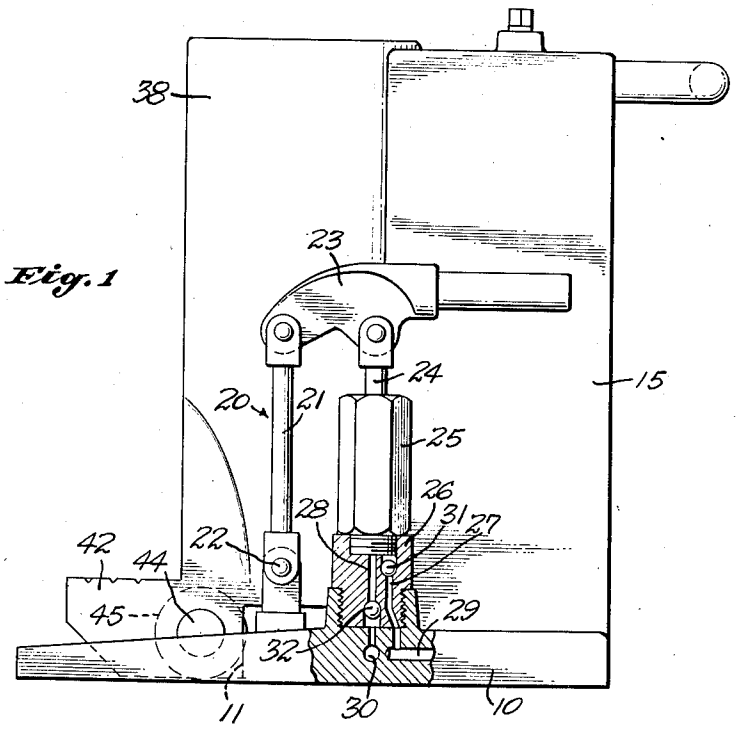
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HYDRAULIC JACK

