July 2, 1963 L. P. BOYER 3,095,978

TRAVELLING CRANES AND THE LIKE

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FIG. 1

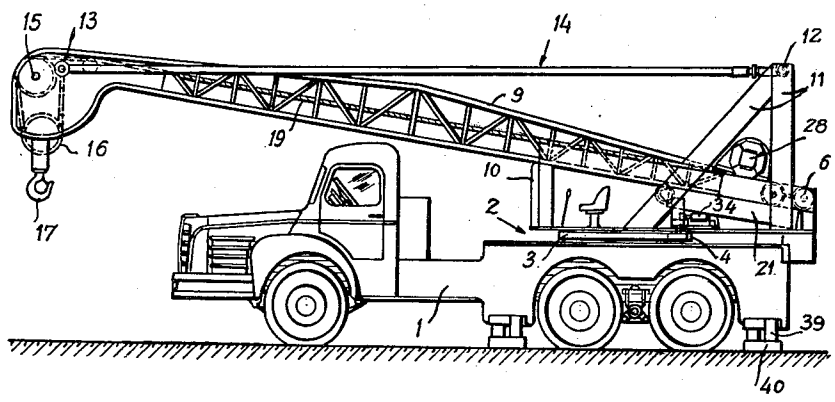
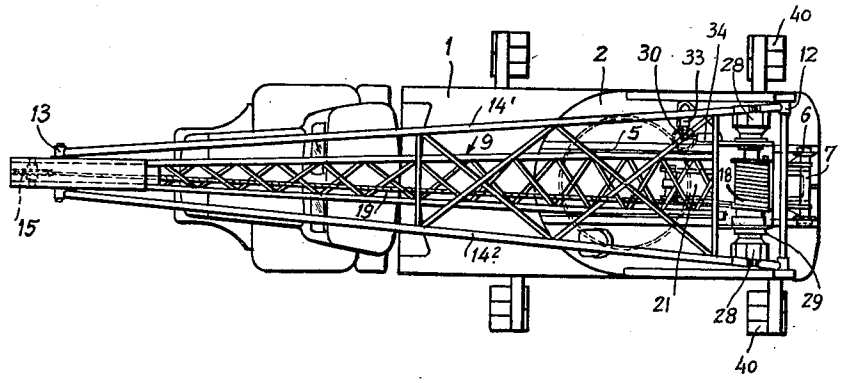



