May 31, 1960 K. N. WILLMORE 2,938,402

LOAD APPLYING DEVICE

Filed Nov. 14, 1958

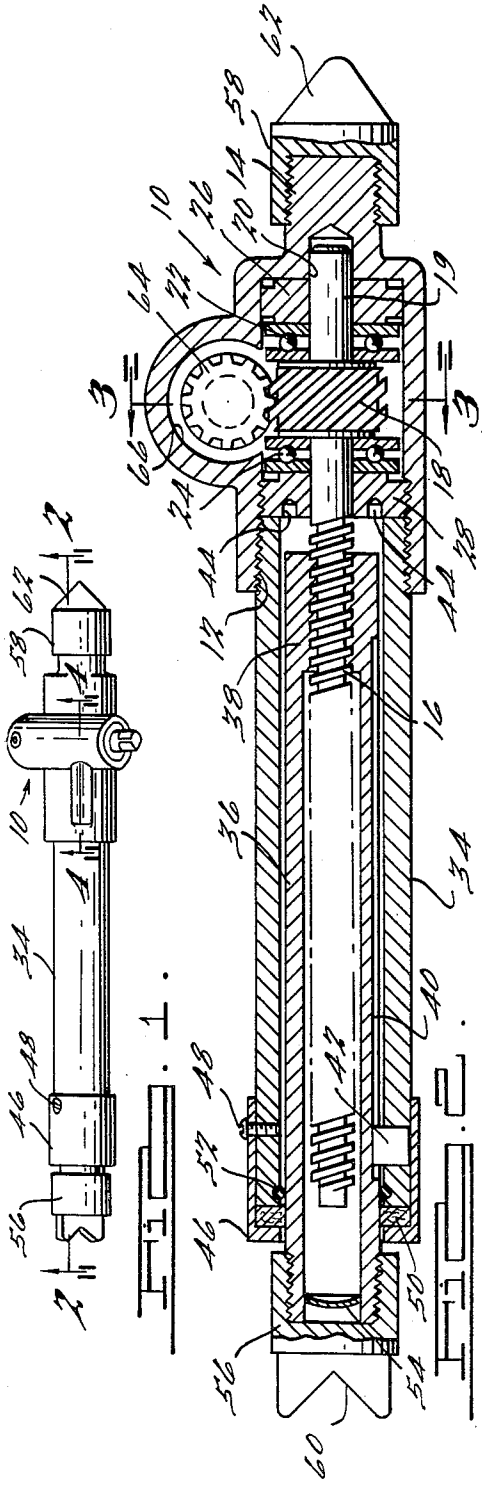


Fig. 1.

Fig. 2.

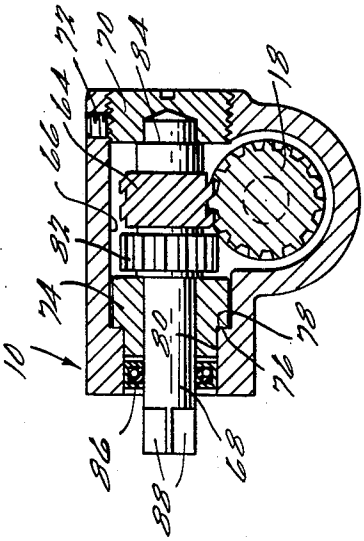


Fig. 3.

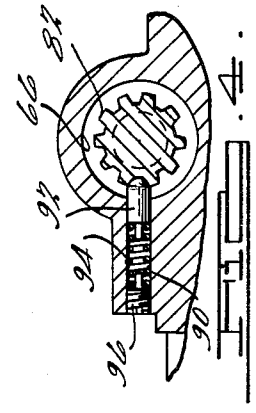


Fig. 4.

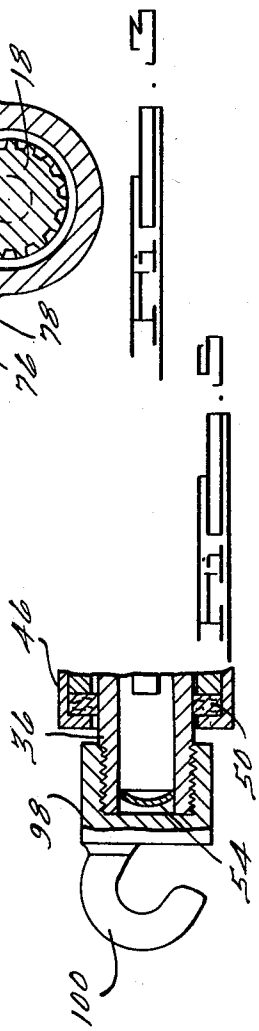


Fig. 5.

