United States Patent

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[54] **HEAVY DUTY CRANE FOR USE IN A NARROW LOADING AREA**
9 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **212/38,** 212/59, 212/145
[51] **Int. Cl.** **B66c 23/36**
[50] **Field of Search** 212/1, 8, 38, 7, 58, 59, 6, 145; 105/127

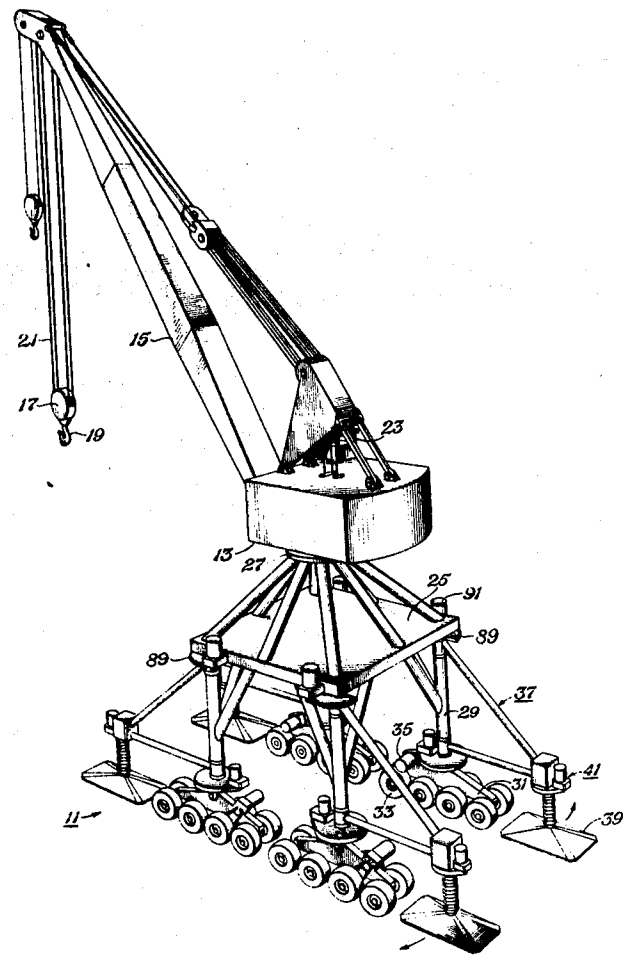
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ABSTRACT: A heavy duty mobile crane having the capability of maneuvering in close quarters, such as a narrow lineal loading area typical of ship dock loading areas. The crane has a plurality of multiple wheeled bogies which can be rotated about substantially vertical axes, and a plurality of outrigger pads capable of lifting the crane to permit rotation of the bogies. The bogies and outrigger pads can be manipulated to effect steering direction changes while the crane remains stationary. Means are provided to adjust the positions of the outrigger pads such that the weight of the crane and its load are shared by the bogies and outrigger pads. The bogies and outrigger pads are capable of alinement so as to present a narrow crane profile and consequently minimize requisite space requirements and obstruction to traffic. Limit means are provided to assure that the bogies and outrigger pads may be automatically stopped at predetermined positions. Means are provided to automatically rotate the bogies in parallel so as to effect substantially the same degree steer for each bogie.