FIG. 2



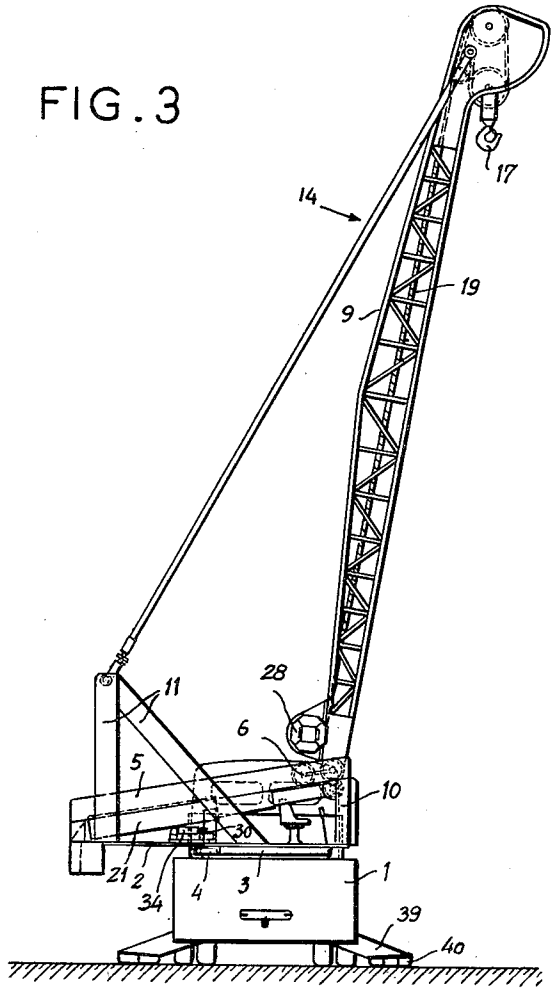

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FIG. 3




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FIG. 4

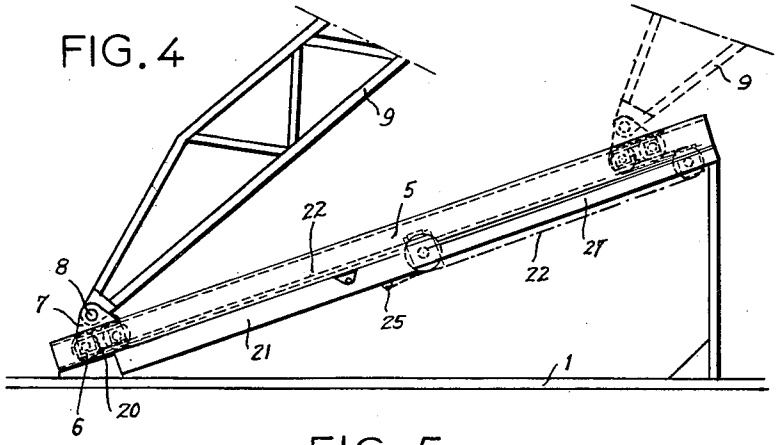



FIG. 5

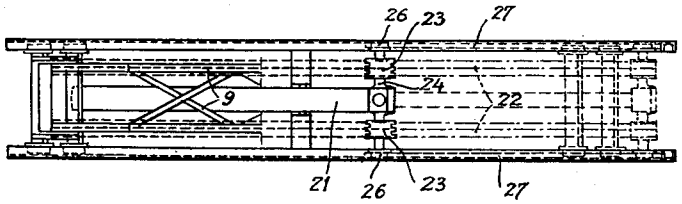



FIG. 6

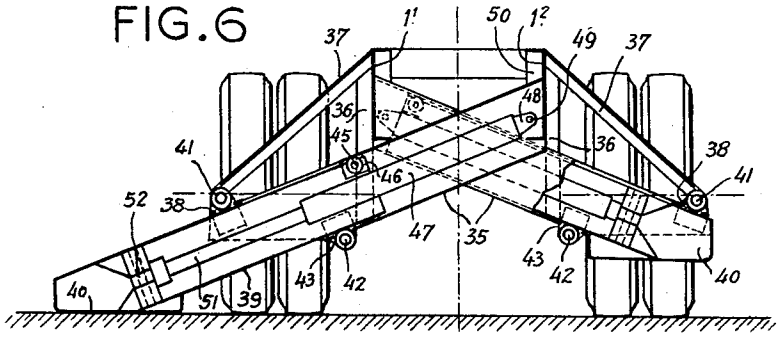
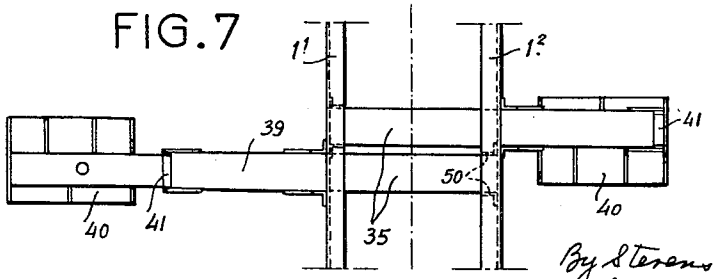