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United States Patent Office 2,938,402
Patented May 31, 1960

2,938,402

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Filed Nov. 14, 1958, Ser. No. 773,960

8 Claims. (Cl. 74—424.8)

This invention relates to load applying devices and particularly to a screw jack for exerting a pulling or a pushing force between two objects.

The invention embodies a screw jack so constructed as to be capable of exerting a substantial load with little effort. The jack has a pair of telescoped tubular casings disposed about a lead screw which has a threaded relation with the inner casing. The outer casing supports a housing containing the driving mechanism which consists of a worm wheel connected to a worm on the lead screw which is secured in position by thrust bearings that can withstand substantial compressive forces.

The worm wheel is supported on a stub shaft which is journaled in a sleeve on the housing in position to mesh with the worm. One end of the stub shaft is formed to receive a tool, motor, or the like for rotating the shaft. The tool may be of the reversible ratchet type, and if a motor is used to rotate the shaft, it is also preferably reversible so that the inner casing of the device may be extended or retracted. The screw jack is light, compact, and self-contained and one which may be easily carried and applied to the work, and also completely sealed and filled with lubricant.

It is one object of the invention to provide a simple and effective load applying device for exerting either a pushing or pulling force between two objects.

It is another object of the invention to provide a load applying device that is a light, compact, self-contained unit which may be easily carried, completely sealed from dirt and moisture, and capable of being filled with lubricant and sealed against the loss thereof.

It is a further object of the invention to provide a load applying device that can be placed in any desired position to obtain the selected pushing or pulling power so long as there is access to the drive mechanism of the device.

It is a still further object of the invention to provide a load applying device that can have a variety of attachments fitted on the ends thereof so that the device may be used in a variety of applications where a pushing or pulling force is needed.

It is a still further object of the invention to provide a load applying device that will exert a relatively large force for its size and weight, the large force obtained being, in part, attributable to the use of ball thrust bearings.

Other objects, features and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a plan view of a load applying device embodying features of the present invention;

Fig. 2 is an enlarged sectional view of the structure illustrated in Fig. 1 taken along the line 2—2 thereof;

Fig. 3 is a sectional view of the structure illustrated in Fig. 2 taken along the line 3—3 thereof;

Fig. 4 is an enlarged sectional view of the structure illustrated in Fig. 1 taken along the line 4—4 thereof; and

Fig. 5 is a fragmentary sectional view of the left end of the structure illustrated in Fig. 2 with a different end fitting attached thereto.

Referring to the drawing, a preferred embodiment of the present invention is comprised of a cylindrical housing 10 having internal threads 12 at one end thereof and an externally threaded end portion 14 projecting from the other end thereof.

A lead screw 16 has a worm 18 fixed on nonthreaded end portion 19 thereof which is disposed within a longitudinally extending bore 20 in the housing 10.

Ball thrust bearings 22 and 24 are provided on either side of the worm 18 to reduce the friction created by thrust forces, and bushings 26 and 28 are provided on either side of the ball thrust bearings to journal the nonthreaded end portion 19 for rotation within the housing 10. The worm 18 is fixed to the nonthreaded end portion 19 of the lead screw in a manner to prevent movement therebetween and the bushing 28 threadably engages the internally threaded end of the housing 10 to provide an axial adjustment for establishing the desired clearance for the thrust bearings 22 and 24 when assembling the device.

An outer tubular casing 34 has external threads on one end thereof which threadably engage the internal threads 12 of the housing 10, and an inner tubular casing 36 is disposed within the outer tube and has an internally threaded end portion 38 that threadably engages the lead screw 16 so that rotation of the lead screw moves the inner casing 36 in and out of the outer casing 34. The inner casing 36 is also provided with a longitudinally extending slot 40 and a key 42 which is fixed to the outer casing 34 and projects into the slot 40 to key the inner casing 36 against rotation as it moves in and out of the outer casing 34.

It will be observed that the externally threaded bushing 28 is provided with recesses 44 on the left face thereof, as viewed in Fig. 2, which can be engaged by a suitable tool to enable the bushing to be screwed into the housing 10. Once the bushing 28 is turned to the desired position, the outer casing 34 can be screwed into the housing 10 and jammed against the bushing 28 to lock it in position.

