MANUALLY OPERATED JACK FOR LIFTING AND LOWERING LOADS FROM AN OVERHEAD SUPPORT

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Fig. 1.
MANUALLY OPERATED JACK FOR LIFTING AND LOWERING LOADS FROM AN OVERHEAD SUPPORT

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This invention relates to manually operated jacks for lifting and lowering loads from an overhead support, and is concerned more particularly, but not exclusively, to jacks suitable for operation by an invalid supported in a harness attached to the jack.

One object of the invention is to provide an improved jack of the kind incorporating a chain adapted to be attached to an overhead support, a casing accommodating the lower end portion of the chain, and a handle for operating the jack to draw the chain into or dispense the chain from the casing.

Another object of the invention is to provide a jack of the kind described in which the chain is drawn in or dispensed from the casing in response to small reciprocal angular movements of the handle.

Yet another object of the invention is to provide a jack with which a heavy load can be lifted or lowered by application of a relatively small torque on the handle.

A further object of the invention is to provide a jack of the kind described which is relatively silent in operation.

According to the invention there is provided a manually operated jack comprising a chain, attachment means secured to one end of the chain and adapted to be attached to an overhead support, a hollow casing accommodating the other end of the chain, the casing having means adapted to be attached to a load to be lifted or lowered by the jack, a sprocket wheel mounted in the casing and engaged with the chain, a handle, and transmission mechanism mounted on the casing and drivably connecting the handle to the sprocket wheel, said transmission mechanism including clutch means, a unidirectional device operable to prevent rotation of the sprocket wheel in a direction to dispense chain from the casing when the clutch is engaged, means operable to disengage the clutch means, and ratchet drive means selectively adjustable between a first operative position coupling the handle to the sprocket wheel for rotation in a first direction but permitting free wheel movement of the handle in a second direction and a second operative position coupling the handle to the sprocket wheel for rotation in said second direction but permitting free wheel movement of the handle in said first direction, whereby the sprocket wheel is rotatable to draw in or dispense chain from the casing in response to angular reciprocal movements of the handle, upon adjustment of the ratchet drive means to the appropriate operative position.

When in use with a harness supporting an invalid, the harness is preferably arranged so that the handle of the jack is accessible to the invalid, and since the jack can be operated by reciprocal movements of the handle, the invalid can himself readily raise or lower the harness.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is a front elevation view of the jack, partially cut away to show details of construction.

FIGURE 2 is a rear elevation view of the jack, also partially cut away.

FIGURE 3 is a sectional side elevation view of the operating mechanism of the jack.

FIGURE 4 is a partially cut-away view of an operating handle of the jack.

As shown in the drawings, the jack comprises a hollow casing 10 which accommodates the lower end portion of a suspensory chain 11 extending through an opening 12 in the upper end of the casing, the chain passing around a sprocket wheel 13 mounted inside the casing and drivably connected through reduction gearing and a clutch mechanism to an operating handle 14. The upper end of the chain is secured to a yoke 15 attached to a support ring 16, and the lower end of the casing 10 is provided with a yoke 17 adapted to be attached to a harness or other load supporting device.

The casing 10 comprises a boss plate 20, the rear face of which is provided with a peripheral wall 21 which cooperates with a rear cover plate 22 to form a central chamber 23 for accommodations the lower end portion of the chain and a passageway 24 having two side walls 25, 26 leading from the opening 12 in the top of the casing into the central chamber 23. The lower end portion of the passageway 24 is curved towards one side of the base plate (as shown in FIGURE 2), and the sprocket wheel 13 is secured on a shaft 27 which extends through the lower end portion of the passageway, with the teeth on the sprocket wheel spaced close to the wall 25 close to an arcuate recess 28 in the central wall 26. The chain extends down the wall 25 and around the sprocket, the wall 25 holding the chain in engagement with the teeth on the sprocket. A steel strip 30 is secured on the wall 26 and has one end 31 which projects towards the sprocket wheel and is formed with a slot through which the teeth of the sprocket wheel pass upon rotation of the sprocket, the strip 30 guiding the chain into the central chamber 23 and preventing jamming of the chain in the passageway.

A roller 32 at the outlet of the passageway holds the chain in contact with the strip 30, and the free end of the chain within the chamber 23 is secured on a pin 33 located in opposing apertures in the base plate and cover plate. The casing 10 is formed with an opening 34 which serves as a hand grip when operating the jack.

The reduction gearing is mounted in a hollow boss 37 on the front face of the base plate and comprises a gear wheel 38 secured on the shaft 27 and a pinion 39 in mesh with the gear wheel 38 and secured on a further shaft 40. Shaft 27 extends through an opening in the base plate and has one end mounted in a bearing 41 in the rear cover plate 22 and its free end mounted in a bearing 42 in a front plate 43 secured on the boss 37. The shaft 40 is rotatably mounted in bearings 44, 45 in the base plate and front plate respectively.

