May 16, 1950 E. H. FENN 2,508,240

HYDRAULIC JACK

Filed July 24, 1947

Fig. 1

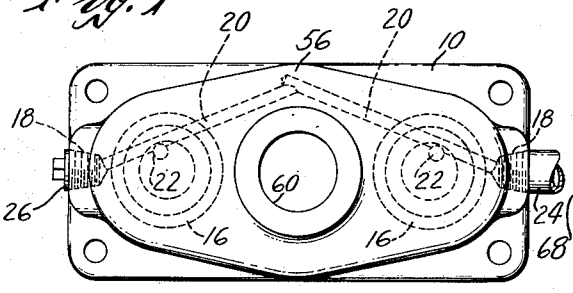


Fig. 4

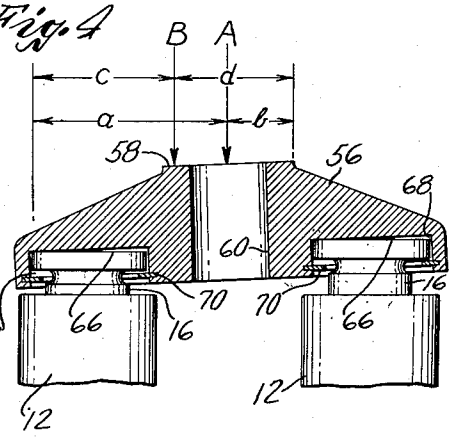


Fig. 2

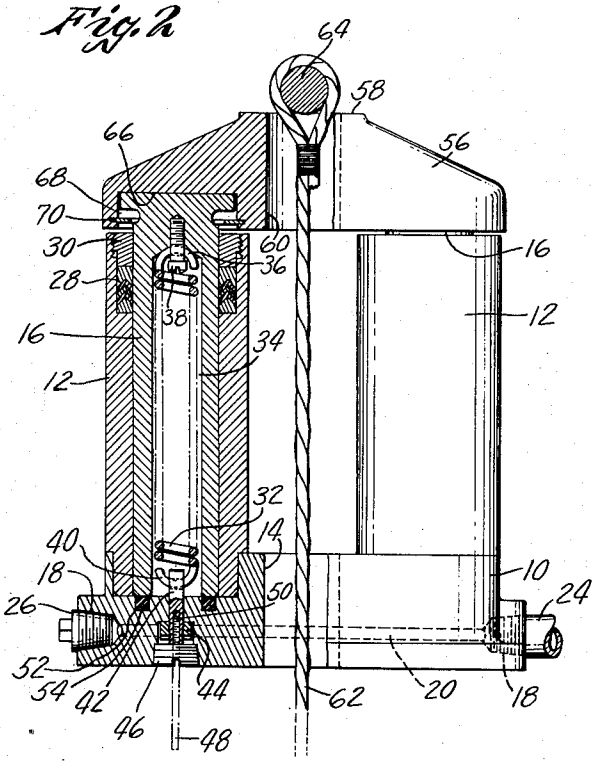
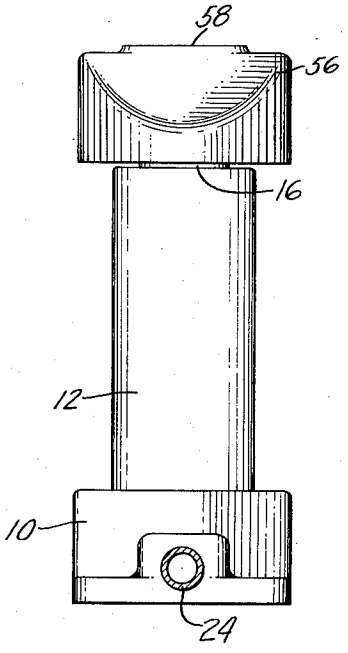


Fig. 3



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HYDRAULIC JACK

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7 Claims. (Cl. 254—89)

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The invention relates to a hydraulic jack adapted for a variety of uses, as for instance the lifting of an object under which it may be placed or the pulling of a chain or cable extending downward therefrom.

One of the objects of the invention is to provide a jack having a plurality of spaced lifting plungers and having a top plate loosely engaging the plungers so that the action of the plungers is equalized by the top plate, notwithstanding minor differences in the forces tending to move the plungers or tending to resist the movement thereof.

Still another object of the invention is to provide in a jack having two cylinders and two plungers a particularly advantageous means for supplying fluid under pressure to both cylinders.