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Fig. 1



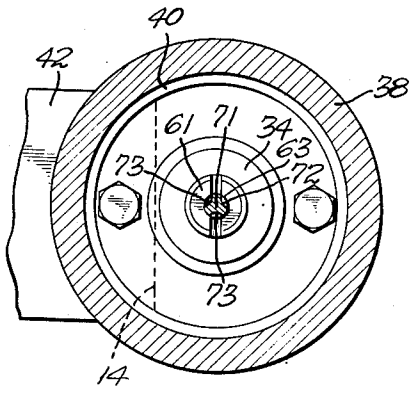


Fig. 5

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Fig. 2

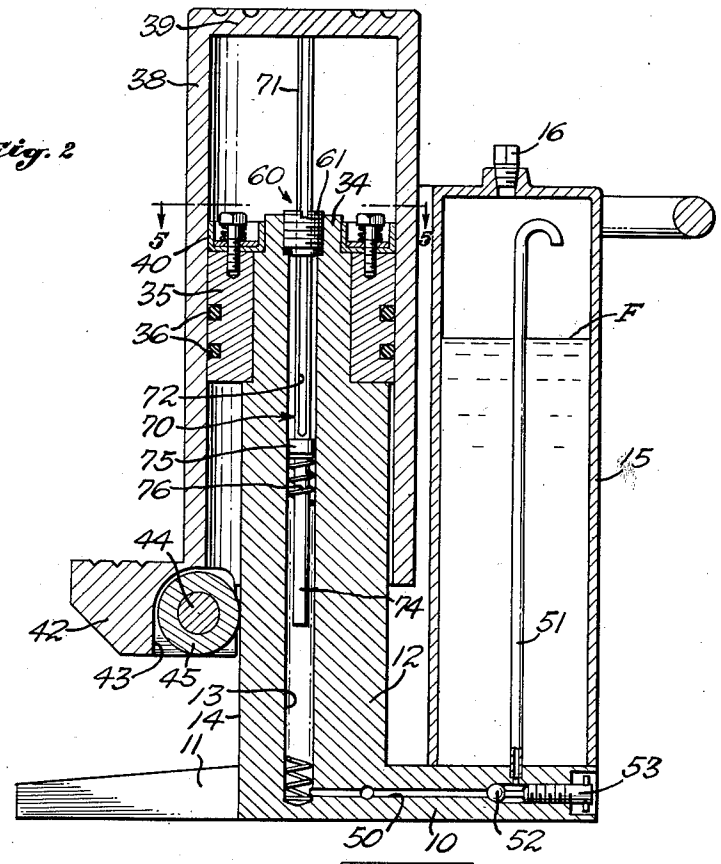


Fig. 3

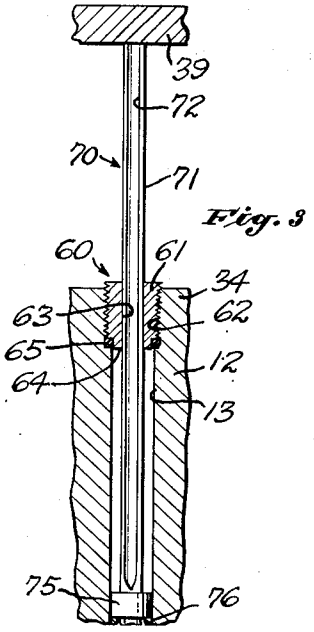
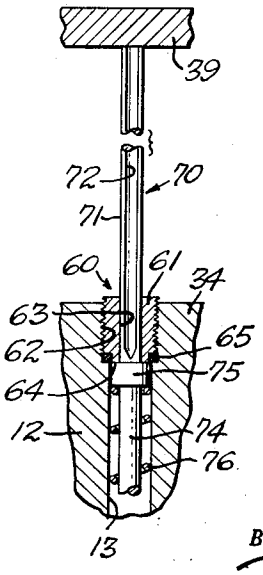


Fig. 4



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2,786,453

HYDRAULIC JACK

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Application November 17, 1953, Serial No. 392,570

2 Claims. (Cl. 121—46)

This invention relates generally to lifting devices and particularly to a hydraulic jack for moving an object. Specifically, the invention is concerned with improvements in a hydraulic jack of the general type disclosed in my United States Patent No. 2,654,568, granted October 6, 1953, for Hydraulic Jack.

My prior patent referred to above discloses a jack having a base provided with a vertical post and a lifting tube or ram slidable on the post and having an upper closed end, the post having a vertical passage communicating with the interior of the ram. Pump means are provided for forcing pressure fluid through the passage into the ram to raise the same. According to the patented structure, the ram is provided with a laterally projecting toe adapted to engage under an object to be lifted and in order to compensate for lateral stresses imposed upon the ram during the lifting of the object by means of the offset toe, a roller is provided adjacent the lower end of the ram, said roller engaging and being rollable along a flat, vertical surface of the post.

While such a jack is now used widely for industrial purposes and is regarded as highly efficient for such use, it has been found that failure of operators to follow directions for operating the device has frequently resulted in damage to the jack. To be more specific, the post has an enlarged piston-like head at its upper end and in the event that the ram is forced upwardly beyond a recommended height the roller is caused to strike against this head to cause damage to the head or to the roller, or both.

It is therefore an important object of the present invention to obviate this disadvantage by providing stop means operative to limit the upward movement of the cylindrical ram to a height which will preclude engagement of the roller means with the piston-like head so as to avoid damage to the parts.

Another object of the invention is to provide a hydraulic jack, of the character referred to, in which the stop means consists of a valve device so constructed and arranged as to function automatically, in response to upward movement of the ram to a predetermined height, to prevent further introduction of hydraulic fluid into the ram, such closing of the fluid passage occurring immediately prior to engagement of the roller means against the upper head of the post.

Another object of the invention is to provide a hydraulic jack of the type indicated in which the valve-type stop means includes an annular, sleeve-like, seat element screwed into the upper end of the fluid passage, and a plunger having an upper end portion of fluted cross section, said flutes forming ducts through which the fluid normally flows from the passage into the ram, the stop means further including a circumferential flange or valve element which, when the ram has moved through its predetermined, safe, upward stroke, moves into sealing engagement with the lower end of the seat element to shut off the flow of fluid.

Another object of the invention is to provide a hydraulic jack of the class specified in which the stop means

includes a spring pocketed in the fluid passage of the post and surrounding the lower end of the plunger with its upper end engaging the flange thereof, the spring thus functioning to normally maintain the upper, projecting end of the plunger against the upper end wall of the ram. By this provision, the plunger is caused to slide upwardly with the ram to cause the valve element to move progressively toward the seat element and to engage the same upon movement of the ram through its predetermined operative stroke.

Another object of the invention is to provide in a hydraulic valve, of the type referred to, sealing means for sealing the seat element against leakage of fluid.

