March 4, 1969 D. J. B. BROWN 3,430,778

LOAD LIFTING

Filed March 15, 1967 Sheet 1 of 3

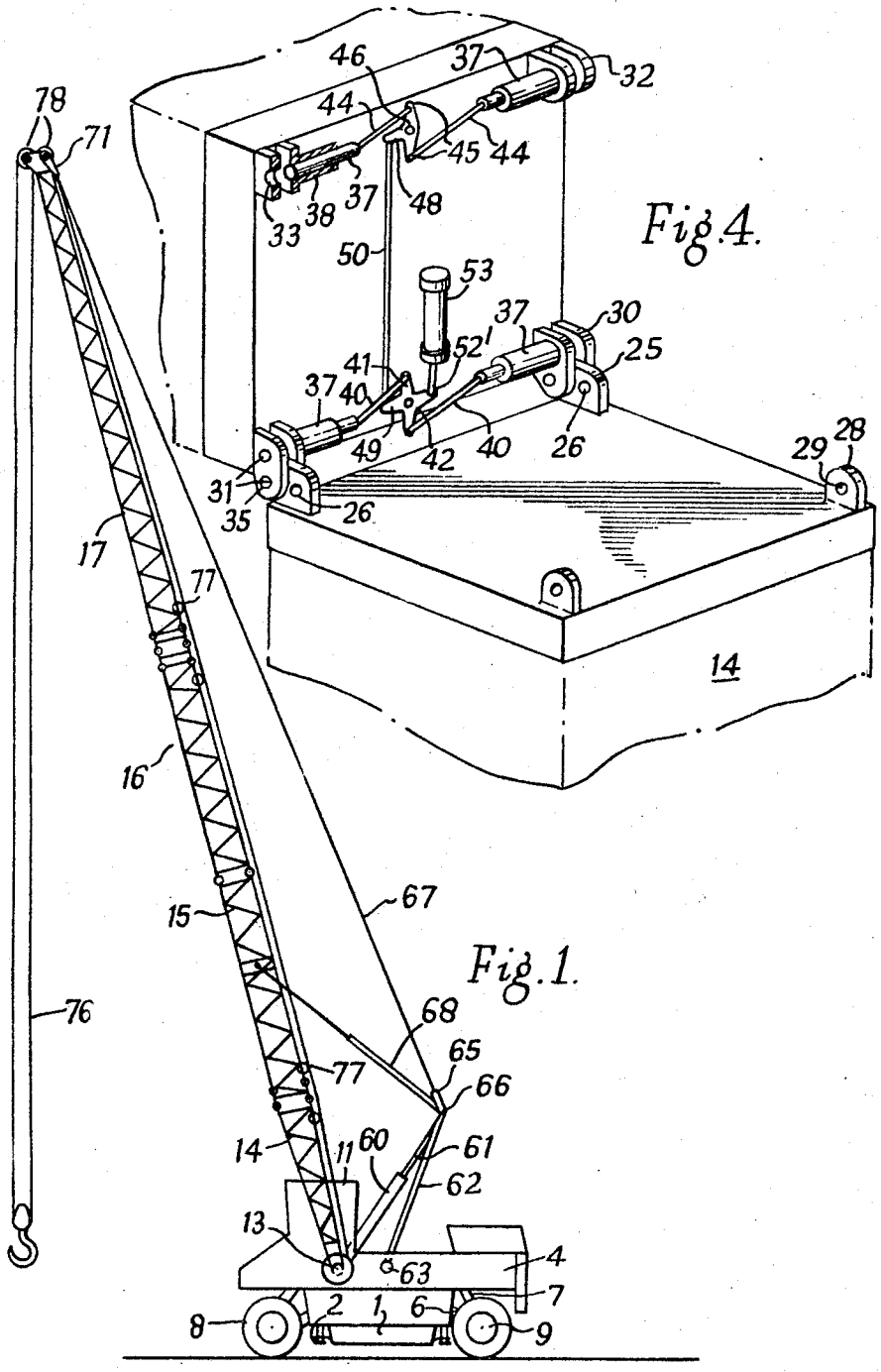


Fig. 4.

