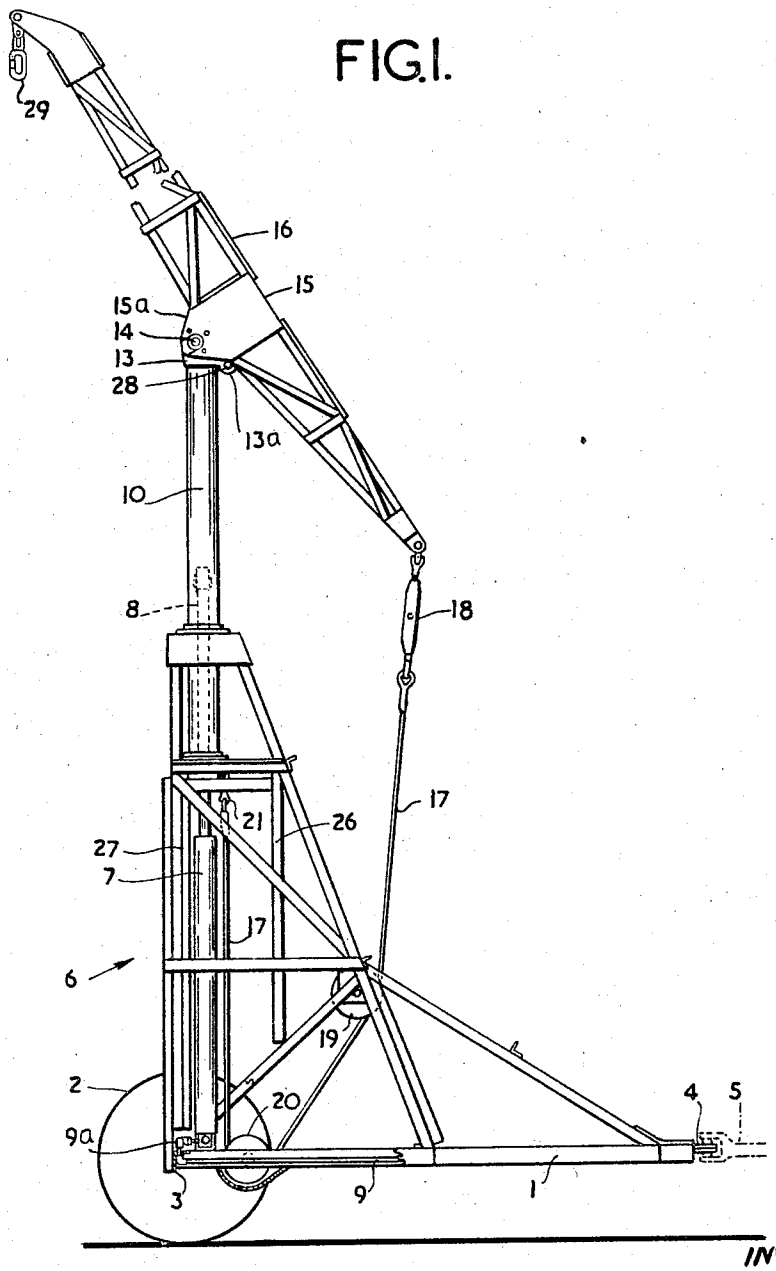
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CRANES

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FIG. 1.