A further object of the invention is to provide means for preventing the leakage of fluid to the exterior when each plunger is in its lowermost position and when the jack is not in use.

A still further object of the invention is to provide an advantageous means for connecting the spring which biases each plunger to its lowermost position, the said spring connecting means being entirely enclosed to prevent the escape of fluid.

Other objects of the invention will be apparent from the drawing and from the following specification and claims.

In the drawing I have shown in detail a preferred embodiment of the invention, but it will be understood that various changes may be made from the construction shown, and that the drawing is not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawing:

Fig. 1 is a plan view of a jack embodying the invention.

Fig. 2 is a combined side view and vertical central sectional view, with a cable in position to be pulled.

Fig. 3 is an end view.

Fig. 4 is a fragmentary diagrammatic view illustrating the equalizing action of the top plate.

The drawing shows a lifting jack having a plurality of lifting plungers and this is essential as concerns certain phases of the invention. Preferably, there are two plungers, although a larger number may be provided if necessary. A jack with two plungers will be described in detail, but it will be understood that as to other phases of the invention a single lifting plunger is sufficient.

It will be understood that such terms as "vertical" and "horizontal" are herein used merely for convenience of description and that they relate to the positions of the parts when the jack is in its upright position as shown. The jack may be used in other positions without departing from the invention.

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The jack comprises a base 10 having a flat bottom surface adapted to rest on a suitable support. Carried by the base 10 are two similar vertical hollow cylinders 12, 12 which are spaced apart transversely. These cylinders are preferably formed separately from the base 10 and the lower end portions of the cylinders extend into corresponding recesses in the top of the base. The cylinders may be variously connected with the base but they are shown as being connected by brazing. Preferably, the base is provided with a relatively large vertical aperture 14 centrally positioned between the two cylinders 12, 12.

Two similar plungers 16, 16 are vertically movable in the respective cylinders 12, 12. Preferably, the interior opening in each cylinder is of uniform diameter throughout and the portion of each plunger within the cylinder is of substantially uniform diameter throughout, the exterior of the plunger closely fitting the interior of the cylinder.

Suitable means is provided for supplying fluid under pressure to the interior of each cylinder below the plunger therein, and this means preferably comprises fluid supply holes formed in the base 10. As shown, the base 10 is provided at opposite ends with holes 18, 18 having tapered threads adapted to receive a pipe or a pipe fitting. Communicating with the holes 18, 18 are drilled diagonal holes 20, 20 which are at such angles that they intersect each other at one side of the central aperture 14 in the base. Communicating with the diagonal holes 20, 20 are holes 22, 22 which are vertical or substantially vertical and which communicate at their tops with the interiors of the cylinders 12, 12 below the plungers 16, 16. A pipe 24 is screwed into one of the threaded holes 18, 18, as for instance the hole at the right, and this pipe is connected with a suitable pump or other source of fluid under pressure. The fluid is ordinarily oil, but as to this the invention is not limited. The other hole 18 is suitably closed, as for instance by means of a plug 26. In lieu of the plug 26 there may be substituted a pipe, not shown, leading to a suitable pressure gauge. It will be seen that when fluid under pressure is introduced through the pipe 24, the said fluid passes through the holes 20, 20 and 22,

22 into the interiors of the cylinders 12, 12 to force the plungers 16, 16 upward.

As stated, the exterior of each plunger 16 closely fits the interior of the corresponding cylinder 12 and there is little opportunity for the escape of fluid between the plunger and the cylinder. However, in order to definitely prevent the escape of fluid, a suitable annular packing 28 is provided in an annular groove near the top of the cylinder. The packing 28 is preferably of the V-type. Positioned above the packing 28 is an annular gland 30 having threaded engagement with the top of the packing 28. By turning the gland 30, the packing can be compressed so as to firmly engage the exterior wall of the plunger. It will be seen that the interior of the packing and the interior of the gland constitute portions of the interior aperture in the cylinder.