FIG. 7



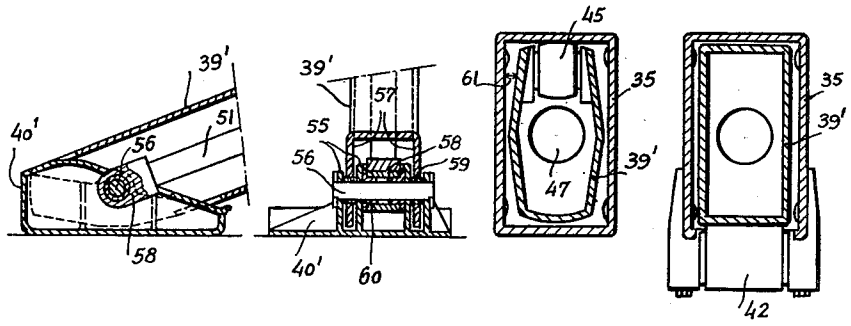

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FIG.8 FIG.9 FIG.10 FIG.11



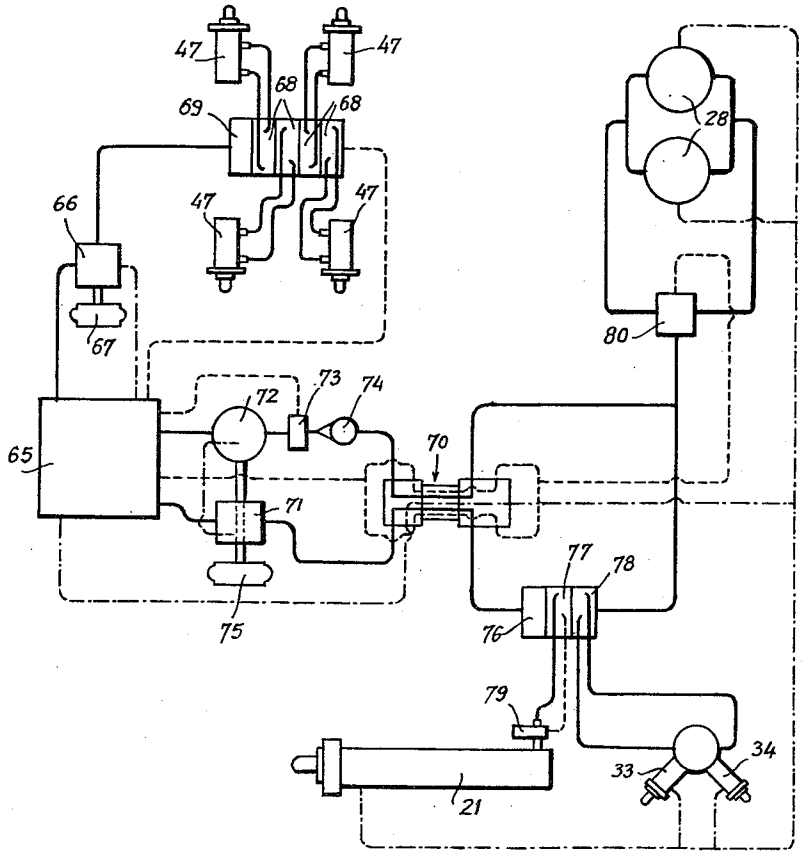




FIG.12

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3,095,978

# TRAVELLING CRANES AND THE LIKE

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7 Claims. (Cl. 212—59)

This invention relates to travelling cranes and like devices, and is concerned more particularly with a novel construction providing notably a very satisfactory solution to the problem of mounting a crane or like device having a luffing jib on the chassis of an automobile vehicle.

In known arrangements of this character, crane jibs are always too long in the travelling or road position, and frequently too short for the hoisting operations proper.

Various solutions have already been proposed for avoiding this inconvenience, such as the addition of an end extension or intermediate elements, folding jib end sections, telescopic mounting, etc.

However, none of these known solutions provides a homogeneous, rigid jib.

On the other hand, and notably in the case of a slewing crane, it is current practice to provide between the chassis and the ground one or two pairs of prop-legs or shoes which are lowered before operating the crane.

It is the essential object of this invention to provide an improved design and mounting of a slewing and luffing crane on the chassis of an automobile vehicle, for example a lorry, characterized by reduced over-all dimensions in the travelling position, by the possibility of disposing of a relatively long but nevertheless rigid and homogeneous jib, and also by the provision of ground-engaging shoes providing a wide supporting area for the assembly, the crane motions and the actuation of said shoes being particularly easy and rapid.

According to the essential feature of this invention, the lower end of the jib is slidably mounted on a slideway or runway in which it is displaceable under the control of a motor ensuring at the same time the derricking or luffing movements of the jib as a function of a luffing arc required for the jib head.

This luffing arc may be obtained in any known manner, notably by means of an oscillating member. Obviously, this arrangement is suitable for cranes, power shovels, or any other equipment involving the luffing of a jib or like element.