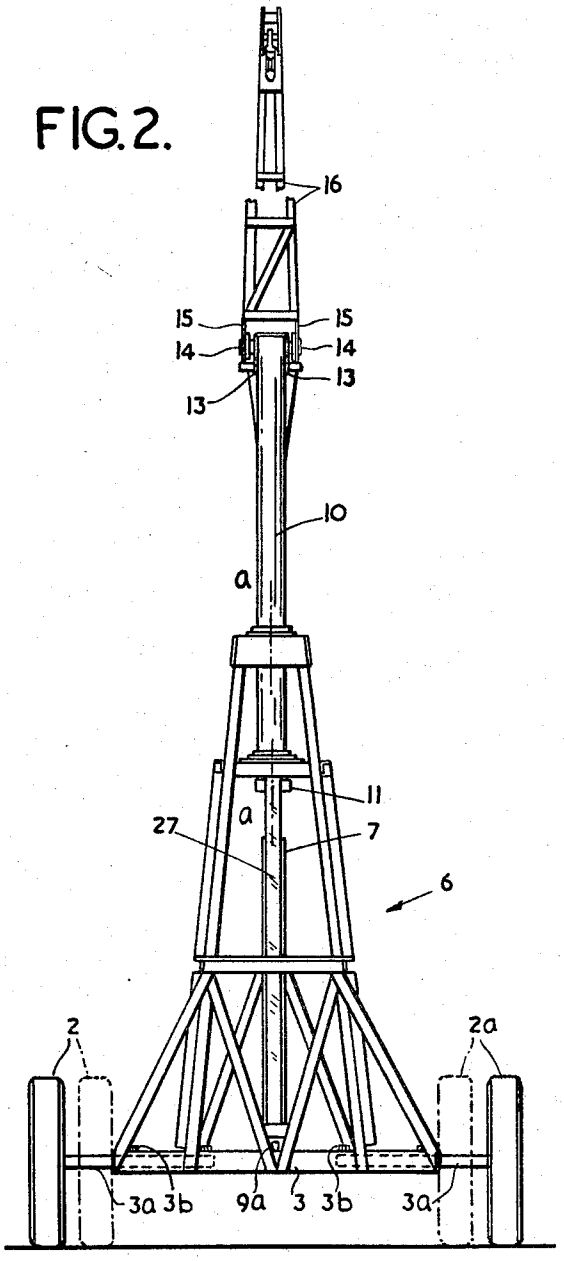
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FIG. 2.



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FIG. 3.

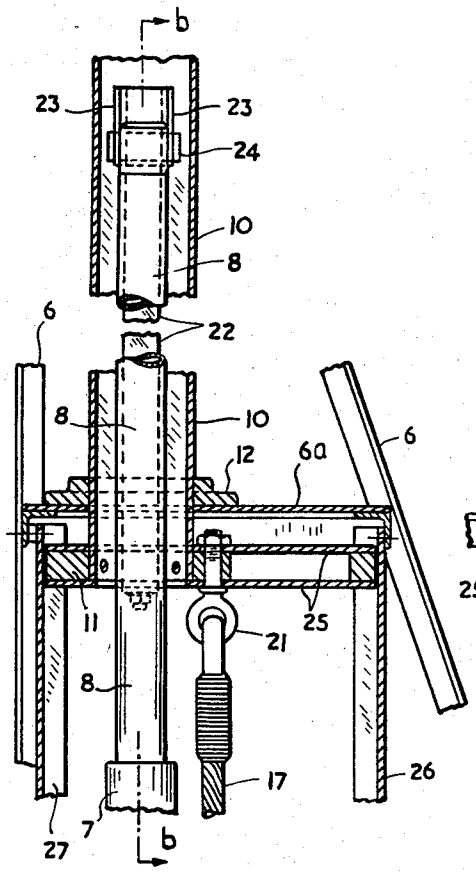
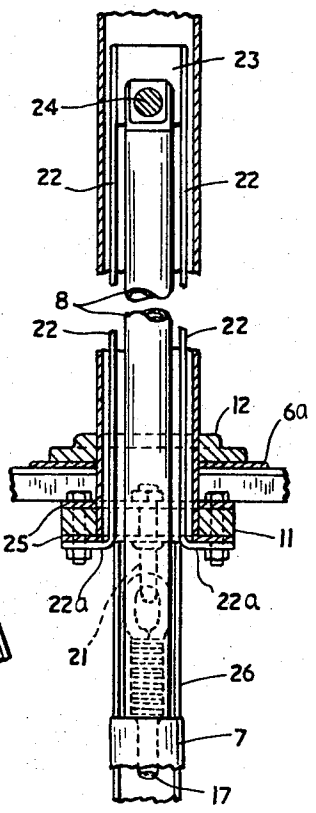


FIG. 4.



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2,924,428

CRANES

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Application February 23, 1956, Serial No. 567,410

Claims priority, application Great Britain February 26, 1955

6 Claims. (Cl. 254—93)

This invention has reference to cranes of the kind wherein a boom is journalled about a horizontal axis at the head of a tower or pillar, and is adapted to be oscillated about the said axis to lift and lower, or assist in the lifting and lowering, of loads suspended from one end thereof.

The principal object of the present invention is to facilitate the swinging of the boom about its angle of oscillation, and to enable the swinging movement to be effected rapidly, expediently and through a maximum angle of travel, by a minimum movement of the boom-actuating means.

A further object of the invention is to obviate the necessity of providing a winch and winch-operated rope or hawser for swinging the boom about its axis or for raising or lowering a load.