A tension spring 32 is provided for biasing each plunger 16 toward its lowermost position. Preferably the spring 32 is located within a central aperture 34 in the plunger and is connected at the top with the plunger and at the bottom with the base. The aperture 34 in the plunger is closed at the top by an integral imperforate portion of the plunger. The upper end of the spring 32 is provided with a loop 36 which extend through a transverse hole in a screw 38 which is threaded into the top portion of the plunger. The screw 38 does not extend through the top of the plunger and there is therefore no possibility for the escape of fluid through the screw hole. The bottom end of the spring 32 is provided with a loop 40 which extends through a transverse hole in a spring connecting element 42. The element 42 is in vertical register with the screw 38 and it extends through a vertical hole in the base 10. The lower portion of the element 42 is threaded and is engaged by a nut 44 seated in a recess in the base surrounding the hole for the element 42. The hole for the element 42 and the said recess communicate with a threaded hole in the bottom of the base which is adapted to receive a screw plug 46. The screw plug 46 provides a seal at the bottom and prevents any escape of oil through the hole which receives the element 42.

During assembly the loop 36 on the spring 32 is entered in the transverse hole in the screw 38 and then by means of a long thin screwdriver the screw 38 is screwed into place in the plunger, this of course being done before the plunger is placed in the cylinder. Then the loop 40 at the bottom of the spring 32 is entered in the transverse hole in the element 42. The plunger and the spring and the element 42 are then put in place, but inasmuch as the coils of the spring are initially in direct contact with each other, the spring is too short to permit the element 42 to extend sufficiently into the base to be engaged by the nut 44. In order to tension the spring, a spring tensioning tool 48 is provided which is adapted to be threaded into a hole 50 in the element 42. During assembly the tool 48 extends through the nut 44 and, with the parts in their partially assembled positions as described, tension is applied to the tool 48 to draw the element 42 downward sufficiently to permit it to be engaged by the nut 44. Then by means of a special wrench, the nut 44 is screwed onto the element 42 to lock it in place, as shown in the drawing, the spring 32 then being under tension. After the element 42 is engaged by the nut 44, the tool 48 is removed and the plug 46 is put in place.

When the jack is in use the pressure which is applied serves to expand the V-type packing 28

to effectively prevent the passage of oil or other fluid. However, when the jack is not in use and when there is no pressure, the packing 28 is less effective and there is the possibility that a small amount of oil may seep past the packing 28, particularly if the jack is positioned on its side instead of upright. The amount of oil that would be thus lost is very small but it appears on the exterior of the jack and is unsightly and gives the impression that a serious leakage is occurring. To avoid any possible seepage of oil as above mentioned, the base is preferably provided below each plunger with an annular groove 52 having a sealing ring 54 therein. The sealing ring is concentric with the plunger and is of such size that it is engaged by the bottom of the plunger when the plunger is held in its lowermost position by the spring 32. Thus the sealing ring 54 effectively prevents any possible flow of oil outward from the interior aperture in the plunger when the jack is not in use.

A transverse top plate 56 is provided which engages the tops of the plungers 16, 16. This top plate has a central load carrying area 58 at the top and it is preferably provided with a relatively large central opening 60 in register with the aperture 14 in the base. When the jack is to be used a load is applied to the top plate 56 on the load carrying area 58 thereof, and fluid under pressure is forced into the cylinders 12, 12 to force the plungers 16, 16 upward. The plungers move the top plate 56 which in turn moves the load. Upon the completion of lifting, the fluid pressure is released and the plungers 16, 16 and the top plate 58 are moved downward by the springs 32.

The jack may be variously used and it may be placed directly under a load to be lifted, and the load may be directly applied to the area 58 of the top plate. However, instead of being placed directly beneath a load to be lifted, the jack may be used to pull a cable or other tension element extending upward throught the hole 14 in the base and connected with the top plate by any suitable connection or attachment means. Fig. 2 shows a cable 62 which extends upward through the holes 14 and 60 and which is looped around a transverse bar 64 resting on the top plate 56 at the load carrying area 58 thereof. The said hole 60 and the immediately adjacent portions of the top plate constitute means between the plungers in register with the aperture 14 in the base for the attachment of a tension element, such as the cable 62.

The plungers 16, 16 have relatively wide horizontal top faces 66, 66 and these top faces may have a diameter slightly greater than the diameter of the plungers. The transverse top plate 56 loosely engages the plungers so as to have a floating action and it has faces which fit the top faces 66, 66 of the plungers. Preferably, the top plate 56 has recesses 68, 68 into which the upper portions of the plungers extend. The plunger engaging faces of the top plate are within the said recesses 68, 68, and the recesses prevent relative transverse movement of the plate. Preferably, the top plate 56 is provided with snap rings 70, 70 which are engaged in annular grooves near the bottoms of the recesses 68, 68. The inner portions of the rings 70, 70 engage below the projecting upper portions of the plungers. The rings 70, 70 thus serve to retain the top plate 56 in place on the plungers without, however, interfering with limited relative movement or floating action between the said top plate and the said plungers.

