due to the weight applied at its upper end, this rotational tendency is effectively countered by the rack which absorbs a part of the load so that the carriage will not be subjected to the entire load. As a result, less force is exerted on the teeth of the rack by the pawl structure on the carriage. Thus, the teeth are not damaged, i.e., burred, by excessive force and the operating life of the jack is thereby extended.

The amount of manually applied force required to move the carriage of prior lifting jacks is also a factor. With the lever arm mounted on the forward end of the carriage, as is the practice in the prior jacks, the carriage must exert a push on the lever arm in order to elevate a weight on its upper end. As compared with a pull on the lever arm, a push requires more effort to lift a given weight. This is analogous to an individual trying to advance a vehicle, such as an automobile, in a forward direction. By pushing on the rear of the vehicle, more effort is required than if the individual were to pull the front of the vehicle forwardly applying the analogy to a lifting jack of this type, the pulling force exerted on the lever arm by the carriage requires less effort than is required to cause the carriage to push the lever arm. The present invention provides for a pull by the carriage on the lever arm by connecting the lower end of the lever arm to the rear end of the carriage. Thus, amount of force applied to the carriage to advance it along the rack will be less than that required to advance it when the lever arm is connected to the front end of the carriage.

The lifting jack of this invention has a variety of uses and is especially adapted for use with passenger automobiles wherein the jack may be conveniently stored in a collapsed condition in the trunk area. The invention is also adapted for application to existing bumper jacks by modifying the same to attach the two lever arms to the rack and carriage respectively. To accomplish this, a pair of supports are connected to the ends of the rack to allow the rack to be disposed in a horizontal position spaced above a supporting surface. The two lever arms can then be pivotally connected to the rack and the carriage respectively, with the one arm being attached to the rear of the carriage and the other arm being connected to the front end of the rack. The carriage will be provided with a projection to allow the lever arm to be connected to the carriage near the underside of the rack, whereby the roller can be disposed adjacent to and in engagement with the underside of the rack.

It is the primary object, therefore, to provide improvements in lifting jacks of the type utilizing a horizontal rack wherein the location at which the lever arm having the weight-supporting means thereon is connected to the carriage allows the jack to be used over extended periods of time without damaging the teeth of the rack or the pawl structure of the carriage and permits the force required to advance the carriage along the rack to be re-

duced over that required to move the carriage on conventional lifting jacks of this type.

Another object of this invention is to provide a lifting jack of the type described wherein one of the pair of lever arms required for such jack is coupled to the normally rearmost end of the carriage so that the carriage will apply a pull to the lever arm as a weight is being elevated rather than a push as has been heretofore relied upon in conventional lifting jacks of this type.

A further object of this invention is to provide an improved lifting jack of the type described wherein the lever arm connected to the rear end of the carriage has a laterally extending roller thereon which engages the underside of the rack so that the rack acts to absorb a part of the load exerted by the lever arm to thereby minimize the force exerted on the carriage and thereby the pressure exerted on the teeth of the rack by the pawl structure of the carriage.

Still another object of this invention is to provide a lifting jack of the horizontal type which can be made from a conventional bumper jack by the attachment to such jack of the two lever arms and pivot means for connecting one arm to the rear arm of the carriage and the other arm to the forward end of the rack with a minimum of modification to the bumper jack itself.

Other objects, features and advantages of the present invention will be more apparent after referring to the following specification and accompanying drawings in which:

FIG. 1 is a top plan view of the lifting jack embodying the teachings of the present invention;

FIG. 2 is a side elevational view of the jack;

FIG. 3 is a cross-sectional view taken along line 3—3 in FIG. 2;

FIG. 4 is an enlarged, fragmentary, cross-sectional view of the jack, illustrating the interior of the carriage and the way in which the lifting lever arm is coupled thereto; and

FIG. 5 is a schematic view of a portion of the jack illustrating the way in which forces are applied to the carriage and to the lifting lever arm.