In accordance with the said invention, a crane comprises a telescopic tower upon the top of which the boom is journalled about an axis located between its ends, and one end of the boom is so connected to the tower that extension or contraction of the tower displaces the said one end in the opposite direction to the said axis, thereby raising or lowering the opposite and load-lifting end of the boom through a distance which exceeds the movement of the tower top or the movement of the said one boom end.

Preferably, the boom end which is connected to the tower is located nearer to the axis than the other end of the boom and is connected to a part of the tower which travels upwardly and downwardly during the expansion and contraction operations, by a tensioned cable, hawser or equivalent flexible member passing around at least one sheave provided at or in the region of the foot of the tower.

The tower may comprise a hydraulic cylinder fixed in and longitudinally of a skeleton framework structure, the ram of the cylinder being secured by its outer end to and internally of a tubular pillar which is coaxial to the cylinder, is slidable longitudinally within the structure, has the boom journalled upon its end remote from the cylinder, and is connected to the boom end nearer the boom axis by the cable or equivalent member.

In order that the invention may be more readily understood and carried into practice, reference will now be made to the accompanying drawings, wherein:

Figure 1 is a side elevation, partly in section, of a mobile crane adapted to be hauled from one site to another by a tractor or like towing vehicle.

Figure 2 is a rear elevation of the crane shown in Figure 1.

Figure 3 is an enlarged scale section, taken on the line *a—a*, Figure 2, of a constructional detail, and

Figure 4 is a section, along the line *b—b*, Figure 3.

The crane shown in the drawings comprises a chassis 1 which is provided at its rear end with two ground wheels 2, 2*a* mounted laterally of the chassis, upon the opposite ends of a transverse axle 3; the other and forward end of the chassis is fitted with a coupling 4 whereby it is adapted to be attached to the tow bar 5 of a tractor or similar power driven towing vehicle.

A skeleton framework or superstructure 6 erected upon the chassis, serves as the base unit of the tower of the crane; a hydraulic cylinder 7 is secured within the said framework with its longitudinal centre line at right angles to the chassis; the said cylinder is located midway between the sides of the chassis, is supported at its lower end near the axle 3, and has a supply and discharge pipe 9 for oil or other liquid under pressure, connected into the said lower end; the pipe 9 extends forwardly along the length of the chassis and is adapted to be connected to a pipe (not shown) provided on the towing vehicle and extending from the outlet of a pump which is adapted to be clutched to the power unit of the said vehicle so that, as and when desired, the liquid may be forced under pressure from a tank or other container installed in the vehicle, into the cylinder.

Alternatively if desired, the pump, tank or other container, a motor for driving the pump, and the necessary associated control gear, may be installed on the chassis 1.

The pipe 9 is fitted, internally thereof, with a valve of any known construction, which is adapted to permit a free flow of liquid into the cylinder from the pump but to control the return flow or exhaustion of liquid from the cylinder. Preferably, the valve is fitted internally of a union 9*a* between the pipe and the lower end of the cylinder.

A ram 8 extends from the upper end of the cylinder into a tubular pillar 10 of which the internal diameter exceeds the external diameter of the cylinder so that the pillar is able to socket on to the outside and travel downwardly of the said cylinder.

At its lower end, the pillar is fixed within a collar 11 and, upwardly of the said collar, passes through and makes a sliding fit within a bush 12 secured upon the head 6*a* of the superstructure. At its upper end, the pillar is reinforced by plates 13 and has an axle pin 14 extending transversely thereof and through the said plates, at right angles to the longitudinal centre line of the pillar.

Side plates 15 incorporated in a boom 16 are formed with depending cheeks 15*a* which engage and are rotatable about the pin 14; the said plates 15 are located between the ends of the boom at a position which is substantially nearer the one end than the other so that, under the action of gravity, the boom tends to swing about the axle pin in the direction which raises the end nearer the said pin; however, except when liquid is being fed into the cylinder 7, such movement is prevented by a cable or hawser 17 which is connected to the said boom end by an adjustable shackle 18, passes over a first sheave 19 journalled in the front of the superstructure upwardly of the chassis, over a second sheave 20 journalled in the chassis at and forwardly of the lower end of the cylinder, and is attached to an eye 21 assembled in the collar 11 (see Figures 3 and 4) forwardly of the lower end of the pillar.