In the specific case of a crane, this luffing motion may advantageously be obtained by means of a rigid tie-rod pivoted on the jib head and of a small post overlying the runway.

It is to be noted that the possibility of imparting a movement of translation to the jib foot permits, in addition to the luffing motion, of making the best possible use of the length of the chassis of the carrier vehicle when the assembly is in its travelling condition.

In the arrangement proposed according to this invention the chassis of the vehicle is provided in addition with telescopically-mounted prop-legs sliding in sheaths mounted across the chassis and directed obliquely downward, these sheaths crossing each other in the plane of symmetry of the chassis, so that the shoes carried by the prop-legs engage the ground well beyond the plan projection or track of the chassis on the ground while being easily retractable within these limits in the travelling condition of the assembly.



In order to afford a clearer understanding of this invention, a typical form of embodiment of a slewing crane carried by an automobile or lorry chassis will now be described by way of example with reference to the diagrammatic accompanying drawings, in which:

FIGURE 1 is a side elevational view of the crane, with the jib in the road or travelling position;

FIGURE 2 is a plan view of the arrangement of FIG. 1;

FIGURE 3 is an elevational view taken from the rear end of the vehicle with the crane in its working position and the jib positioned to provide the maximum height of the hook;

FIGURE 4 is a side elevational view showing on a larger scale the mounting of the jib foot and the control means therefor;

FIGURE 5 is a plan view of the assembly shown in FIG. 4;

FIGURE 6 is a cross-sectional view of the chassis showing a typical embodiment of telescopic prop-legs;

FIGURE 7 is a plan view of the assembly of FIG. 6;

FIGURE 8 is a section taken upon the line A—A of FIG. 9, showing a typical mounting of a shoe pivotally mounted on a prop-leg;

FIGURE 9 is a section taken upon the line B—B of FIG. 8;

FIGURE 10 is a cross-sectional view showing a typical mounting of the upper portion of the telescopic prop-leg of a ground-engaging shoe;

FIGURE 11 is a similar view showing the lower portion of the same leg, and

FIGURE 12 is a schematic fluid diagram for the operation of the present invention.

In the drawings, the reference numeral **1** designates the chassis of the vehicle, for example a lorry, on which the crane of this invention is mounted.

The crane proper comprises a slewing platform **2** which may be mounted for swivelling motion on the chassis **1** in any known and suitable manner, with a central pintle and the interposition of rollers or like members running on a circular track.

In this example the platform **2** is pivotally mounted on a ball race secured on the chassis and carrying an externally toothed annulus **3** in meshing engagement with a driving pinion **4** carried by the platform **2**. The rotation of this pinion **4** ensures the rotation or slewing movement of the platform **2** on the chassis **1**.

Mounted on this platform **2** (FIGS. 4 and 5) is a rectilinear runway consisting of a pair of registering parallel U-sectioned guide members **5** receiving the supporting rollers **6** of a carriage **7** on which the foot of the crane jib **9** is pivoted at **8**. These guide members **5** constitute in this example an inclined runway secured at one end of the platform **2** and supported at the opposite end by posts **10**.

Moreover, in the vicinity of the lower ends of guide members **5** which correspond to the travelling position of the jib bottom, the platform **2** supports an A-frame **11**. Pivotally mounted between the top or vertex of the A-frame **11** and the free end of the jib, that is, at **12** and **13**, is a tie-rod assembly **14** consisting of a pair

of rigid tubes $14^1$, $14^2$ braced by suitable members, as shown in FIG. 2.

The jib 9 proper consists of a trussed girder carrying on its head the fixed pulley 15 of a two-part rope carrying the pulley 16 of a snatch block and hook unit 17.

Secured on the jib foot is a hoisting winch 18 for winding the hoisting rope 19 passing over the aforesaid pulleys and anchored at 13 on the jib head.

The jib foot is displaceable between the opposite ends of the runway consisting of the guide members 5 by means of a mechanism mounted on the carriage 7 and comprising preferably a hydraulic cylinder 21.