Fig. 1.

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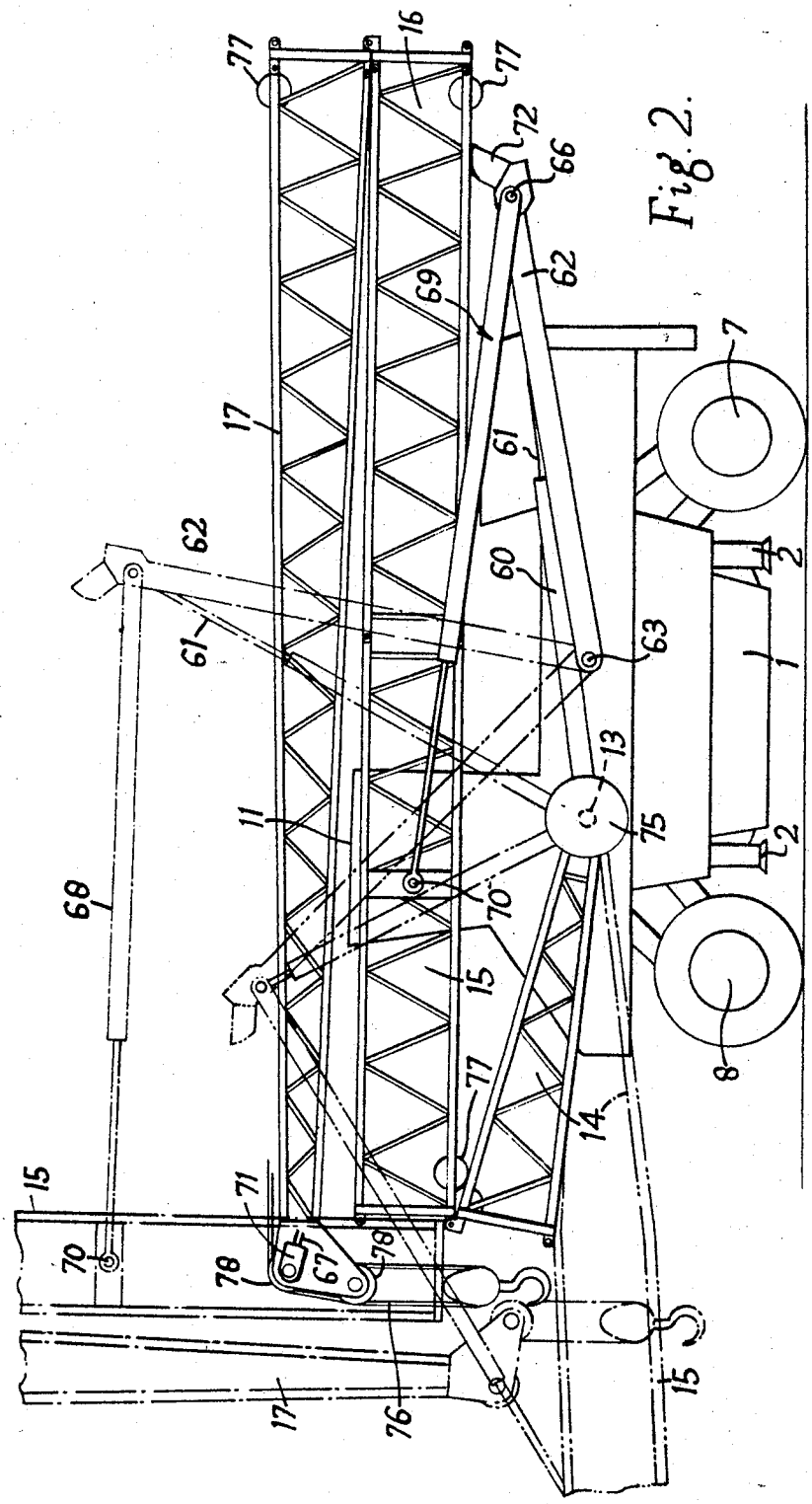


Fig. 2.