The lifting jack of this invention is broadly denoted by the numeral 10 and includes a rack 12 adapted to be disposed in a horizontal position, a carriage 14 mounted on rack 12 for movement in opposed directions along the same and a pair of lever arms 16 and 18 pivotally connected at their lower ends to the rack and the carriage respectively as shown in FIG. 2. Arm 18 has a foot or pad 20 on one end thereof for engaging the underside of an object to be elevated, such as the frame of a vehicle. Pad 20 moves up and down in response to the movement of carriage 14 back and forth along rack 12.

Rack 12 is provided with a plurality of longitudinally spaced teeth 22 on the upper extremity thereof. The rack may have any desired cross-section but, for purposes of illustration, it has the cross-section shown in FIG. 3 wherein it is provided with side surface 24 for supporting inwardly extending portions 26 on carriage 14. Rack 12 is also provided with a pair of flat surfaces 28 on the underside thereof for a purpose to be described. A pair of feet 30 are secured to the rack at opposite ends thereof for supporting the same in a generally horizontal position spaced above a supporting surface.

Carriage 14 provides a tubular housing for a pair of pawls or dogs 32 and 34. A jacking lever 36 is pivotally coupled to the carriage by a pin 38 and extends upwardly and outwardly therefrom, dog 34 being pivotally coupled to the carriage on pin 38 and dog 32 being pivotally coupled to jacking lever 36 by a pin 40 spaced from pin 38 as shown in FIG. 4. A spring 42 interconnects dogs 32 and 34 and a lateral projection 44 on a rotatable arm 46 moves into and out of biasing relationship to spring 42. When projection 44 biases the spring downwardly, the spring forces dogs 32 and 34 towards teeth 22. The dogs are then in positions to cause carriage 14 to move forwardly as jacking lever 36 is moved up and down. When

projection 44 is out of biasing relationship to spring 42, there is no tendency to force the dogs toward the teeth. The dogs are then in position to cause the carriage to move in reverse as jacking lever 36 is moved up and down. Carriage 12, including dogs 32 and 34, lever 36, spring 42 and projection 44, is essentially of conventional construction and is the structure normally used with bumper jacks.

Arm 16 is comprised of two sections on opposed sides of the rack, each section being pivotally coupled to the forward end 48 of rack 12 by a pin 50 which extends transversely to the rack adjacent to the lower surfaces 28 thereof as shown in FIG. 2. The opposite end of each section of arm 16 is coupled by a pin 52 to a corresponding section of arm 18 between the ends of the latter and adjacent to the end having pad 20 thereon, arm 18 also having a pair of sections 58 on opposed sides of the rack. It is to be noted that pad 20 is pivotally coupled by a pin 54 to the upper end of arm 18.

Carriage 14 is provided with a pair of projections 56 (FIGS. 2, 3 and 4) which extend downwardly from its normally bottommost margin on opposed sides of the rack. Sections 58 of arm 18 are connected at their lower ends by a pin or shaft 60 to respective projections 56 in the manner shown in FIG. 3. A roller 62 is rotatably carried on shaft 60 and normally engages the flat surfaces 28 on the underside of rack 12. Thus, roller 62 is in rolling engagement with the underside of the rack and the rack is in load bearing relationship to lever arm 18.

In operation, jack 10 is disposed on the ground in a collapsed position with the rack substantially horizontal and with carriage 14 adjacent to the opposite end 64 of rack 12 opposite to end 48. Thus, pad 20 will be spaced below the object to be elevated. A bar 66, such as lug wrench, is inserted into the tubular outer end 68 of jacking lever 36 in the manner shown in FIG. 2 and arm 46 is rotated in a direction to cause projection 44 to bias spring 42 inwardly.

By applying an up-and-down movement to bar 66, dog 32 is caused to be received within the spaces between successive teeth, whereupon the dog 32 acts as a fulcrum as force is applied to the carriage to cause it to move toward end 48 of rack 12. Dog 34 prevents reverse movement of the carriage as dog 32 is progressively advanced to the spaces between adjacent teeth.

As carriage 14 is advanced toward end 48, pad 20, after engaging the object to be elevated, is moved upwardly inasmuch as lever arm 18 becomes more and more vertical due to its connection with carriage 14 and lever arm 16. As the desired elevation is attained, the jacking action is halted whereupon the necessary operations can be performed on the elevated object.

