United States Patent

[11] 3,627,157

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[21] Appl. No. **811,329**
[22] Filed **Mar. 28, 1969**
[45] Patented **Dec. 14, 1971**
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[32] Priority **July 1, 1968**
[33] **Great Britain**
[31] **31281/68**

[54] **LIFTING DEVICES**
8 Claims, 3 Drawing Figs.

[52] U.S. Cl. **214/394,**
280/43.13, 280/43.23, 254/124
[51] Int. Cl. **B66f 11/00**
[50] Field of Search 214/390–396;
280/43.17, 43.13, 43.11, 43.23, 35;
172/400, 412; 254/49, 94, 86 H, 121, 43, 44, 124

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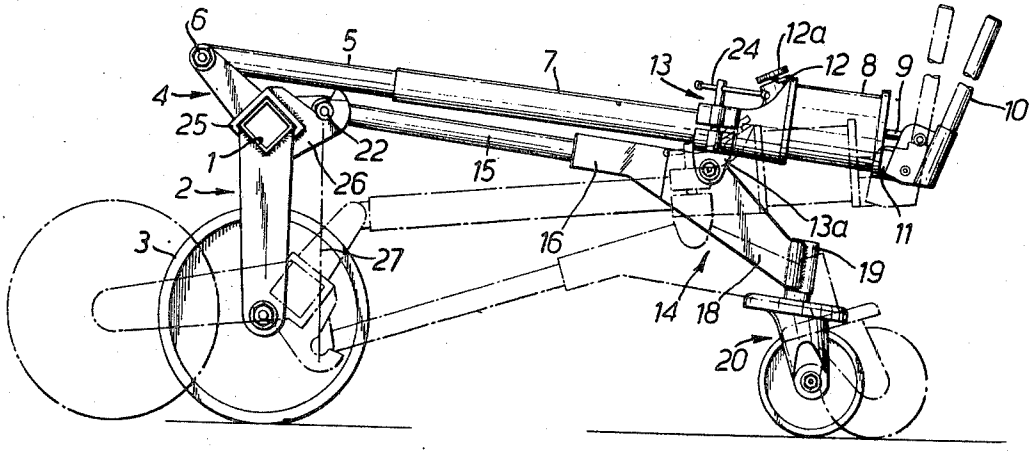
ABSTRACT: A device for lifting manhole covers in which hooks for attachment to the cover are mounted upon and are rotatable with a lifting beam to produce vertical lifting movement of the hooks. The beam can be rotated by an hydraulically operated jack. The beam is mounted upon arms having wheels at their ends.