The clutch mechanism is mounted on a stub shaft 46 which forms a front extension on the shaft 40 and comprises a drive disc 47 keyed to the stub shaft, a unidirectional ratchet wheel 48 rotatably mounted on the stub shaft, two friction discs 49, 50 mounted on the stub shaft on opposite sides of the ratchet wheel 48, and a nut 51 mounted on a screw thread on the front end of the stub shaft, the screw thread having a direction such that rotation of the nut 51 in the free wheel direction of the ratchet wheel moves the nut towards the ratchet wheel. The rear end of the nut has a circular collar 52 and the front of the nut projects beyond the front end of the stub shaft and has a square cross section. A bolt 53 having a collar 54 is screwed on to a stud 46' on the front end of the stub shaft 46, the bolt being arranged so that the nut 51 is capable of a small degree of axial movement along the screw thread on the stub shaft between the friction disc 50 and the collar 54.

Two pawls 55 are pivotally mounted on pins 56 on the front plate, the pawls being biased by springs 57 into engagement with the teeth on the ratchet wheel 48. The two pawls are arranged so that, when one pawl is in locking engagement with the radial flank 58 of a tooth on the
ratchet wheel the other pawl engages the centre of the inclined flank 59 on the next succeeding tooth. The two pawls can thus lock the ratchet wheel against rotation in one direction at half pitch intervals of angular movement of the ratchet wheel.

Each of the pawls comprises a steel body 60 and an insert 61 being located in a recess in the free end of the pawl on the side adjacent the ratchet wheel, and the depth of the insert being less than the height of the radial flanks 58 of the teeth on the ratchet wheel. Thus, upon rotation of the ratchet wheel in the free-wheeling direction, the inserts slide silently over the teeth and there is no clicking noise usually associated with ratchet gearing. When however the pawl is in locking engagement with a tooth preventing reverse rotation, the steel body of the pawl abuts against the radial flank of the tooth and no load is transmitted through the insert.

The handle 14 is similar in construction to a ratchet spanner, and comprises a ratchet wheel 64 rotatably mounted in a bearing in one end of the handle, the ratchet wheel having a square section aperture 65, a double pawl 66 mounted on a pivot pin 67 on the handle, a lever 68 connected to the double pawl, and a spring 69. The double pawl 66 is provided with two teeth 70, 71 and two abutting surfaces 72, 73 on the base of the pawl. The pawl is movable by the lever 68 between a first operative position in which the tooth 70 is held in engagement with teeth on the ratchet wheel by the action of the spring 69 on the abutting surface 72, coupling the handle to the ratchet wheel 64 for rotation in a clockwise direction as shown in FIGURE 4 and permitting free-wheel movement of the handle relative to the ratchet wheel 64 in the anti-clockwise direction, and a second operative position in which the tooth 71 is held in engagement with the teeth on the ratchet wheel 64 by the action of the spring 69 on the abutting surface 73, coupling the handle to the ratchet wheel 64 for rotation in an anti-clockwise direction as shown in FIGURE 5 permitting free-wheel movement of the handle relative to the ratchet wheel 64 in the clockwise direction.

The handle 14 is fitted on the stub shaft 46 with the square section front end of the stub shaft a close fit within the square section aperture 65 in the ratchet wheel 64, the handle being held in position by the collar 52 on the nut and the collar 54 on the bolt 53.

In operation, the ring 16 is mounted on an overhead support and an invalid is seated in a harness attached to the yoke 17 on the casing of the jack. The torque exerted on the sprocket wheel 13 due to the load on the chain is transmitted through the reduction gearing and tends to turn the stub shaft 46 in a direction to screw the stationary nut 51 towards the drive disc 47. This results in the drive disc 47, friction disc 49, ratchet wheel 48, friction disc 50 and the nut 51 being clamped together with a force proportional to the load on the chain. The pawls 55 however prevent the ratchet wheel 48 from turning in a direction to dispense chain from the casing, and the frictional force between the ratchet wheel 48, friction disc 49, and drive disc 47 locks the drive disc to the ratchet wheel and thereby prevents rotation of the sprocket wheel, so that the weight of the invalid is securely held by the jack.

In order to raise the harness, the invalid sets the lever 68 on the handle to the appropriate position and reciprocates the handle to turn the nut 51 in an anti-clockwise direction as viewed in FIGURE 1. The torque applied to the handle increases the clamping force acting on the ratchet wheel 48 and turns the ratchet wheel 48 in the free-wheeling direction. The drive disc 47 rotates with the ratchet wheel 48 and nut 51, due to the frictional force between these friction discs 49, 50, and the sprocket wheel is turned in a direction to draw chain into the casing and thereby raise the casing and the attached harness.