A cup-shaped end cover 46 is slidably disposed over the left end of the inner casing 36 and is fixed to the outer casing 34 by any suitable means such as a screw 48 to retain a seal 50 in sealing engagement with the outer surface of the inner casing 36. An O-ring 52 may also be disposed between the inner and outer casings, if desired, to provide an additional seal. An expansion plug 54, such as a Welch plug, is fixed within the end of the inner casing 36 to close it off and provide an enclosed chamber for holding a suitable lubricant to lubricate the lead screw 16. With this construction, both casings can be filled with lubricant and are sealed against loss of the lubricant.

Suitable end fittings 56 and 58 are threadably connected to the end of the inner casing 36 and the projecting end portion 14 of the housing 10, respectively, to adapt the device of the present invention for applying a pushing force. It will be observed that the fitting 56 has a V-notch 60 therein to adapt it for engaging a shaft or the like and that the fitting 58 has a conical nose 62 thereon for engaging suitable surfaces. Of course, different types of end fittings can be attached to the device in place of the fittings 56 and 58 to adapt the force applying device for exerting a variety of pushing or pulling forces. For example, in Fig. 5 an end fitting 98 is illustrated threadably connected to the end of the inner casing 36 and having a hook portion 100 thereon to adapt the device for exerting a pulling force.

To rotate the worm 18 a worm wheel 64 is disposed within a transversely extending chamber 66 of the hous-

ing 10 which communicates with the main interior of the housing. The worm wheel 64 is keyed to a shaft 68 having the right end thereof, as viewed in Fig. 5, journaled in a bushing 70 threadably engaging the housing 10 and closing off the right end of the chamber 66. A suitable set screw 72 or the like may be provided for locking the bushing 70 in place. The other end of the shaft 68 is journaled in a bushing 74 having an annular shoulder 76 thereon which abuts against an annular internal shoulder 78 formed in the wall of the transverse chamber 66 to limit movement of the bushing toward the left, as viewed in Fig. 5, the bushing preferably being press fit into the left end 80 of the chamber 66 which is reduced in diameter by the shoulder 78. A ratchet or cogwheel 82 is keyed to the shaft 68 between the worm wheel 64 and the bushing 74 for a purpose which will be described hereinafter.

With this construction, the bushing 70 which engages an annular shoulder 84 adjacent the right end of the shaft 68 positions the elements carried by the shaft 68 axially and prevents axial movement thereof. A seal 86 can be disposed about the left end of the shaft 68 to seal off the transverse chamber 66 for lubricating purposes and flats 88 or the like may be formed on the end of the shaft to adapt it for engagement by a suitable tool or by a reversible motor or the like.

Referring to Fig. 4, a bore 90 is provided in the housing 10 which communicates with the transverse chamber 66, and a plunger 92 is slidably disposed within the bore so that one end thereof engages the teeth of the cogwheel 82. A suitable spring 94 or the like is retained within the bore 90 by an end plug 96 screwed within the bore so that the compression of the spring can be adjusted to adjust the force urging the plunger 92 into yieldable engagement with the cogwheel 82. Depending upon the pitch of the worm 18 and the worm wheel 64, as well as the pitch between the lead screw 16 and the end portion 38 of the inner casing 36, the shaft 68 may or may not rotate in response to reaction forces applied to the inner casing 36. However, in the event that the pitch of these members does permit rotation of the shaft 68, the spring mounted plunger 92 can be adjusted to engage the cogwheel 82 and provide enough additional resistance to prevent rotation of the shaft 68 by reaction forces applied to the inner casing 36. However, the spring mounted plunger 92 will not prevent direct rotation of the shaft 68 by a tool or motor engaging the flats 88 on the end of the shaft.

While it will be apparent that the embodiments of the invention herein disclosed are well calculated to fulfill the objects of the invention, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. A load applying device comprising a housing, a lead screw having a nonthreaded end portion extending within said housing, a worm rigidly fixed on said nonthreaded end portion intermediate the ends thereof, a thrust bearing on said nonthreaded end portion on each side of said worm, a first radial bearing journaling the free end of said nonthreaded end portion within said housing, a second radial bearing journaling the other end of said nonthreaded end portion in said housing, and means for adjustably positioning said radial bearings within said housing to prevent axial movement thereof whereby said lead screw is journaled for rotation and against axial movement relative to said housing and said thrust bearings reduce the friction resulting from axial loading of the lead screw to a minimum.