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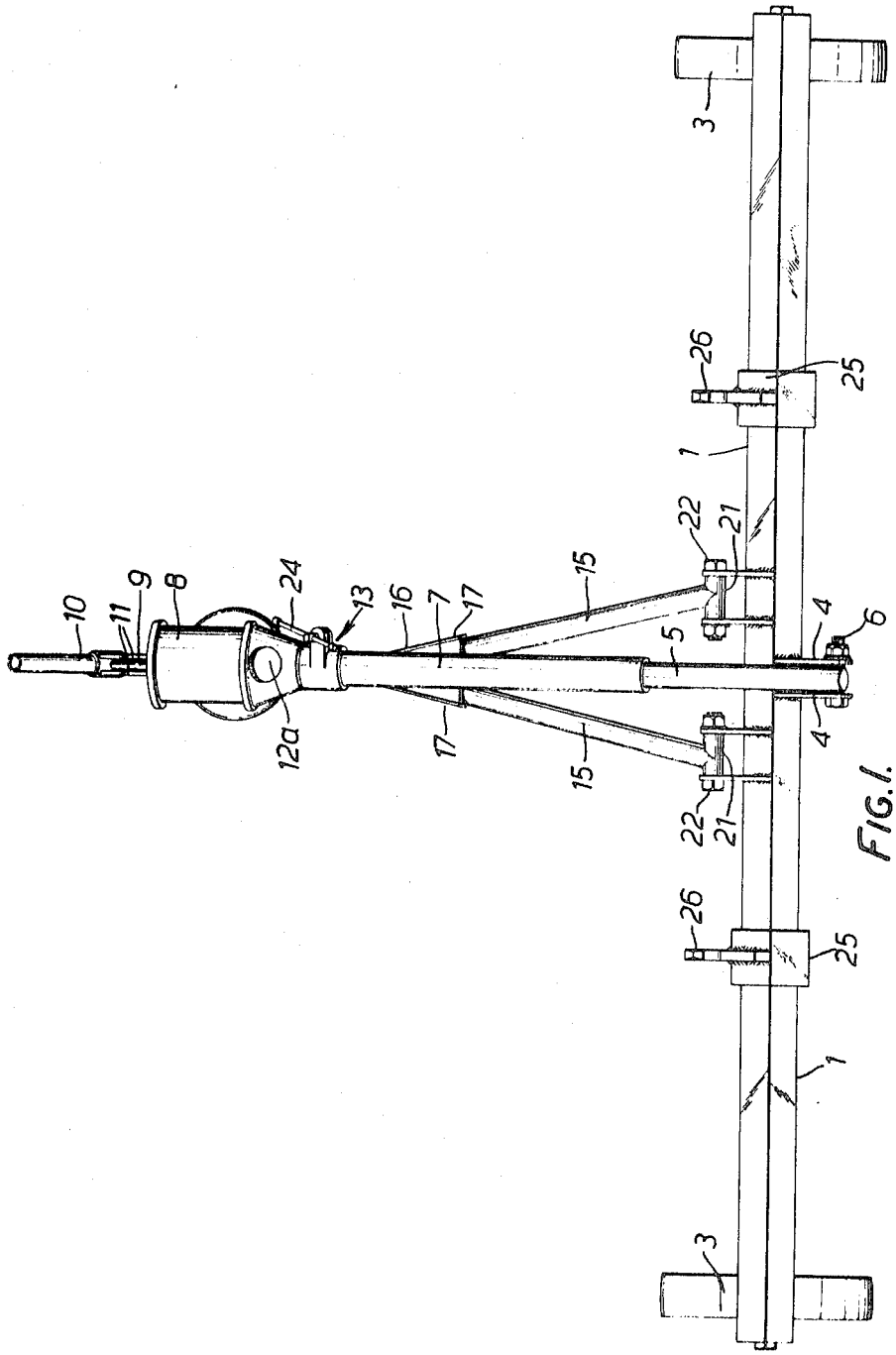

FIG. 1.

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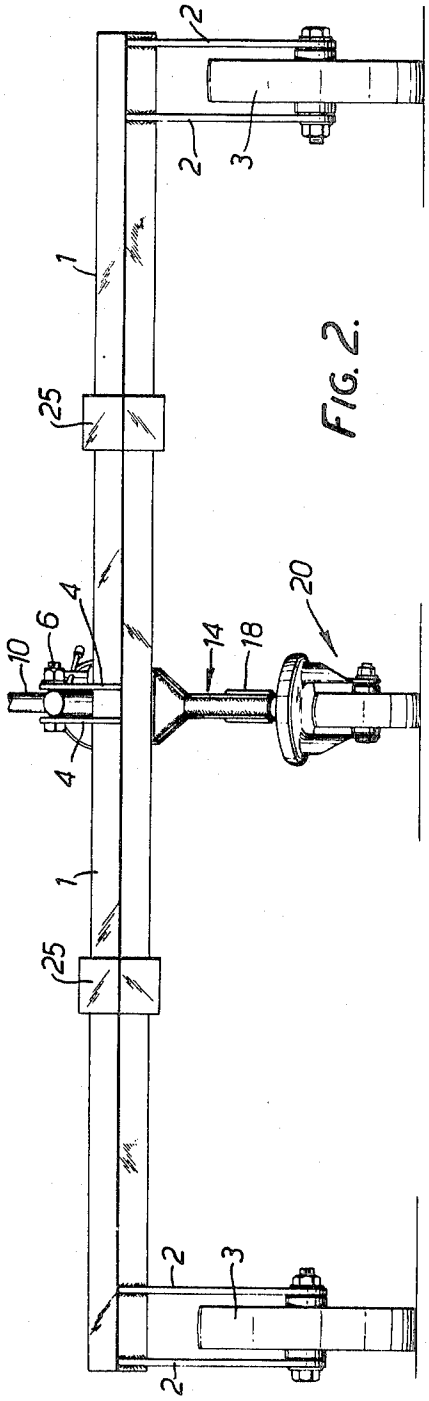

FIG. 2.