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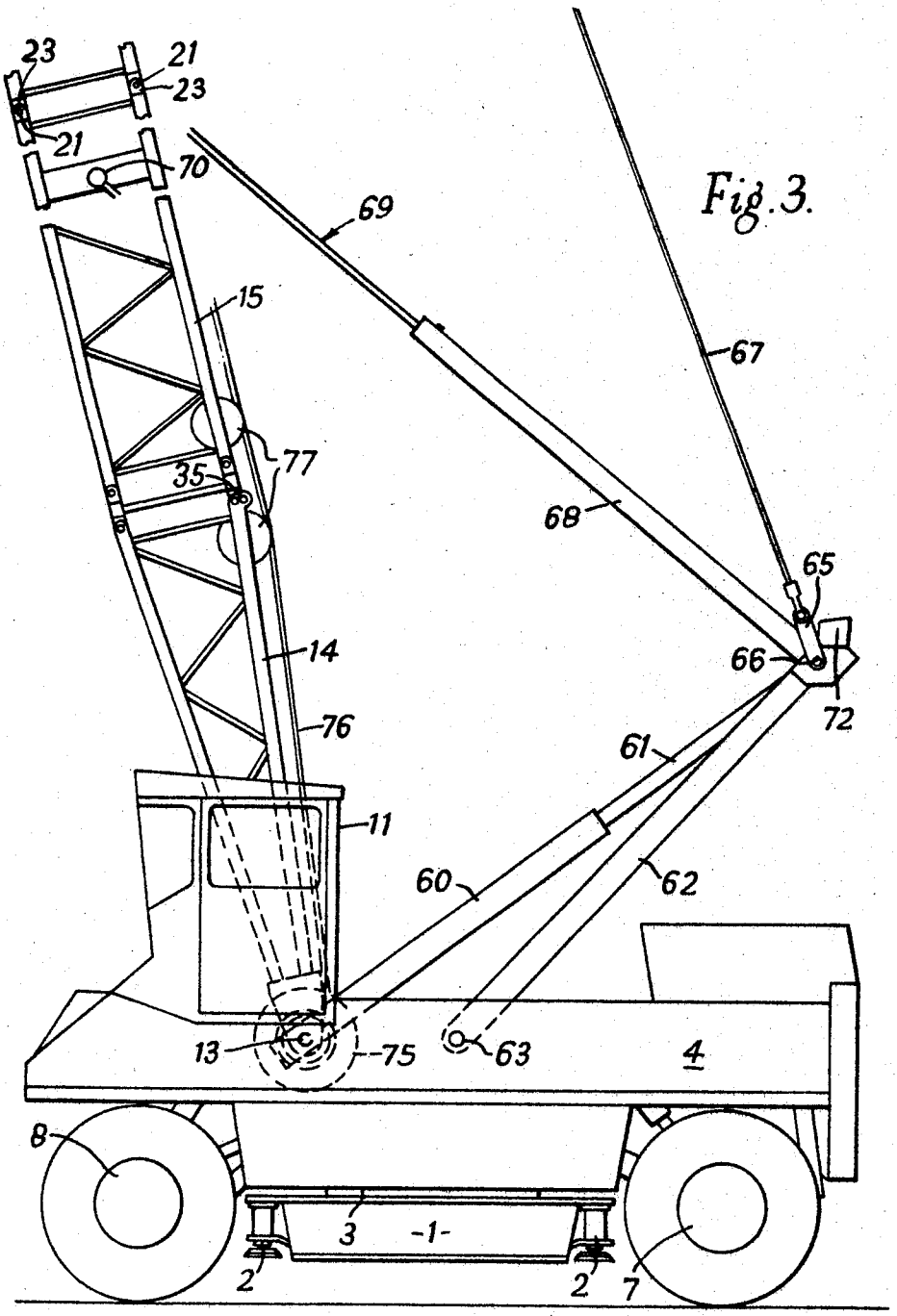


Fig. 3.