2. A load applying device comprising a housing, a lead screw having a nonthreaded end portion extending within said housing, a worm rigidly fixed on said nonthreaded end portion intermediate the ends thereof, a thrust bearing on said nonthreaded end portion on each side of said worm, a first radial bearing journaling the free end of said nonthreaded end portion within said housing, a second radial bearing journaling the other end of said nonthreaded end portion in said housing and threadably engaging said housing in a manner to permit axial movement thereof relative to the housing when rotated whereby said lead screw is journaled for rotation and against axial movement relative to said housing and said thrust bearings reduce the friction resulting from axial loading of the lead screw to a minimum.

3. The subject matter as claimed in claim 2 including a tubular casing extending over said lead screw with one end thereof threadably connected to said housing and adapted to be tightened against said second radial bearing to lock it against rotation.

4. The subject matter as claimed in claim 3 including an inner tubular casing disposed over said lead screw and within said outer tubular casing, the end of said inner tubular casing adjacent said housing threadably engaging said lead screw and the other end thereof having a plug inserted therein so that said inner casing forms an enclosed chamber about said lead screw, a seal disposed between said tubular casing, key means for preventing rotation of said inner tubular casing and permitting sliding movement thereof in response to the rotation of said lead screw, and an end fitting mounted on the other end of said inner casing and in said housing to adapt said device for applying forces.

5. A load applying device comprising a housing, a lead screw having a nonthreaded end portion journaled for rotation within said housing, a worm rigidly fixed on said nonthreaded end portion intermediate the ends thereof, a drive shaft journaled within said housing and extending transversely to the axis of said nonthreaded end portion, a worm wheel keyed to said shaft and meshing with said worm, a cogwheel keyed to said shaft adjacent said worm wheel, and a spring mounted plunger projecting from the wall of said housing and engaging the teeth of said cogwheel to yieldably resist rotation thereof in either direction.

6. A load applying device comprising housing having a first cylindrical chamber opening on one end thereof and a second cylindrical chamber extending transversely to and communicating with said first chamber, a lead screw having a nonthreaded end portion extending within said first chamber and journaled in the housing for rotation and against axial movement relative thereto, a worm rigidly affixed to said nonthreaded end portion, a drive shaft journaled for rotation and against axial movement within said transverse chamber, a worm wheel keyed to said drive shaft and meshing with said worm, a cogwheel keyed to said drive shaft adjacent said worm wheel, and a spring mounted plunger projecting from the wall of said housing and engaging the teeth of said cogwheel to yieldably resist rotation thereof.

7. A load applying device comprising an elongated housing having a longitudinally extending chamber therein opening on one end thereof, said one end of the housing being internally threaded and the other end thereof having an externally threaded portion, a lead screw having a nonthreaded end portion, a worm wheel rigidly fixed to said nonthreaded end portion intermediate the ends thereof, means for journaling said nonthreaded end portion within said chamber for rotation and against axial movement relative thereto, said means including an externally threaded radial bearing threadably engaging said internal threads of said housing and ball thrust bearings to reduce friction caused by axial loads on said lead screw, an outer tubular casing extending over said lead screw and having one end thereof threadably connected to said internal threads and adapted to be tightened against said radial bearing, an inner tubular casing disposed over said lead screw and within said outer tubular casing, means for slidably keying said tubular

casings together, a seal disposed between said casings, one end of said inner tubular casing threadably engaging said lead screw and the other end thereof having an expansion plug disposed therein so as to close it off to form an enclosed chamber about said lead screw, and worm wheel means journaled in said housing for rotating said worm.

8. The subject matter as claimed in claim 7 wherein said housing has an elongated chamber extending transversely to and communicating with said longitudinally extending chamber and said worm wheel means comprises a drive shaft extending into said transverse chamber from one end thereof, said one end of the chamber having an annular internal shoulder therein to provide an end portion of reduced diameter, a radial bearing disposed within said transverse chamber and abutting against said internal shoulder, said radial bearing having a hub portion thereon press fit within said reduced end portion, a cogwheel keyed to said drive shaft adjacent said radial bearing, a worm wheel keyed to said drive shaft adjacent said cogwheel, an externally threaded

radial bearing screwed into the other end of said chamber for rotatably supporting the inner end of said drive shaft and preventing axial movement thereof in a direction away from said one end of said transverse chamber, and a spring mounted plunger projecting from the wall of said transverse chamber and engaging the teeth of said cogwheel to yieldably resist rotation thereof.

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