This cylinder 21 is mounted under the runway frame and has associated therewith a transmission comprising chains 22 and sprockets 23 whereby a complete stroke of the carriage 7 is obtained by means of only one-half of the stroke of cylinder 21 (see FIGS. 4 and 5).

To this end, the head of the rod emerging from hydraulic cylinder 21 carries a transverse shaft 24 having mounted, for loose rotation thereon, on either side of the rod axis, a sprocket 23 engaged by a roller chain 22 anchored at one end on the carriage 7 at 20 and at the other end on the cylinder body at 25. FIG. 4 illustrating the extreme positions in which the jib foot may be brought through the actuation of the hydraulic cylinder 21 shows more clearly the manner in which this motion amplifying mechanism is constructed. FIGS. 4 and 5 show in addition a typical manner in which the head of the cylinder rod may be guided by having the transverse shaft 24 provided externally of the sprockets 23 with a pair of rollers 26 engaging channel sections 27 secured under the guide members 5 of carriage 7.

From a comparison of FIGS. 1 and 3, it will be clearly seen that when the carriage 7 and therefore the jib foot are caused to travel in the direction away from the road position in which they are adjacent to the A-frame 11, the jib head is simultaneously raised under the control of the tie-rod 14.

FIG. 3 further shows the maximum height attained by the snatch block hook 17 when the jib foot has been driven to its position remotest from the A-frame 11, it being understood that a lower height corresponding to a greater range or radius can be obtained, according to needs, by utilizing only one portion of the permissible stroke of the hydraulic cylinder 21.

It will be noted that the runway on which they carriage 7 is mounted covers the full length of the platform 2, that is, the major dimension thereof as permitted by the length of the chassis in its road position.

Thus, in the example illustrated, when the jib is lowered to its road position above the driver's cab, the carriage and jib foot are moved to their rearmost position on the chassis of the vehicle, so that a relatively long and one-piece jib can be used without appreciably increasing the dimensions of the assembly.

When the crane jib is luffed, it is brought to a convenient operative position with respect to the platform. On the other hand, this construction utilizes a rigid tie-rod the chief advantage of which is to guarantee a reliable lateral stability of the jib, irrespective of its position.

Preferably, the winch 18 is actuated by means of a pair of hydraulic motors 28 mounted on the jib on either side and endwise of the hoisting winch drum. With this arrangement the shaft bearings of these motors 28 may advantageously constitute at the same time the shaft bearings of the winch 18 driven directly from these motors. The motors 28 may be of any known and suitable type, for example with radial pistons.

This hydraulic actuation of the winch 18 permits a simple yet efficient mounting of the safety brake usually provided on the winch, this brake being diagrammatically shown at 29 and comprising braking shoes constantly urged by spring means to their applied position from which they are released by the actuation of a hydraulic cylinder inserted in the control circuit of the aforesaid motors 28.

Similarly, in this example, the slewing motion of the platform is controlled by hydraulic means, and to this end the driving pinion 4 is rotatably solid with a crank plate carrying crankpins 30 driven by the piston-rods of a pair of hydraulic cylinders 33, 34' having their axes disposed at right angles to each other; these cylinders are hingedly secured on the platform 2.

The props illustrated in FIGS. 6 and 7 may also be advantageously controlled by hydraulic means.

In this specific embodiment the shoes carried by telescopic prop-legs are disposed by pairs and mounted in metal sheaths 35 secured transversely on the chassis 1 of the vehicle so as to extend obliquely and downwardly. These sheaths 35 of rectangular cross-section have their upper ends secured on registering faces of the longitudinal beams $1^1$ and $1^2$ of the chassis. Each lower end of the sheath is suspended by lateral angle members 36 secured vertically on the outer face of the longitudinal beam which is opposite to the beam on which the upper end is mounted and also by an oblique bracing leg 37 extending from the upper fixation point of the angle members 36 to a strap 38 secured endwise of the sheath.

It will be seen that the lower ends of the sheaths extend substantially within the limits of the track of the vehicle.

Slidably mounted in each sheath is a telescopic leg 39 carrying on its outer end a ground-engaging shoe 40 having a relatively wide bearing surface.

This leg 39 is mounted for easy sliding movement in the sheath and co-acts therein with external longitudinally offset rollers 41, 42 carried by the strap 38 and by another strap 43 secured on the sheath, the latter being formed with adequate apertures to permit the passage of these rollers.