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# LOAD LIFTING

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4 Claims

## ABSTRACT OF THE DISCLOSURE

A jib for a load lifting apparatus comprising at least two interconnected sections, with pivot means and locking means disposed between two of the adjacent sections so that the sections may be locked as a jib or be released so that the section may be folded into a retracted storage position.

### *Background of the invention*

*Field of the invention.*—This invention relates to load-lifting apparatus and in particular though not exclusively to mobile cranes of the kind adapted to be driven on public highways.

*Description of prior art.*—As is known there are many types of mobile crane of the kind referred to above and in many cases, due to the length restrictions for road vehicles in most countries, it is necessary to provide a jib which can be dismantled for transportation purposes into a number of sections in order that the overall length requirements of the country concerned are not exceeded.

It has been usual practice, in cases in which the working jib length exceeds that which is allowable under the length requirement for road vehicles, to arrange for the jib sections to be capable of being assembled or dismantled manually whilst laid on the ground or on suitable trestles and it has been found that assembly or dismantling time is lengthy and requires several men to carry out the necessary assembly or dismantling operations.

Again due to the length requirements for road vehicles similar arrangements have been applied in certain cases to load-lifting apparatus such as excavators and the like with the same disadvantages as those applicable to cranes.

It is an object of this invention to provide a load lifting apparatus of the kind referred to above in which assembly dismantling of the jib or the like sections of a load lifting means can be accomplished easily. A further object of the invention is to provide for luffing and derricking the jib without the use of a winch.

*Summary of the invention.*—According to the present invention there is provided a load lifting apparatus having a jib composed of two or more interconnected sections, at least one section being mounted to pivot about a pivot centre on an adjacent section, whereby the one section may be positioned in alignment with an adjacent section for use of the jib or to pivot relative to the adjacent section to a storage position for transportation purposes, and including locking members for locking the sections into alignment for use of the jib.

### *Brief description of drawings*

The invention will now be described by way of example with reference to a mobile crane as shown in the accompanying drawings in which:

FIGURE 1 is a diagrammatic side view of a mobile crane showing the jib in the operative position;

FIGURE 2 is a view similar to FIGURE 1 on a larger scale and with the jib in the inoperative position as for transportation purposes;



FIGURE 3 is a side elevation of the crane shown in FIGURES 1 and 2 on a larger scale; and

FIGURE 4 is a perspective view showing two sections of the jib which are mounted to pivot with respect to each other showing the locking arrangement.

### *Description of preferred embodiment*

In the drawings there is shown a mobile crane which has a chassis 1 provided with stabilising legs 2 slidable within the chassis 1 as described in our copending patent application No. 11,675/66. The chassis 1 carries on its upper surface a turntable unit 3 which in turn carries on its upper surface a main frame 4, the whole providing in practice a chassis. Attached to the front and rear of the main frame 4 are pivot links 6 and hydraulic couplings 7 which carry front and rear wheel axles 8 and 9 respectively.

The rear axle 9 may correspond to that described in our copending patent application No. 11,284/66 and is connected to a drive motor (not shown) by a transmission shaft (not shown). Towards the front and on one side of the upper part of the main frame 4 is a drivers cab 11 from which all the operations of the crane are controlled.

Alongside and towards the rear of the drivers cab 11 is carried the lower end of a jib 12 which is mounted by means of a pivot shaft 13 extending between side-arms (not shown) of the main frame 4.

The jib 12 comprises an inner section 14 of which the inner end is pivotally mounted between the side arms by the pivot shaft 13, two centre sections 15, 16 and an outer section 17. The outer section 17 carries conventional cable pulleys 20 mounted on bearings brackets 21 carried by the outer section 17. The two centre sections 15, 16 are rigidly locked together by bolts 21 extending through apertures provided in brackets 23 carried by the adjacent ends of the sections 15, 16. The free ends of the sections 15 and 16 each are similar and for convenience the end section 15 will be described with reference to FIGURE 4. Projecting from one edge of a section is a pair of spaced pivot brackets 25 (FIG. 4) each having two apertures 26, and on the opposite side of the sections are a pair of lugs 28 each having an aperture 29.