To lower the harness, the invalid sets the lever 68 to its opposite position and reciprocates the handle to turn the nut 51 in an anti-clockwise direction as viewed in FIGURE 1. The torque applied to the nut 51 tends to screw the nut 51 away from drive disc 47 and reduces the clamping force between the ratchet wheel 48 and the drive disc 47 an amount sufficient to allow the drive disc to rotate relative to the ratchet wheel 48. The nut 51 and drive disc 47 then turn in unison and rotate the sprocket wheel in a direction to dispense chain from the casing. Immediately on cessation of rotary movement of the nut 51 in a direction to dispense chain, the torque on the sprocket wheel due to the load on the chain again engages the clutch to clamp the drive disc to the ratchet wheel 48 and prevent further dispensing of the chain.

I claim:

1. A manually operated jack suitable for operation by an invalid supported in a harness attached to the jack, said jack comprising: a hollow casing having an opening at the upper end thereof; a sprocket wheel mounted in said casing; a suspensory chain extending through said opening into said casing and engaged with said sprocket wheel with one end of said chain accommodated within said casing; attachment means on the other end of said chain for securing same to the upper end of said suspension; said casing having means adapted to be attached to said harness; an external handle; transmission mechanism mounted in said casing and drivewayly connecting said handle to said sprocket wheel; said transmission mechanism, including, a drive shaft, reduction gearing driveably connected said drive shaft to said sprocket wheel, and ratchet drive means between said handle and said drive shaft; a ratchet wheel; friction clutch means operable to clutch said sprocket wheel to said drive shaft in response to the torque exerted on said drive shaft due to a load on said chain; and a plurality of pawls mounted on said casing and resiliently urged against the teeth of said ratchet wheel to prevent rotation of said sprocket wheel in a direction to dispense said chain from said casing when said clutch means are engaged; said pawls being movable in succession into locking engagement with each tooth of said ratchet wheel at part pitch intervals of angular movement of said ratchet wheel.

2. A manually operated jack as claimed in claim 1 and having two pawls engageable with the teeth of the ratchet wheel, said two pawls being movable in succession into locking engagement with each tooth of said ratchet wheel at half pitch intervals of angular movement of said ratchet wheel.

3. A manually operated jack as claimed in claim 1 wherein each of the pawls comprises a body and an insert of relatively soft material mounted in said body and arranged to slide over the teeth of the ratchet wheel upon rotation in the free-wheeling direction, the depth of said insert being less than the depth of said teeth on said ratchet wheel, whereby said body abuts against a flank of each tooth when said pawl is in locking engagement with said tooth.

4. A manually operated jack suitable for operation by an invalid supported in a harness attached to the jack, said jack comprising: a hollow casing having an opening at the upper end thereof; a sprocket wheel mounted in said casing; a suspensory chain extending through said opening into said casing and engaged with said sprocket wheel with one end of said chain accommodated within said casing; attachment means on the other end of said chain for securing same to the upper end of said suspension; said casing having means adapted to be attached to said harness; a drive shaft rotatably mounted in said casing; reduction gearing between said drive shaft and said sprocket wheel; a driving member mounted on said drive shaft and having a screw threaded connection there-
with a ratchet wheel; friction clutch means operable to clutch said ratchet wheel to said shaft and said driving member; said clutch means being engageable in response to relative angular movement between said shaft and said driving member; a plurality of pawls mounted on said casing and resiliently urged against the teeth of said ratchet wheel to prevent rotation of said sprocket wheel in a direction to dispense said chain from said casing when said clutch means are engaged; said pawls being moveable in succession into locking engagement with each tooth of said ratchet wheel at part-pitch intervals of movement of said ratchet wheel; an external handle; and ratchet drive means between said handle and said drive member; said ratchet drive means being selectably adjustable between a first operative position coupling said handle to said drive member for rotation in a first direction but permitting free wheel movement of said handle in said first direction, whereby said sprocket wheel is rotatable to draw in or dispense chain from said casing in response to small angular reciprocal movements of said handle, upon adjustment of said ratchet drive means to the appropriate operative position.

References Cited by the Examiner

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Inventor</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>842,039</td>
<td>1/1907</td>
<td>Walt</td>
<td>74—146</td>
</tr>
<tr>
<td>1,451,498</td>
<td>4/1923</td>
<td>Faitz</td>
<td>74—146</td>
</tr>
<tr>
<td>1,888,474</td>
<td>11/1932</td>
<td>Sanders</td>
<td>74—44</td>
</tr>
<tr>
<td>3,047,114</td>
<td>7/1962</td>
<td>Stevens</td>
<td>254—167</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>692,320</td>
<td>6/1953</td>
<td>Great Britain</td>
</tr>
</tbody>
</table>

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