The advantages of the before-mentioned loose or floating engagement between the plate and the plungers will be apparent from an examination of Fig. 4 which is partly diagrammatic. In manufacturing, it is difficult to obtain exact spacing between the cylinders and to obtain exact parallelism of the cylinders and plungers. The floating top plate allows some variations of the machining of the cylinders and plungers without producing distortion and consequent friction. The top plate is subject to minor deflection under load and if the plungers were rigidly connected there would be corresponding distortion or displacement of the latter with resultant friction. The loose engagement of the top plate with the plungers avoids any distortion of the plungers on account of deflection of the top plate.

Furthermore, inasmuch as the plungers both receive fluid from the same source, the pressures below the two plungers are the same or substantially the same and the plungers tend to move upward approximately in unison. However, there may be a tendency toward minor variations in movement, such variations resulting from minute differences in pressure, from variations in the tensions of the springs, and from variations in the frictional resistance between the plungers and the cylinders, particularly at the packings 28. If the top plate 56 were rigidly connected with the tops of the plungers, any tendency of one cylinder to move to a greater extent than the other would tend to distort the top plate and would cause increased friction between the plungers and the cylinders and this would seriously interfere with the proper functioning of the jack. The difficulty would be particularly serious after the load had been removed as the increased friction resulting from the distortion or cramping might be sufficient to prevent the downward return of the plungers by the springs. With the described loose engagement of the top plate with the tops of the plungers the latter can move freely and always to the same extent.

As illustrated in Fig. 4, it is assumed that the plunger at the right tends to move farther than the plunger at the left. As soon as the plunger at the right moves to even a minute extent beyond the plunger at the left, the top plate engages with the right plunger at the extreme inner edge thereof and engages the plunger at the left at the extreme outer edge thereof. If it be assumed that the load is centrally applied at the position A, the load is at the distance *a* from the point of engagement with the plunger at the left, and is at the much shorter distance *b* from the point of engagement with the plunger at the right. On account of the moment thus established a much larger portion of the load is carried by the plunger at the right which has moved farthest. This increased load on the plunger at the right counteracts its tendency to move farther and permits the plunger at the left to move up to the same level. It will be apparent that the same conditions would prevail in reverse if the plunger at the left tended to move farther than the plunger at the right. Thus the two plungers are caused to move upward in substantial uniformity inasmuch as any tendency of one of them to move farther than the other is immediately corrected.

In the foregoing explanation it has been assumed that the load is applied centrally at the position A. The same condition applies even if the load is not applied centrally and is applied at one side of the center, as for instance at the position B. With the load at the position B it is at the distance *c* from the point of engagement with the plunger at the left, and at the distance *d* from the point of engagement with the plunger at the right. The distance *d* is less than the distance *c* and the action is the same as already described. The correcting tendency is less pronounced, but it is nevertheless sufficient to cause the plungers to move in unison.

In the description of the action of the top plate and the plungers, it has been assumed that there are only two plungers. It will be evident, however, that the invention is not necessarily limited to a jack having only two plungers.

What I claim is:

1. In a hydraulic jack, the combination of a base, two transversely spaced similar vertical hollow cylinders on the base, two similar plungers in the respective cylinders having relatively wide horizontal top faces, means for supplying fluid at equal pressures to the interiors of the cylinders below the said plungers therein, a transverse top plate loosely engaging the top faces of the plungers and having a central load carrying area at the top, the said top plate having faces which fit the top faces of the plungers when the said top faces are at the same level and which engage the inner edge of the top face of one plunger and the outer edge of the top face of the other plunger when the plungers are at different levels, and means loosely connecting the top plate with the plungers to prevent separation, the said means permitting limited tilting of the top plate with respect to the plungers.

2. In a hydraulic jack, the combination of a base, two transversely spaced similar vertical hollow cylinders on the base, two similar plungers in the respective cylinders having relatively wide horizontal top faces and having annular grooves below the top faces, means for supplying fluid at equal pressures to the interiors of the cylinders below the said plungers therein, a transverse top plate loosely engaging the top faces of the plungers and having a central load carrying area at the top, the said top plate having bottom recesses into which the plungers extend and the said recesses having faces which fit the top faces of the plungers when the said top faces are at the same level and which engage the inner edge of the top face of one plunger and the outer edge of the top face of the other plunger when the plungers are at different levels, and means carried by the top plate and extending into the grooves in the plungers for preventing separation of the top plate from the plungers, the said means permitting limited tilting of the top plate with respect to the plungers.