A further object of the invention is to provide a stroke-limiting means which is extremely simple in construction and economical to produce, one which is highly efficient and fool-proof in action, and one which may be readily applied to existing, as well as to new jacks during the manufacture thereof.

Further objects will appear from the following description and from the drawings, which are intended for the purpose of illustration only, and in which:

Fig. 1 is a side elevational view of the improved hydraulic jack, one of the pumps being shown in section;

Fig. 2 is a vertical sectional view through the jack;

Fig. 3 is a fragmentary, vertical sectional view, showing the stop-valve open to allow flow of the hydraulic fluid into the hollow ram to raise the same;

Fig. 4 is a view similar to Fig. 3, showing the stop valve closed to shut off the flow of the fluid into the ram; and

Fig. 5 is a cross-sectional view, taken on line 5—5 of Fig. 2.

Referring to the drawings in detail, the improved hydraulic jack is of the general type disclosed in my patent referred to above, the jack having a base **10** adapted to rest upon a surface, the base having a slot **11** at one side. Formed integrally with the base **10** is a vertical post **12** which has an axial bore or fluid passage **13**. At its side adjacent the slot **11**, the post is provided with a flat, vertical surface **14**. Projecting upwardly from the base **10** is a cylindrical reservoir **15** for containing a supply of hydraulic fluid F, the reservoir having a filler opening, closed by a filler plug **16**.

One or more pump means **20** are provided on the base **10**, each pump including an upstanding link **21** pivoted at **22** and an actuating lever **23** pivotally connected to the upper end of the link **21** and to the upper end of a reciprocable plunger or piston **24**. The plunger **24** is slidable in a bearing **25** which, in turn, is connected to a valve housing **26** having passages **27** and **28** which communicate with passages **29** and **30** which, in turn, communicate respectively with the interior of the reservoir **15** and the bottom of the flow passage **13**. Incorporated in the valve passages **29** and **30** are ball valves **31** and **32**. When the piston **24** is moved upwardly, it unseats the ball **31** and draws hydraulic fluid from the reservoir through the line **29**. During downward movement of the piston **24**, the ball **31** is seated and the ball **32** is unseated to cause the fluid to be forced through the line **30** into the lower end of the post **12**.

Carried by the post **12** at its upper reduced end **34** is a stationary piston head **35** having sealing rings **36**. Surrounding the head **35** is a tubular ram **38** having an upper closed end **39**. A sealing element **40** carried by the reduced end **34** to further seal the clearance space between the head **35** and the inner surface of the ram **38**. At its lower end, the ram **38** is provided with a laterally projecting toe **42** adapted to underlie an object to be lifted. Disposed inwardly of the toe **42** is a recess **43** across which extends a pin **44**, a roller **45** being rotatable on this pin and adapted to roll along the flat surface **14** as the ram moves upwardly and downwardly on the post **12**.

As will be apparent, when hydraulic fluid is forced upwardly through the passage 13 and impinges against the upper end 39 of the ram 38, the latter is forced upwardly to lift the object supported upon the end 39 or by the toe 42. A return passage 50 leads from the flow passage 13 to a return pipe 51 which returns the fluid to the reservoir. The passage 50 normally is closed by a ball 52 which is seated by means of a release screw 53. With the ball 52 seated, the fluid is trapped within the ram 38 to maintain the object in raised position. When it is desired to lower the ram 38, the screw 53 is loosened to allow unseating of the ball 52 and return of the fluid to the reservoir 15.

As thus far described, the jack structure is identical with that disclosed in my patent hereinbefore referred to. While such a jack is highly efficient in use, it has the disadvantage of allowing the ram to move upwardly to a position where the roller 45 may strike against the lower end of the stationary piston head 35 to cause damage to these parts. The present invention is concerned with stop means designed to limit the upward stroke of the ram 38 to a height wherein the roller 45 is located in proximity to, but spaced slightly below, the piston head 35 so as to prevent damage to these parts. The stop or stroke-limiting means is constructed and arranged as next described.

The stop means 60 is in the nature of an automatically actuated valve and includes a sleeve-like seat element 61 which is screwed into a threaded counterbore 62 at the upper end of the post 12, the element having a bore 63 being coaxial and communicating with the passage 13. The seat element 61 has a lower, reduced end 64 which carries an annular resilient seal 65, in the form of an O ring which is compressed against the bottom surface of the counterbore 62 to seal the threads of the seat element 61.