The apertures 26 in the spaced brackets 25 and the apertures 29 in the spaced lugs 28 respectively are co-axial.

The ends of the inner and outer sections 14 and 17 respectively are similar and for convenience reference will be made to the inner section 14. The inner sections 14 have a pair of pivot brackets 30, provided with a pair of apertures 31, and a pair of lugs 32 provided with an aperture 33, arranged to correspond to the brackets 25 and lugs 28 with the respective apertures being coaxial. The section 15 is connected to the inner sections 14 by pivot pins 35 passing through one of the apertures 26 in each of the brackets 25 and one of the apertures 31 in each of the brackets 30. Four locking pins 37, slidably mounted in four brackets 38 are carried by each of the free ends of the section 15 and each of the pins 37 is shown aligned so that when the jib sections are coaxial the pins 37 may slide into the apertures 26 in the brackets 25 and apertures 29 in the lugs 28 to lock the sections together. Links 40 extend from each of the pins 37 which engages the apertures 26 in the pivot brackets 25 to connect with diametrically opposite projections 41 of a star wheel 42 pivotally carried by the section 15. Similarly, links 44 extend from the locking pins 37 mounted to engage the apertures 29 of the lugs 28 to connect with the opposite arms 45 of a bell crank lever 46 similarly mounted to pivot on the section 15. An arm 48 of the bell crank lever 44 and an arm 49 of the star wheel are interconnected

by a rod 50 and a further arm 52 of the star wheel 42 is connected to the ram of a pneumatic or hydraulic cylinder 53. On the supply of air hydraulic fluid to the cylinder the ram moves the star wheel 42 which on rotation transmits movement to the locking pins 37. In an alternative construction, the locking pins may be manually operated. The description has been made to the locking pins 37 being carried by the section 15 but the arrangement may be reversed so that the pins are carried by the section 14. Alternatively, the pins 37 may be carried by a separate locking unit which is attached between two sections which are to pivot with respect of each other. When the sections are locked with their longitudinal axles in alignment the jib extends as a single rigid unit.

Mounted on each side of the inner jib section 14 and on the same pivot shaft 13 as the inner end of the inner jib section is a hydraulic derrick jack 60. A ram 61 extends from each of the hydraulic jacks 60 and the rams 61 are connected at their free ends to the upper end of a derrick portal frame 62 of which the lower ends are attached to the main frame 4 by pivot pins 63 extending through mounting brackets (not shown) carried at a position remote from the pivot shaft 13 for the inner jib section 14. On extension and retraction of the rams 61 of the hydraulic jacks 60 the derrick portal frame 62 is caused to articulate in a vertical plane about its pivots 63. One end of a pair of links 65 is attached at the upper free end of the derrick portal frame 62 by pivot pins 66 and cables 67 extend from between the free ends of the links 65 to between the free ends of links 71 mounted on each side of the upper end of the outer jib section 17. By this interconnection of the portal frame 62 and the jib when the portal frame 62 is moved by the rams 61 corresponding movement is transmitted to the jib.

A compression strut 68 having a slidable rod 69 adjustable with respect of the housing of the strut 68 is connected to the upper end of the derrick portal frames 62 by the pivot pin 66 and extends to the jib section 15 where it is connected by a pivot shaft 70 which extends between opposite sides of the section 15.

The upper end of the derrick portal frame 62 carries between the link arms 65 a bolster support unit 72 which provides a rest for the centre jib section 15, 16 when the jib is in the storage or transportation position to be described later.

A conventional drum 75 for a cable 76 is provided by the main frame 4 and to which is anchored one end of the cable 76 used for load lifting or lowering. The cable 76 passes over guide pulleys 77 carried by the sections 14, 15, 16 and 17, and the cable pulleys 78 at the free end of the outer section 17.

During use the jib may be moved to any positions about the chassis 1 by rotation of the turntable 3.