Another roller 45 is rotatably mounted in a strap 46 internally and near the upper end of the leg 39 so as to emerge from the latter for engagement with the upper inner portion of sheath 35.

The telescopic movements of each leg 39 are controlled through a double-acting hydraulic cylinder 47. The upper bottom of this cylinder comprises an eye 48 engaged by a pivot pin 49 carried by angle members 50 secured on either side of the sheath on the longitudinal beam supporting this sheath.

The piston rod 51 of the hydraulic cylinder is attached to the lower end of the telescopic leg 39.

In the form of embodiment illustrated diagrammatically in FIGS. 6 and 7, this rod 51 is connected at 52 to a separate member carried by the outer end of the leg 39 and also to the rigidly mounted shoe 40.

However, the contact between the shoe and the ground may be improved, in spite of unevennesses of the latter, by pivotally or hingedly mounting the shoe, the leg constituting in addition a swivelling shoe mounting.

A typical embodiment of this character is illustrated in diagrammatic form in FIGS. 8 to 11.

As shown notably in FIGS. 8 and 9, the shoe $40^1$ comprises a frame forming at 55 a strap supporting a horizontal pivot pin 56 extending at right angles to the longitudinal axis of the telescopic leg $39^1$.

To this end, the leg $39^1$ has its outer end formed with a fork 57 engaging the strap 55 and also with an eye-lug 58 rigid with the outer end of rod 51.

The pivot pin 56 extends through this assembly, notably through the fork 57 and eye-lug 58 with the interposition of bearings 59, 60 and is assembled and locked at its ends on the strap 55 formed on the shoe.

This assembly is also characterized, as shown in FIGS. 10 and 11, by a certain freedom in the angular movements of the telescopic leg $39^1$ about its longitudinal axis.

This freedom is so controlled that it cannot be used unless the telescopic leg is in operation. To this end, the upper portion of leg $39^1$ which is to remain in the rec-

tangular-sectioned sheath 35 has a polygonal cross-section fitting in the sheath and permitting an angular movement 61 in one or the other direction (see FIG. 10).

FIGURE 11 shows the lower portion of leg $39^1$ in its retracted position, this portion alone having a rectangular cross-section fitting approximately into that of the said sheath 35, whereby the aforesaid angular movement is prevented in the road position. Of course, the hydraulic cylinder controlling each shoe does not interfere with this angular movement, the latter being transmitted to the piston-rod of this cylinder.

The hydraulic circuitry is fed with fluid under pressure, the necessary pressure being derived from the power unit of the vehicle, for example under the conditions shown in the circuit diagram of FIG. 12.

The reference numeral 65 designates the reservoir of the installation, and in this diagram the thick lines represent the pressure fluid distributor pipe lines, the broken lines the exhaust and return pipe lines and the chain-dotted lines the leakage pipe lines.

The hydraulic cylinders 47 controlling the bearing shoes are fed from the reservoir 65 by means of a pump 66 driven by a power take-off illustrated diagrammatically at 67 and provided on the gearbox. The supply of pressure fluid to these cylinders is controlled separately by means of four distributors 68 of a conventional, four-way type, which constitute in this example a compact unit with an exhaust valve 69 and may be mounted conveniently in the driver's cab. Thus, the driver may easily adjust the adequate propping or operative setting of the vehicle by selectively controlling through the delivery of fluid under pressure to each corresponding cylinder the position of each telescopic leg.

On the other hand, the complete hydraulic control system mounted on the platform is fed by means of a revolving joint 70 of any suitable type which is disposed on the central pintle of the slewing platform 2.

The source of fluid under pressure connected to this assembly comprises two pumps having their outlets connected to each other, one pump 71 being a high-pressure piston pump and the other 72 a mean-pressure gear pump having inserted in its output line a safety valve 73 and a non-return valve 74 to prevent any back flow from pump 71 to pump 72. Thus, the pump 72 is effective for increasing the output in the hydraulic circuit associated with the platform as long as the pressure necessary for the operation of the platform-controlled members is below a predetermined minimum value; when the pressure exceeds this value, the output of pump 72 is directed by the valve 73 to reservoir 65. Both pumps 71 and 72 are driven in series from a power take-off shown in diagrammatic form at 75 and disposed between the clutch and gearbox of the vehicle.