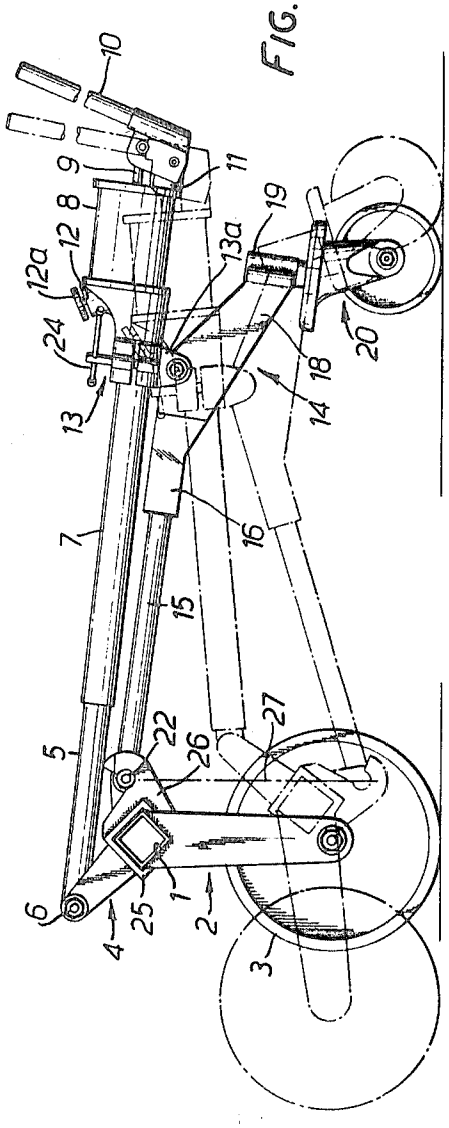

FIG. 3.

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LIFTING DEVICES

BACKGROUND OF THE INVENTION

This invention relates to lifting devices and has particular reference to devices for lifting the covers of manholes.

The covers of manholes providing access to underground chambers, for example, inspection pits and jointing chambers, have to be lifted from time to time to permit personnel to enter the chamber. In many cases, for example when the chambers are beneath carriageways, the covers are heavy because they are designed to withstand any load that may be applied to them by traffic on the carriageway. Consequently, the covers are difficult to lift. Lifting devices previously proposed have not been entirely satisfactory, some are bulky and heavy and require a two-man team for effective use, in addition, some devices have to be assembled before use and dismantled afterwards.

It is an object of the present invention to provide an improved lifting device suitable for lifting manhole covers which is of relatively simple construction and easy to use.

SUMMARY OF THE INVENTION

According to the present invention a lifting device for lifting a load comprises in combination, a lifting beam having a longitudinal axis, a frame member, means for rotating the lifting beam about its longitudinal axis, a pivotal coupling interconnecting said means and said frame member, a first arm extending from the beam and fixed relative to the said longitudinal axis, said first arm being pivotally attached to said frame member, two further arms extending by equal distances from the beam, said further arm being spaced apart along the beam and fixed relative to the said longitudinal axis, and, rotatable with the beam, at least one point of attachment for attaching a load to the device.

In one embodiment of the invention the means for rotating the beam includes a hydraulically operated jack with a piston connected to the beam by another arm or arms extending at right angles to the beam.

Preferably, the spaced arms have wheels rotatably mounted upon them adjacent to their outermost ends to facilitate the lifting action and to enable the device to be used to move an article which it has lifted.

The article may be lifted by one or more hooks mounted upon the beam for rotation therewith. The cross section of the beam in a plane transverse to its longitudinal axis is preferably noncircular, in which case the hooks are attached to or form part of sleeves slidably mounted upon the beam.

The constraining linkage may comprise a frame pivotally attached at one end to the beam and pivotally mounted upon the hydraulic jack. The frame may have a wheel mounted upon it to facilitate movement of the device. The point of pivotal attachment of the frame of the jack may be adjustable in such manner as to control the height of the hooks above the ground.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view of the embodiment, and

FIG. 2 and 3 are front and side elevation respectively of the embodiment, FIG. 3 also showing the device in a typical position at the commencement of lifting.

DESCRIPTION OF PREFERRED EMBODIMENT

The lifter comprises a lifting beam 1 of square cross section transverse to its length and at the ends of which are fixed, as by welding for example, the ends of pairs of radius arms 2. Between each pair of radium arms at the ends thereof remote from beam 1, wheels 3 are rotatably mounted.

Secured to the beam midway of its ends is a further pair of radius arms 4 which extends from the beam at an angle of about 135° with respect to the pairs of arms 2 as can be seen from FIG. 3. One end of a piston rod 5 is pivotally secured between the outer ends of the arms 4 by means of a pivot pin 6.