When it is desired to lower pad 20, projection 44 is swung away from spring 42 and pawls 32 and 34 allow carriage 14 to move towards end 64 of rack 12 in increments as bar 66 is moved up and down.

It is to be noted that the position of the lower end of lever arm 18 causes the carriage to pull the lever arm as the carriage moves toward end 48 of rack 12. This is illustrated in FIG. 5 wherein a number of forces are shown in a schematic view of the jack and include the following forces: force F_1 represents the downward force due to the weight to be elevated; force F_2 represents the force applied to lever arm 18 by lever arm 16 at their common junction; force F_3 represents the force applied by lever arm 18 to rack 12 and carriage 14 due to the tendency for lever arm 18 to rotate about pin 52 under the influence of force F_1 ; force F_4 represents the force applied by the jacking lever 36 to the carriage as the bar 66 is moved downwardly; and force F_5 represents the force which must be applied manually to the bar 66 to cause force F_4 to be applied to the carriage. Upon observation of FIG. 5, it is clear that force F_4 pulls the lower end of lever arm 18 forwardly and this is to be distinguished from the prior art structures which pro-

vide for a push to the lever arm inasmuch as the lower end of lever arm 18 has, in the past structures, been pivotally coupled to the carriage in the vicinity denoted by the numeral 70 (FIGS. 2 and 5). In such a case, pin 38 (where force F_4 is applied) is below and to the rear of region 70 so that a push in effect is given to the lever arm to raise a weight thereon. By providing a pull instead of a push on lever arm 18, less force has been found to be required to move the carriage forwardly.

Since roller 62 engages the underside of rack 12, the rack absorbs some of the force applied by the lever arm in the vicinity of shaft 60. Thus, dog 32 is not driven against the teeth with an extremely large force as would exist if all of the force exerted by lever arm 18 were to be taken up by the carriage. Thus, the teeth are relieved of any substantial pressure which would tend to cause them to burr and thereby to be damaged. In the prior art structures, all of the force applied by the lever arm is taken up by the carriage and, as a result, the force on the teeth applied by the dog structure is extremely high and, unless the teeth are of high quality material, burring of the teeth takes place in a relatively short time and after relatively a few number of uses of the jack. Thus, the presence of roller 62 effectively relieves the pressure on the teeth and prolongs the life of the lifting jack of this invention.

The teachings of this invention can be applied to an existing bumper jack of the type normally provided as standard equipment on many automobiles today. To utilize a conventional bumper jack, only the rack and carriage of the same are utilized, the foot plate is not needed. The feet 30 are first welded or otherwise rigidly affixed to the ends of the rack and then projections 56 are secured to carriage 14 in any suitable manner, such as by welding.

Thereafter, lever arms 16 and 18 are connected by pins 50 and 60 to rack 12 and carriage 14 respectively, whereby the jack is complete and ready for use. The lug wrench, which normally is utilized with the bumper jack, can be used with lifting jack 10. A slight modification may be required on jacking lever 36 to cause its outer tubular end 68 to extend longitudinally of the rack as shown in FIG. 2. This is for the convenience of the user where the lifting jack is disposed beneath the underside of a vehicle and jacking area is limited. If desired, a kit can be prepared for commercial sales by assembling the necessary components for transforming a conventional bumper jack into the lifting jack of this invention.

Lifting jack 10 provides an extremely rugged structure which minimizes the force required to elevate a given weight and also prolongs the life of the jack due to the fact that the teeth of the rack do not become burred over extended periods of use of the jack. The jack can be effectively stored in the trunk of an automobile since it can collapse inasmuch as carriage 14 can be disposed adjacent to end 64 of rack 12 with lever arms 16 and 18 effectively extending longitudinally of the rack.

While one embodiment of the present invention has been illustrated and described, it is clear that other embodiments can be made without departing from the scope of the present invention.

It is claimed:

1. In a lifting jack of the type having a rack adapted to be disposed in a generally horizontal position: a carriage having a front end and a rear end and adapted to be coupled to said rack for forward and reverse movement along the same; an arm pivotally secured to said carriage adjacent to said rear end and extending forwardly and upwardly therefrom when said carriage is mounted on said rack, said arm having weight supporting means adjacent to the upper end thereof; and means secured to said arm for coupling the same to said rack at a location to cause said weight-supporting means to be elevated as said carriage is moved forwardly along said rack.