A distributor block mounted on the platform is connected to the high-pressure pump 71 and consists of an exhaust valve 76 and two distributors 77, 78 of a conventional, four-way type, adapted to deliver fluid under pressure to the luffing cylinder 21 and also to the cylinders 33, 34 controlling the slewing movements of the platform.

The luffing cylinder 21 consists in this case of a single-acting cylinder having inserted in its feed line a servo-actuated auxiliary valve 79 of conventional type which is fed through one or the other of the outlets of distributor 77, according as it is desired to raise or lower the jib.

On the other hand, the two hoisting motors 28 may be fed with the common output from the two pumps 71, 72 through a distributor 80 of a conventional, four-way type, adapted in its extreme positions to control the up- and downward movements of the snatch block hook 17 by causing the rotation of the winch drum 18 in one or the other direction.

Although the present invention has been described in conjunction with the preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention and appended claims.

I claim:

1. A travelling crane comprising a supporting chassis, a platform rotatably mounted on said chassis, vertically inclined guide means extending across said platform, a jib having a base mounted on said guide means and the jib extending in the same direction therewith, means connecting the base to the guide means for oscillating and sliding movement therealong, a short frame mounted on said platform adjacent to the lower end of the guide means, tie-rod means having one end pivotally connected to the head of said jib and the other to the upper end of said frame and means connected to the base of said jib to displace it in said guide means and constituting the sole means for raising and lowering said jib.

2. A travelling crane comprising a supporting chassis, a platform rotatably mounted on said chassis, vertically inclined guide means extending across said platform, a jib having a base mounted on said guide means and the jib extending in the same direction therewith, means connecting the base to the guide means for oscillating and sliding movement therealong, a short, triangular frame mounted on said platform adjacent to the lower end of the guide means, tie-rod means having one end pivotally connected to the head of said jib and the other to the apex of said frame and means connected to the base of said jib to displace it in said guide means and constituting the sole means for raising and lowering said jib.

3. The combination of claim 1, wherein said last means includes a hydraulic cylinder parallel to said guide means, the cylinder extending about one-half the length of said guide means and having a piston rod which moves through the other half of said length, a rotary member carried by the free end of the piston rod and a flexible member passed over the rotary member and connected to the base of the jib and to a fixed point.

4. The combination of claim 1, wherein a hoisting winch is mounted on the jib and a hydraulic motor for the winch mounted on said jib.

5. The combination of claim 1, wherein a hoisting winch drum is mounted on the jib and a pair of hydraulic motors are mounted at each end of the winch drum and constitute the shaft bearings thereof.

6. In combination with an automotive vehicle having a chassis and a driver's cab, a crane comprising a platform rotatably mounted on said chassis rearwardly of the cab, inclined guide means extending across said platform and being positionable parallel with the longitudinal axis of the chassis, a short vertical frame mounted on the platform and disposed adjacent to the lower end of the guide means, a jib extending in the same direction as said guide means and having a base connected in an oscillating and sliding manner to said guide means, tie-rod means having one end pivotally connected to the head of the jib and the other end pivotally connected to the upper end of the frame and means connected to the base of the jib for displacing it in the guide means and constituting the sole means to raise and lower the jib.

7. A travelling crane comprising a supporting chassis, a platform rotatably mounted on said chassis, vertically inclined guide means extending across said platform, a jib having a base mounted on said guide means and the jib extending in the same direction therewith, means connecting the base to the guide means for oscillating and sliding movement therealong, a short frame mounted on said platform adjacent to the lower end of the guide means, tie-rod means having one end pivotally connected to the head of said jib and the other to the upper end of said frame and means connected to the base of said jib to displace it in said guide means and constituting the sole

means for raising and lowering said jib; the jib, the tie-rod means and the short frame being such that in the moved back position of the jib at the base of the short frame, the tie-rod means is substantially horizontal, the inclination of the guide path being close to that of the jib in this position.

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