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SHEET 1 OF 2

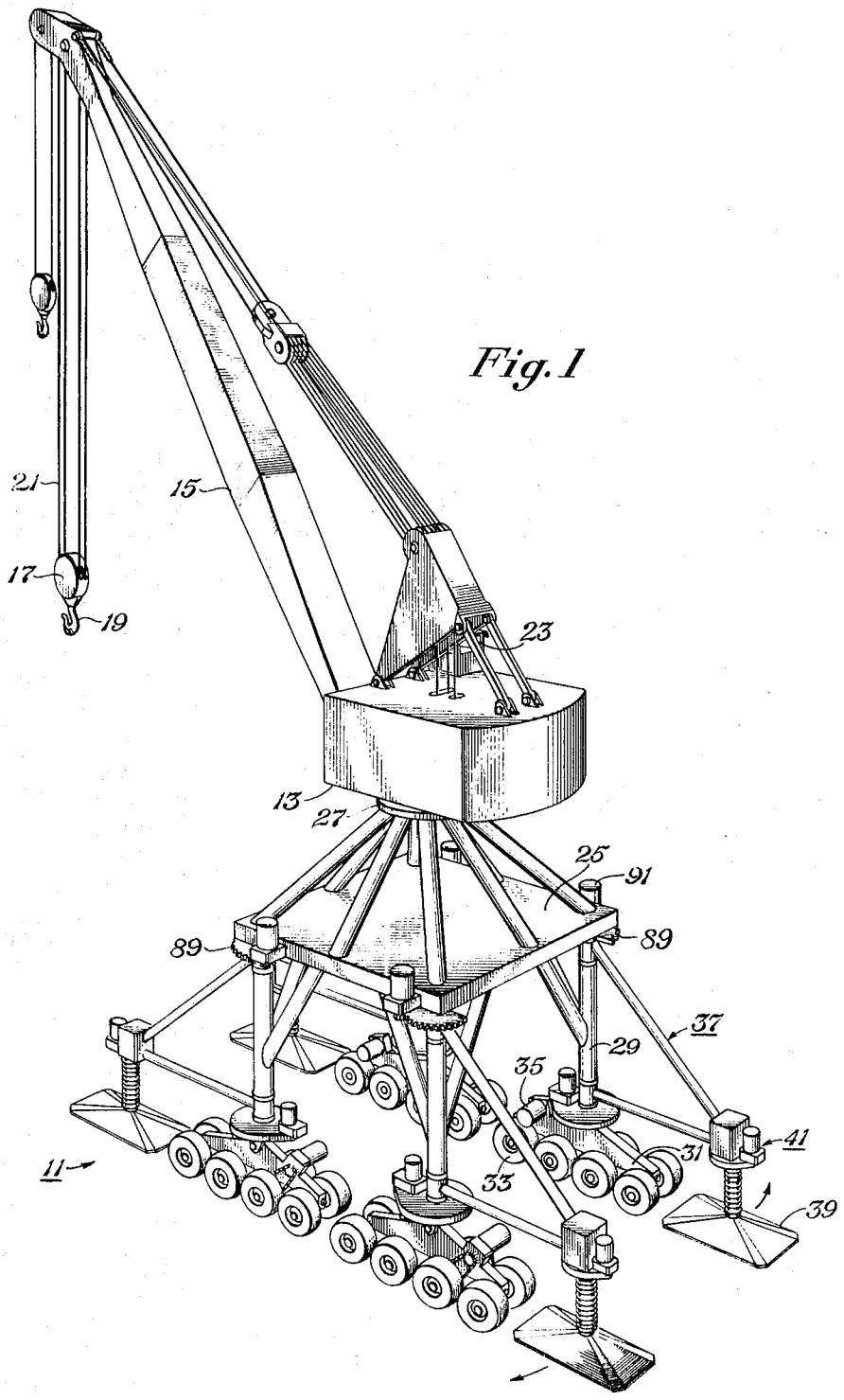


Fig. 1

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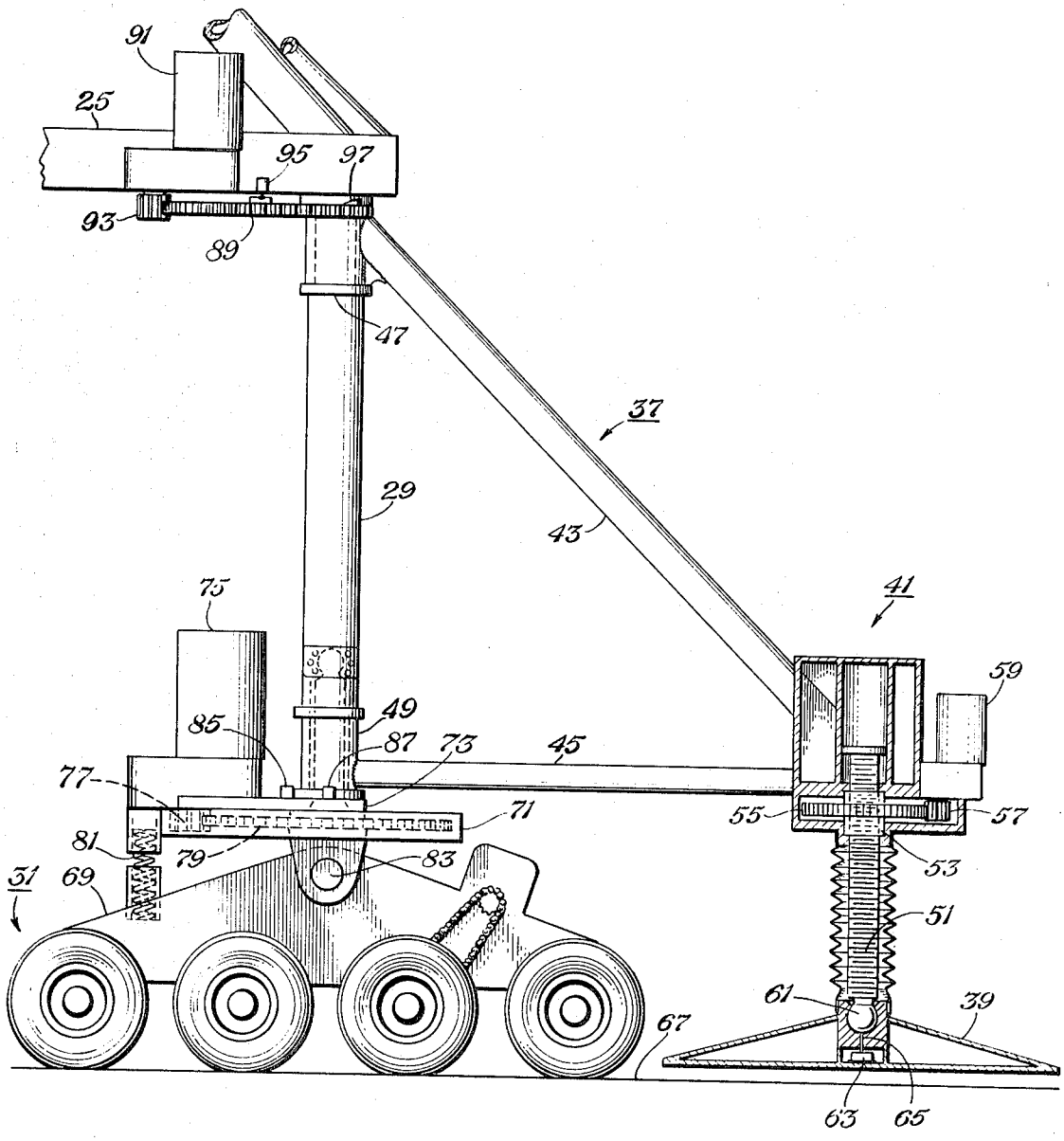


Fig. 2

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HEAVY DUTY CRANE FOR USE IN A NARROW LOADING AREA

BACKGROUND OF THE INVENTION

This invention relates to heavy duty mobile cranes and more particularly to such cranes in applications where the crane operates in close quarters, as for example a narrow lineal area such as a dock for loading ships. Heavy duty mobile cranes of the prior art have not been entirely suitable for such applications because they were not capable of maneuvering in close quarters. The present invention seeks to provide a heavy duty mobile crane that is not only readily capable of maneuvering in close quarters, but at the same time does not require excessive space or tend to impede traffic along a narrow lineal operating area, and additionally provides for minimum load concentration on the operating area surface.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided an improved heavy duty mobile crane which is readily maneuverable in close quarters. The crane has a main base carrying a positionable boom, load carrying means operable in conjunction with the boom, and draw works for controlling the boom and load carrying means. The crane further includes a base platform supporting the main base for relative rotating movement; a plurality of bogies each containing a plurality of wheels, each bogie being connected with and supporting the base platform and each bogie being rotatable through at least 90° about a substantially vertical axis, at least one of said wheels on at least one of said bogies being reversibly driven by a driving means to effect movement of the crane in either direction along the bogie longitudinal axis; and a plurality of extended supporting means adapted together to support the entire weight of the crane to lift same to allow rotation of the bogies, with each extended supporting means being connected with the base platform and rotatable through at least 90° about a substantially vertical axis, and consisting essentially of an outrigger, a ground engaging pad, and an adjusting means adapted to move the said pad into and out of contact with the ground. In a preferred embodiment, there are provided a plurality of supporting means stably supporting the base platform above the ground at a height sufficient to allow traffic to pass thereunder, with the bogies being connected with the respective supporting means. In a preferred embodiment the bogies are positionable for moving in any direction and means are provided for effecting alinement of said bogies and said extended supporting means with either the longitudinal or the lateral axis of the crane. Also, in a preferred embodiment, the pads contain limit means operable to stop the lowering of respective pads responsive to contact of the pad with the ground so that the weight of the crane and its load is shared by the bogies and the extended supporting means. Additional aspects of the invention will hereinafter appear.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of one embodiment of the invention; and

FIG. 2 is a side view of a portion of the embodiment illustrated in FIG. 1 illustrating elements in greater detail.