2. In a lifting jack of the type having a rack adapted to be disposed in a generally horizontal position: a carriage having a front end, a rear end, and a bottom extremity and adapted to be coupled to said rack for forward and reverse movement along the same; an arm pivotally secured to said carriage adjacent to said rear end and said bottom extremity and extending forwardly and upwardly therefrom when said carriage is mounted on said rack, said arm having weight supporting means adjacent to the upper end thereof; means secured to said arm for coupling the same to said rack at a location to cause said weight-supporting means to be elevated as said carriage is moved forwardly along said rack; and means coupled to said arm for shiftably engaging the underside of the rack, whereby the rack will be in load-bearing relationship to the arm.

3. In a lifting jack as set forth in claim 2, wherein said engaging means includes a roller adapted to be disposed in rolling engagement with the underside of the rack.

4. In a lifting jack as set forth in claim 2, wherein said arm comprises a pair of spaced sections adapted to be disposed on opposed sides of the rack, said engaging means being disposed between and coupled to said arm sections and adapted to be disposed in rolling engagement with the underside of the rack.

5. In a lifting jack: a rack adapted to be disposed in a horizontal position; a carriage having a pair of opposed ends and being mounted on said rack for movement in opposite directions along the same; a first arm having weight-supporting means at one end thereof; a second arm pivotally secured to and extending upwardly from one extremity of said rack, the upper end of said second arm being pivotally secured to said first arm intermediate the ends of the latter, the opposite end of said first arm being pivotally coupled to said carriage at the end thereof remote from said one extremity of the rack, whereby said weight-supporting means will be raised and lowered as said carriage moves toward and away from said one extremity.

6. In a lifting jack as set forth in claim 5, wherein is provided a projection secured to and extending outwardly from said remote end of the carriage with said projection being disposed longitudinally of said rack, said opposite end of the first arm being pivotally connected to said projection.

7. In a lifting jack as set forth in claim 5, wherein said rack is provided with a bottom surface, said carriage having a projection extending below said bottom surface of the rack, said opposite end of the first arm being connected to said projection, and wherein is included means coupled to said opposite end of the first arm and shiftably engaging said bottom surface for holding said opposite end against upward movement when a weight is supported by said weight-supporting means.

8. In a lifting jack as set forth in claim 7, wherein said first arm includes a pair of sections on opposed sides of the rack, said holding means including a roller between said sections with the roller normally in engagement with said bottom surface.

9. In a lifting jack of the type having a rack adapted to be disposed in a horizontal position and a carriage mounted on and movable along said rack in opposite directions: a first arm and a second arm; means on said first arm for pivotally connecting one end thereof to one extremity of said rack; means pivotally connecting the other end of the first arm to said second arm between the ends of the latter, said second arm having weight-supporting means adjacent to one end thereof; and means on the opposite end of the second arm for pivotally coupling the same to said carriage adjacent to the end thereof remote from said one extremity of said rack.

10. In a lifting jack as set forth in claim 9, wherein said coupling means includes a projection adapted to be rigidly secured to said carriage and to extend downwardly therefrom, said second arm being pivotally mounted on

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said projection, and means extending laterally from said projection for shiftable engaging the underside of the rack when said first and second arms are coupled to said rack and said carriage respectively.

11. In a lifting jack as set forth in claim 9, wherein is provided means adapted to be secured to the ends of the rack for supporting the same in a substantially horizontal position above a supporting surface.

12. In a lifting jack: a rack adapted to be disposed in a generally horizontal position and provided with a plurality of longitudinally spaced teeth thereon; a carriage shiftable mounted on said rack and having an actuatable mechanism engageable with the teeth for moving the carriage in increments along the rack when the mechanism is actuated; an arm pivotally secured to said carriage adjacent to one end thereof and normally extending upwardly therefrom and toward the opposite end thereof,

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said arm having weight-supporting means thereon adjacent to the upper end thereof; and means coupling the arm to said rack to cause said weight means to be elevated as said carriage moves along said rack with said opposite end of the carriage in advance of said one end thereof.

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