3. In a hydraulic jack, the combination of a base having a central vertical aperture, the said base having diagonal horizontal fluid supply holes which intersect at one side of the vertical aperture and having substantially vertical fluid supply holes communicating with the respective diagonal holes, means for closing the outer end of one diagonal hole, means for supplying fluid under pressure to the outer end of the other diagonal hole, two transversely spaced similar vertical hollow cylinders on the base communicating at their lower ends with the respective vertical fluid supply holes, two similar vertically movable lifting plungers in the respective cylinders, and a top plate engaging the upper ends of the plungers and having means between the plungers in register with the vertical aperture in the base for the attachment of a tension element.

4. In a hydraulic jack, the combination of a base having a substantially vertical fluid supply hole therein, means for supplying fluid under presssure to the said fluid supply hole, a vertical cylinder on the base open at the top and communicating at the bottom with the vertical fluid supply hole in the base, a lifting plunger vertically movable in the cylinder, the plunger having a longitudinal aperture therein open at the bottom and closed at the top, a sealing ring engaging the base and the plunger when the latter is in its lowermost position, the said sealing ring surrounding the bottom of the plunger aperture and surrounding the top of the vertical fluid supply hole, and a spring for biasing the plunger downward to press the lower end thereof against the sealing ring.

5. In a hydraulic jack, the combination of a base having a substantially vertical fluid supply hole therein and having an annular groove in its top surrounding the fluid supply hole, a sealing ring in the groove in the base, means for supplying fluid under pressure to the said fluid supply hole, a vertical cylinder on the base concentric with the said groove and the said sealing ring, the said cylinder being open at the top and communicating at the bottom with the vertical fluid supply hole in the base, a lifting plunger vertically movable in the cylinder, the plunger having a longitudinal aperture therein open at the bottom and closed at the top and the said plunger when in its lowermost position engaging the annular sealing ring, and a spring for biasing the plunger downward to press the lower end thereof against the sealing ring.

6. In a hydraulic pack, the combination of a base having a vertical unthreaded spring connecting hole therein, a vertical hollow cylinder on the base open at the top and concentric with the hole in the base, a lifting plunger vertically movable in the cylinder, the plunger having a longitudinal aperture therein open at the bottom and closed at the top, means for supplying fluid under pressure to the interior of the cylinder below the plunger, a tension coil spring within the aperture in the plunger and connected at its upper end with the top portion thereof, a threaded element extending through the vertical hole in the base and engaging the lower end of the spring, and a nut positioned below the said vertical hole in the base and having threaded engagement with the said threaded element, the said nut upon being rotated relatively to the base and relatively to the last said element serving to move the said element downward through the hole and to thereby tension the spring so as to bias the plunger downward.

7. In a hydraulic jack, the combination of a base having a vertical unthreaded spring connecting hole therein, a vertical hollow cylinder on the base open at the top and concentric with the hole in the base, a lifting plunger vertically movable in the cylinder, the plunger having a longitudinal aperture therein open at the bottom and closed at the top, means for supplying fluid under pressure to the interior of the cylinder below the plunger, a tension coil spring within the aperture in the plunger and connected at its upper end with the top portion thereof, an element extending through the vertical hole in the base and engaging the lower end of the spring, the said element being exteriorly threaded and having a central threaded hole for the reception of a spring tensioning tool, and a nut engageable with the threaded exterior of the element so that when the element is moved downward by the tensioning tool to tension the spring the nut can engage the said element to hold it in its spring tensioning position.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
957,177	Baker	May 10, 1910
1,536,413	Thrift	May 5, 1925
1,685,697	Guerin	Sept. 25, 1928
1,686,993	Suter	Oct. 9, 1928
1,864,454	MacDougall	June 21, 1932
2,019,353	Lower	Oct. 29, 1935
2,087,718	Bowman	July 20, 1937
2,161,659	Shepard	June 6, 1939
2,163,959	Nilson	June 27, 1939
2,231,680	Pfauser	Feb. 11, 1941

FOREIGN PATENTS

Number	Country	Date
274,455	Great Britain	Mar. 8, 1928