The piston rod 5 forms part of an hydraulically operated jack whose cylinder is shown at 7. The cylinder 7 has an enlarged reservoir portion 8 at one end containing a second piston whose piston rod 9 is pivoted to a handle 10 itself pivoted at one end to a lug 11 on the reservoir portion 8. There is a one-way valve (not shown) which permits flow of hydraulic fluid into the interior of the cylinder 7 only. Projecting from the reservoir portion 8 is a rod 12 with a knurled know 12*a* which controls the release of hydraulic liquid from the interior of cylinder 7 to the interior of the reservoir portion 8.

Slidable along the cylinder 7 is a clamp 13 having projections 13*a* between which is pivotally mounted at 13*b* a frame 14 consisting of rods 15 which extend forwardly to the beam 1 from a housing 16 having bifurcations 17 which receive the ends of the rods 15 and an angled portion 18 to whose end is fixed a castor tube 19 containing the mounting spindle of a castor wheel 20. The ends of the rods 15 remote from the housing 16 carry castor tubes 21 by means of which the rods 15, which diverge outwardly as seen in FIG. 1, are pivotally secured by pivot pins 22 between further pairs of radius arms 22*a* fixed to the beam 1.

Slidably mounted upon the beam 1 are two sleeves 25, both of square internal cross section, carrying hooks 26. As can be seen from FIG. 1, the sleeves are arranged one on each side of the pair 4 of radius arms. The eyes of the hooks 26 are aligned with the pivot pins 22, this ensuring a vertical lifting action.

Prior to use, the piston rod 5 is fully retracted into the cylinder 7 as indicated in FIG. 3 in chain-dotted lines. In addition, the clamp 13 is positioned and locked in a position adjacent that end of the cylinder 7 adjacent portion 8. Lifting keys are then inserted in the sockets provided in the manhole cover, and the apparatus is maneuvered into a location over the cover in which the beam straddles the latter with the wheels 3 on the ground at the sides of the cover and with the hooks 26 (previously moved to appropriate positions along the beam 1) engaged in the lifting keys. The positions of the various components of the device, when the latter is in the location just referred to, are those shown in chain-dotted lines in FIG. 3.

In some cases it may be found the the hooks 26 are not low enough to engage the keys when the parts of the device are in the chain-dotted positions. When that happens, the clamp 13 is loosened by means of the tommy bar 24 and the clamp together with the frame 14 is moved towards the beam 1 thereby lowering the hooks 26 to a position in which they engage the lifting keys. Clamp 13 is then locked in position.

To lift the cover, an operator pumps the handle 10 to force hydraulic liquid into the cylinder 7 and cause the piston rod to extend from the cylinder. The movement of the piston rod, acting through the pairs 2 and 4 of radius arms, causes the wheels 3 to move along the ground from the position shown in chain-dotted lines in FIG. 3 to that shown in full lines and lifting beam to move upwardly. The hooks 26 also move upwardly with the beam and follow a line of movement indicated by the chain-dotted lines 27. This upward movement lifts the manhole cover by an amount sufficient to clear the ground and the device with the manhole cover suspended from the hooks 26 can then be wheeled to a position clear of the manhole.

To replace the cover, the device with the suspended cover is positioned over the manhole and the cover lowered by allowing hydraulic liquid to flow out of the cylinder 7 to the reservoir portion 8 by operation of the release rod mentioned above.

The weight of the cover returns the components of the device, in a controlled manner, to the chain-dotted position of FIG. 3 and the hooks 26 can then be disengaged from the lifting keys.

The apparatus can be used with the several different types of lifting keys used for different types of manhole cover and, in some cases, the keys are used to break the seal between the manhole cover and its frame before being used to raise the cover.

The cross section of the beam normal to its length need not be square, other shapes both noncircular and circular can be used. If the cross section is circular then the lifting hooks must be fixed to the beam in order to rotate with it and it may be necessary to provide several pairs of hooks at different positions along the beam in order to deal with covers whose lifting key sockets are of different spacings.