The ram 8 extends into and upwardly of the tubular pillar and its upper end is anchored to the latter by two straps 22 and a crosshead 23. Each strap is formed with a foot 22*a* which is bolted to the collar 11 and extends upwardly from the foot between the ram and the inside of the pillar, the upper strap ends being welded or otherwise permanently secured to opposite sides of the crosshead and the crosshead being fixed to the upper end of the rod by a pin 24.

The collar 11 is carried between a pair of plates 25 making sliding engagement with forward and rearward guides 26, 27 which are fixed within the superstructure forwardly and rearwardly of and parallel to the cylinder,

the said guides being of a length not less than the maximum upwards and downwards movement or stroke that may be imparted to the pillar. Hence, the guides, in combination with the bush **12**, are adapted to ensure that the pillar maintains its coaxial relationship to the cylinder during the said upwards and downwards strokes.

To extend the telescopic tower assembly consisting of the superstructure **6**, cylinder **7**, ram **8**, and pillar **11**, liquid under pressure is pumped into the cylinder thereby driving the ram outwardly of the cylinder, and the pillar upwardly of the bush **12**, the outwards movement of the ram being transmitted to the pillar through the cross-head **23** and straps **22**.

Further, the upwards movement of the pillar raises the axle pin **14** and, therefore, the boom plates **15**; at the same time, the pillar raises the collar **11** and eye **21**; the raising of the eye imparts a corresponding lengthwise movement to the cable or hawser **17**, which therefore pulls down the boom end nearer to the axle pin **14**. This simultaneous movement of the axle pin and boom end in opposite directions, causes the opposite and load-lifting end of the boom to rise through a distance which is considerably greater than the lift that would have been imparted thereto if only the upwards stroke of the pillar, or the downwards travel of the boom end nearer the axle pin had taken place. Therefore, a maximum angular movement is imparted to the boom and a maximum lift is imparted to the load-lifting end of the boom, by a minimum upwards stroke of the ram and pillar assembly.

The pillar reinforcing plates **13** are formed with forwardly projecting ears **13***a* through which a stop pin **28** extends into the planes of and below the corresponding cheeks **15***a* so that the lower edges of the said cheeks are caused to impact the ends of the said stop pin and thereby limit both the angular movement that may be imparted to the boom by the upwards stroke of the ram and pillar, and the said upwards stroke.

By exhausting the liquid from the cylinder, the ram is retracted into the cylinder to contract the tower, and the pillar, axle pin and eye are lowered, with the result that the boom end nearer to the said pin is raised and the load-lifting end of the boom is lowered through a distance which exceeds the downwards stroke of the pillar. The maximum speed at which the said load-lifting end is lowered, is determined by the valve within the union **9***a* and is so controlled that the lowering movement cannot take place at an excessive or dangerous speed. The height of the superstructure, the stroke of the ram, and the distances between the axle pin and boom ends, are so related that when the ram reaches the end of its downwards or return stroke, the load-lifting end of the boom is located at or close to ground level; consequently, a hook **29** is attached to the said load-lifting end to enable any load that it is desired to lift, to be attached to the boom. Such an arrangement obviates the necessity of providing a second and winch-controller cable or hawser for load-lowering purposes.

To enhance the stability of the crane when in use for lifting and lowering loads, or when being towed from one site to another, each of the road wheels is journalled upon the end of a separate axle component **3***a* which is displaceable longitudinally of and within the main axle component normally being held against such displacement by bolts **3***b* or equivalent clamping expedients which, when slackened, enable the components **3***a* to be displaced outwardly of the main component to locate the ground wheels **2**, **2***a* in the positions shown in full lines in Figure 2, thereby providing optimum stabilizing conditions, or to be displaced inwardly of the said main component to locate the ground wheels in close proximity to the chassis (as shown in dotted lines in Figure 2) when, for example, it is desired to tow the crane through a gateway or along a road where other traffic is likely to be encountered.

Although the invention has been described with specific reference to a crane which is erected upon a chassis having only two ground wheels at its rearward end, it is to be understood that the invention is equally applicable to cranes erected upon chassis having more than two ground wheels, or to chassis fitted with wheels adapted to run on rails, or to stationary cranes; also, although it is convenient, when the crane is adapted to be towed by a power driven vehicle, to utilise the said vehicle for mounting the pump and liquid reservoir, and the power unit of the vehicle for driving the pump, the said pump, reservoir and a special power unit may, as previously stated, be mounted on the same chassis as the crane; in such an arrangement, the special power unit may also be utilised for rotating ground wheels provided at the forward end of the chassis.