The stop means 60 also includes a plunger 70 which is slidable vertically in the flow passage 13. The plunger 70 has an upper portion 71 which is fluted as indicated at 72, this portion being slidable through the bore 63. The flutes or grooves 72 define with the bore 63 a plurality of channels 73 (Fig. 5) through which the hydraulic fluid normally can flow upwardly into and downwardly from the ram 38. The plunger 70 has a lower, circular portion 74 and an intermediate enlargement or flange 75 providing a valve element, there being clearance between the periphery of the flange and the passage 13.

Pocketed within the passage 13 and surrounding the lower portion 74 is a coil spring 76. The lower end of the spring 76 seats against the lower end of the passage 13 and its upper end engaged under the valve flange 75. The compressed spring 76 thus functions to force the plunger 70 upwardly so as to maintain its upper end engaged against the under side of the closed end 39 of the ram 38.

Assuming that the ram 38 is in its lower, inoperative position with its closed end 39 adjacent the upper end 34 of the post 12, the valve flange 75 is located at a considerable distance below the seat element 61. To lift an object, the jack is positioned to locate either its upper end 39 or its toe 42 beneath the object and the pump means 20 is actuated to force hydraulic fluid upwardly through the passage 13 and channels 73 to react between the upper end of the post 12 and the end 39 of the ram to force the latter upwardly and lift the object. During this upward, operative stroke of the ram, the upper end of the plunger 70 is maintained against the closed end 39 by the action of the spring 76.

As the pumping action is continued, the plunger 70 slides upwardly and the roller 45 approaches the piston head 35. Eventually, the valve flange or element 75 engages against the lower end or seat of the sleeve-like element 61 to shut off the flow of the fluid into the ram and thus prevent further upward movement of the ram. The valve flange 75 is tightly seated against element 61 due to the combined force of the fluid pressure acting against the effective area of the flange and the upward thrust of the spring 76. The length of the fluted portion 71 of the plunger above the valve portion 75 is so calculated that the flow of fluid is stopped when the upper portion of the roller 45 is located slightly below the lower end of the piston head 35.

To lower the ram, it is only necessary to loosen the screw 53 to unseat the ball 52, whereupon the weight of the ram causes the latter to descend under the influence of gravity, this action forcing the fluid downwardly through the channels 73 and passage 13 and thence through the return line 50 and pipe 51 into the reservoir. At the same time, the plunger 70 is pushed downwardly to inoperative position by the ram.

It is thus seen that by the present stop or limit means, upward movement of the ram through an operative stroke is positively checked so as to avoid engagement of parts which would cause damage thereto. The stroke-limiting valve means is especially simple in construction and economical to produce. Moreover, the valve means may be incorporated in hydraulic jacks during the manufacture thereof, or readily installed in existing jacks without materially modifying their structure.

In accordance with the provisions of the patent statutes, I have herein described the principle of the invention, together with the construction which I now consider to represent the best embodiment thereof. I wish to have it understood, however, that the stroke-limiting means is suseptible of various modifications which would fall within the spirit and scope of the invention, as defined in the appended claims.

I claim as my invention:

1. In a hydraulic motor having an upstanding post provided with an axial flow passage, a cylindrical ram slidable on said post and having an upper closed end, pressure fluid introduced between said post and said closed end effecting upward movement of said ram through an operative stroke: an annular seat element detachably mounted in the upper end of said post and having a bore coaxial with said passage; an elongate plunger disposed coaxially within said flow passage and having an upper portion slidable in said seat element, said upper portion having longitudinally-extending grooves in its periphery defining with said bore a plurality of channels through which hydraulic fluid can flow from said passage into said ram, said plunger having an enlargement disposed below said seat element and providing an annular valve portion; and a spring pocketed within said passage and surrounding the lower end of said plunger and engaging said valve portion, said spring being operative to force said plunger upwardly to maintain its upper end in engagement with said closed end of said ram so as to cause the plunger to move vertically with the ram, said valve portion being engageable with said seat element to shut off the flow of hydraulic fluid into said ram upon movement of said ram through a predetermined operative stroke.

2. A hydraulic jack as defined in claim 1 in which said seat element consists of an externally threaded sleeve screwed into a screw-threaded counterbore in the upper end of said post, said seat element having a reduced lower extension; and a sealing ring surrounding said extension and compressed against the bottom of said counterbore.

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