In summary, the load-lifting device, as shown, comprises in combination a lifting beam **1** having a longitudinal axis, a frame member **14–21**, means **5–10** pivotally attached to said lifting beam **1** for rotating the latter about its longitudinal axis, a pivotal coupling means **13*a*–13*b*** interconnecting said rotating means **5–10** and said frame member **14–21**, first arm means **22*a*** extending radially from said beam **1** and fixed relatively to said longitudinal axis and pivotally attached at **22** to said frame member **14–21**, second and third arm means **2, 2** fixed to the beam **1** for rotation therewith and spaced apart along the longitudinal axis of the beam, the second and third arms means **2,2** extending radially from the beam **1** to support the latter above ground at a height determined by the angular position of the beam, and attachment means **26** rotatable with said beam providing at least one point of attachment for attaching a load to the beam. In said combination, in the preferred form shown, said frame member **14–21** comprises bifurcations **15** extending from said pivotal coupling **13*a*–13*b*** toward said beam **1**, and the first arm means comprises two parallel arms **22*a*** of equal length spaced apart along said beam **1** and pivotally attached to said bifurcations **15** at **22**, respectively; said attachment means comprises a plurality of lifting attachments **25–26** mounted upon said beam **1** so as to be rotatable therewith, which have lifting surfaces or hooks **26** aligned with the pivot pins **22**, i.e., lying along a line joining the points **22** of pivotal attachment of the bifurcations **15** to said first arm means **22*a***, as shown in FIGS. **1** and **3**; wheels **3** are mounted upon said second and third arm means **2,2**, at their outer ends for facilitating rotation of said beam and movement of the device along the ground; the pivotal coupling means **13*a*–13*b*** is adjustable in position towards and away from said beam **1** by loosening the clamp screw **24** and sliding the same along the member **7**; and a front wheel **20** is rotatably mounted upon the frame member **14–21**, as best shown in FIG. **3**.

I claim:

1. A lifting device comprising in combination a lifting beam, spaced arms fixed to the beam and extending away from the longitudinal axis of the beam, wheels rotatably mounted upon said spaced arms at the outermost of the latter, means for rotating the beam about its longitudinal axis, a linkage comprising a frame pivotally attached to the beam and to the said means, the point of pivotal attachment of the frame to the said means being adjustable in position towards and away from the beam, a ground wheel rotatably mounted upon said frame, and, at least one lifting hook mounted upon the beam for rotation therewith.

2. A lifting device as claimed in claim **1**, in which said frame is pivotally attached to further arms fixed to the beam and spaced apart along the length thereof.

3. A lifting device for lifting a load comprising, in combination,

a. a lifting beam (**1**) having a longitudinal axis,
b. a frame member (**14–21**),
c. means (**5–10**) pivotally attached to said lifting beam (**1**) for rotating the latter about its longitudinal axis,
d. a pivotal coupling means (**13*a*–13*b***) interconnecting said rotating means (**5–10**) and said frame member (**14–21**),
e. first arm means (**22*a***) extending radially from said beam (**1**) and fixed relatively to said longitudinal axis and pivotally attached (at **22**) to said frame member (**14–21**),
f. second and third arm means (**2, 2,**) fixed to the beam (**1**) for rotation therewith and spaced apart along the longitudinal axis of the beam, the second and third arm means (**2, 2,**) extending radially from the beam (**1**) to support the latter above ground at a height determined by the angular position of the beam, and,
g. attachment means (**26**) rotatable with said beam providing at least one point of attachment for attaching a load to the beam.

4. A lifting device as claimed in claim **3**, wherein:

h. said frame member (**14–21**) comprises bifurcations (**15**) extending from said pivotal coupling (**13*a*–13*b***) toward said beam (**1**), and wherein
i. said first arm means (**22*a***) comprises two parallel arms of equal length spaced apart along said beam (**1**) and pivotally attached to said bifurcations, respectively.

5. A lifting device as claimed in claim **4**, wherein:

j. said attachment means (**26**) comprises a plurality of lifting attachments (**25–26**) mounted upon said beam (**1**) so as to be rotatable therewith, said lifting attachments having lifting surfaces (**26**) lying along a line joining the respective points (**22**) of pivotal attachment of said bifurcations (**15**) to said first arm means (**1**).

6. A lifting device as claimed in claim **3**, further comprising:

h. wheels (**3**) rotatably mounted upon said second and third arm means (**2,2**) at their outer ends for facilitating rotation of said beam and movement of the device along the ground.

7. A lifting device as claimed in claim **3**, wherein:

h. said pivotal coupling means (**13*a*–13*b***) is adjustable in position towards and away from said beam (**1**).

8. A lifting device as claimed in claim **3**, further comprising:

h. a front wheel (**20**) rotatably mounted upon said frame member (**14–21**).

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