Having described our invention, what we claim and desire to procure by Letters Patent is:

1. A mobile crane comprising a tower, a pillar accommodated within the tower, a boom journalled between its ends upon the head of the pillar and about an axis transverse to the boom, cable means connecting one end of said boom to said pillar below the said head, a member mounted near the tower below the pillar around which member the said cable means passes, and means for displacing the pillar longitudinally of the tower to swing the boom about the axis transverse to the boom.

2. A mobile crane comprising a tower, a pillar accommodated within and displaceable longitudinally of the tower, a boom journalled about a transverse axis between its ends, the said axis being disposed at the head of the said pillar, tension cable means connecting one end of said boom, which is nearer to the said axis, to the said pillar below the said head thereof, a member mounted at the foot of the tower around which member the said cable means passes, and means for displacing the said pillar within the said tower to swing the said boom about the said transverse axis.

3. A mobile crane comprising a tower mounted upon a chassis, a pillar carried within and displaceable axially of the said tower, a boom journalled between its ends at the head of the said pillar, the said boom being adapted to swing about an axis at the said head, the said axis being nearer to one end of the boom than to the other end of the boom, a pulley mounted on the tower, tensioned cable means of which one end is connected to the said nearer end of the boom, the opposite end is connected to the pillar and the intermediate portion passes around the said pulley, and a hydraulic cylinder disposed within and longitudinally of the said tower, a ram provided on and displaceable by fluid pressure within the said cylinder being adapted to move the said pillar longitudinally of the tower and to raise or lower the axis of the said boom together with the said opposite end of the said cable means, whereas the said one end of the said cable means is thereby caused to move in the opposite direction to that of the said axis and the boom is swung about the said axis so that the said other end and load-carrying end of the said boom is moved through a distance in excess of the distance through which the said axis is moved.

4. A mobile crane comprising a tower, a pillar, a boom, cable means, a first sheave, a second sheave, and a hydraulic cylinder, the said pillar being located within but being displaceable axially of the said tower, the said cylinder being disposed within the said tower and being provided with a ram which is displaceable axially of the cylinder, which ram is anchored to the said pillar so that upon application of fluid pressure to the cylinder the said ram and pillar are moved axially of the said tower, the said boom being pivoted about a transverse axis at the head of the pillar, one end of the boom being nearer to the said axis than is the other end of the boom, the said nearer end being connected to one end of the said cable means, the latter passing over the first

and second sheaves and being connected to the pillar, the said first sheave being carried on the adjacent the foot of the tower, and the said second sheave being located upwardly of the said first sheave and nearer to the said nearer end of the boom than the said first sheave.

5. A mobile crane comprising a tower, a pillar and a hydraulic cylinder housed within and longitudinally of the tower, a boom journalled at the head of the pillar about a transverse axis which is nearer one end of the boom than the other end of the boom, a collar secured to the lower end of the said pillar, cable means of which one end is secured to the said collar and the other end is secured to the said nearer end of the boom, a sheave mounted on the said tower below the said pillar, the said cable means passing around the said sheave, and a ram provided on the said cylinder and anchored to the said pillar so that the said pillar may be displaced longitudinally of the tower by fluid pressure applied in the said cylinder whereby the said boom may be swung about the said transverse axis.

6. A mobile crane comprising a tower mounted upon the chassis of a vehicle, a hollow pillar disposed within and longitudinally of the said tower, a fluid pressure cylinder disposed within and longitudinally of the said pillar, a ram provided on the said cylinder and adapted to be displaced longitudinally thereof being secured to the said pillar whereas the said cylinder is secured to the said tower, a boom pivoted between its ends about a transverse axis and journalled about the said axis at the head of the pillar, cable means, a collar disposed about the said pillar, an anchorage point provided on the said collar, a coupling provided on the said boom on the end thereof nearest the said axis, a sheave mounted on the said chassis below the said collar, the said cable means being coupled at one end to the said coupling, passing around the said sheave and being anchored at its other end to the said anchorage point, whereby raising or lowering of the said axis is effected by displacing the said ram longitudinally of the said cylinder under fluid pressure in the said cylinder, the said raising or lowering of the said axis resulting in a raising or lowering of the said collar and hence of the said anchored end of the cable means through an equal distance, in the same direction, and therefore in a lowering or raising of the said coupled end of the cable means through an equal distance in the opposite direction, so that the said boom is swung about the said transverse axis.

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