When it is required to move the crane after use the jib is lowered into a horizontal position by retracting the rams 61 within the hydraulic derrick jacks 60 as shown in dotted outline in FIGURE 2. In the lowered horizontal position the weight of the jib is carried by the derricking cables 67. Withdrawal of the locking pins 37 attaching jib sections 14 and 15 allows section 14 to pivot at 13 and 35 and kneel upon the ground or near to the ground being supported by sliding stays attached between section 14 and the lower part of main frame 4 (not shown). This kneeling motion of section 14 is imparted by hydraulic retraction of jacks 60. The locking pins 37 are withdrawn from the apertures 26 in the brackets 25 and the apertures 29 in the lugs 28 so that the upper section 17 and the centre section 16 may pivot about their pivot pins 35.

In this condition the cable 67 is no longer capable of moving the jib since upon kneeling of section 14 the cable becomes slack. On expansion of the rams 61 from the derrick jacks 60, the derrick jacks 60 are moved so that they articulate towards the rear of the main frame 4 about their pivots 63. The compression strut 68 connected between the derrick portal frame 62 and the section 15 is drawn rearwardly by the movement of the jacks 60 which causes the sections 15, 16 to be drawn rearwardly at the same time. During such movement the centre sections 15, 16 pivot with respect of the inner section 14 and the outer section 17 pivots to hang vertically against the centre sections 15, 16 as shown in FIGURE 2 in dotted outline. Due to the geometrical arrangement of the strut and its pivot connection on further rearward movement the centre section comes into contact with the bolster unit 72 attached to the upper end of the derrick portal frames and supports the centre section. When the jib is in this position the derrick portal frames and the associated jacks extend angularly upwards and rearwards from the main frame as shown in FIGURE 2.

To erect the jib for use, the reverse series of operation take place.

The invention is not restricted to the particular embodiment described, for example, the jib length can be increased by adding sections to the centre of outer sections or if desired the jib can be provided with simply two sections, i.e., an inner and outer section and in which case there will only be one region of fold. Also there may be provided more than two fold regions such as between the two sections of the centre section of the particular embodiment described.

In a further modification the pulley over which the cable used for hoisting and lowering may be replaced by a bucket carrying unit so that the apparatus may be converted to an excavator. The length of jib can again be adjusted to suit the operational requirements by inserting and removing sections as required.

As will be appreciated by mounting the cab towards the front end of the apparatus the operator may observe where the hook, bucket or the like is to be used which greatly facilitates operation.

I claim:

1. In a load lifting apparatus having a chassis and a jib carried by said chassis, the improvement of which comprises:
- a jib formed of at least two sections,
- one section being pivotally connected to the chassis;
- pivot means between said sections;
- locking means between said sections for locking them in alignment to form the jib and for release of said locking means to allow said sections to be folded for storage or transport;
- a derrick portal frame pivotally connected to the chassis remote from the pivotal connection of said one section;
- jack means including a ram having one end connected coaxially with the pivot connection between said one section and the chassis; and
- pivot means connecting the free end of said jack means to the free end of said derrick portal frame.

2. A load lifting apparatus according to claim 1, comprising means interconnecting said free end of said derrick portal frame to the other section of said jib whereby movement of said ram of said jack transmits motion to said derrick portal frame which in turn transmits motion to said jib.

3. A load lifting apparatus according to claim 2, comprising a bolster unit carried by said derrick portal frame for engagement by said other jib section when said jib is in a storage position.

4. In a load lifting apparatus having a chassis and a jib carried by said chassis, the improvement of which comprises:
- locking means between said two sections for locking them in alignment to form the jib and for release of said locking means to allow said section to be folded for storage or transport;
- said locking means including four locking pins slidably mounted in bracket means on one of said sec-

tions and engageable within lugs carried by the other of said sections;

a four arm star wheel carried by said one of said sections;

a bell crank lever carried by said one of said sections remote from said star wheel;

means interconnecting an arm of said star wheel and an arm of said bell crank lever;

drive means connecting to another arm of said star wheel for transmitting rotary motion thereto;

means connecting each of the other two arms of said star wheel to respective ones of said locking pins; and



means connecting the other two arms of said bell crank lever to the remaining ones of said locking pins.

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