DESCRIPTION OF PREFERRED EMBODIMENTS

A preferred embodiment of the invention is illustrated in FIGS. 1 and 2 of the drawings. Therein, crane 11 has a main base 13 carrying a positionable boom 15. The usual load-carrying means; such as, sheaves in block 17 having attached hook 19 and supported by cable 21; operate in conjunction with the boom by means of a draw works assembly on the main base 13 for controlling the boom and load-carrying means. Operator's cabin 23 with its console facilitates observance and control by the operator. Base platform 25 supports main base 13. Connecting means 27 rotatably connects main base 13 with base platform 25. Connecting means 27 may include conventional ring gear and pinion for effecting an azimuth of the boom and facilitating loading operations. Any other means capable of effecting azimuthal orientation of the loaded boom 15 can be employed as connecting means 27.

A plurality of supporting means illustrated by leg 29 stably support the base platform above the surface. A bogie 31 supports respective ones of legs 29. Each bogie 31 contains a plurality of wheels 33 for increased load bearing area. At least one of wheels 33 on at least one of bogies 31 is reversibly driven by driving means 35 to move crane 11 in either direction along the longitudinal axis of the bogie. Ordinarily, each of the bogies will have a pair of wheels driven via a common axle by the driving means to effect uniform movement of the crane and lessen strain on the supporting means.

An extended supporting means; such as outrigger 37, ground engaging pad 39, and adjusting means 41; is connected with respective ones of the supporting means. The extended supporting means are constructed so that all together they are able to raise and support the entire weight of the crane. Each adjusting means 41 is capable of lowering the ground engaging pad 39 to the ground and raising its proportionate share of the weight of crane 11 to allow rotation of bogies 31 about substantially vertical axes.

In this way, a high degree of mobility is available even though crane 11 may be extremely large and bulky. To achieve the mobility along both the longitudinal and lateral axes of crane 11, bogies 31 must be rotatable about supporting means through at least 90°. The longitudinal axis of the crane is defined for purposes herein as the central axis of the crane parallel to the bogie longitudinal axes when the bogies and extended supporting means are alined as shown in FIG. 1, and the lateral axis of the crane is the central axis of the crane which is normal to the longitudinal axis. Although it will be appreciated that bogies 31 can be positioned along either the longitudinal or the lateral axis and attain any destination, in order to effect directional steer in all directions intermediate the longitudinal and lateral axes, bogies 31 preferably move in parallel at the same rate so as to track the same degree of steer. For universal degree of steer in all directions, bogies 31 must be rotatable through more than 90°. For example, bogies 31 may be rotatable through 90° to the right and 90° to the left to effect truly universality of steer. It is preferable that limit switch means be employed to automatically stop the rotation of the bogies when they aline with the crane longitudinal and lateral axes. A manual override may be employed to allow the operator to effect the degree of steer he wishes.

On the other hand, the extended supporting means will be positioned, ordinarily, after crane 11 is stationary for a given loading assignment. In the preferred embodiment, extended supporting means are alined with the longitudinal axis of their respective associated bogie to present a narrow profile along a lineal loading area to facilitate passage of traffic beneath base platform 25. Accordingly, only 90° of rotation is necessary for extended supporting means; although greater rotation can be employed.

The extended supporting means, the bogie, and the means effecting the respective rotations are illustrated in FIG. 2. Outrigger 37 has structural support members 43 and 45 fixed to respective sleeves 47 and 49 that are rotatable at spaced regions on leg 29.

Adjusting means 41 comprises a shaft 51 having threads on the upper portion, a nut 53 affixed to a ring gear 55 so as to raise and lower shaft 51 when ring gear 55 is rotated in the corresponding direction. Pinion 57 engages ring gear 55 and is connected with torque means; such as, motor 59; for reversibly rotating the ring gear and, hence nut 53. Ground engaging pad 39 is pivotally mounted by ball joint 61 to the lower end of shaft 51. Pad 39 must have a relatively large load-bearing area in order to support its share of the weight of the crane and its load. Preferably pad 39 is rectangular in form such that it can be alined with the longitudinal axis of its respective bogie and not extend into the traffic way and obstruct flow of the traffic.

Limit means in the form of a limit switch 63 has an actuator arm 65 protruding into ball socket 61 in such a manner that when the pad is suspended, the limit switch contacts are closed; but responsive to contact of the limit switch actuator arm with the ground, the limit switch contacts are opened. In this way, lowering of pad 39 to actuate the limit switch 67 allows bogies 31 and extended supporting means 37 to share the weight of the crane and its load. The ratio of this weight sharing can be selected by selecting the position of the switch actuator arm relative to the pad lower surface. Manual override is provided for further lowering of pad 39 to raise the crane and bogies for rotation of the bogies.

Rotation of the bogies is effected by rotating bogie frame 69 mounted to the underside of turntable 71. Turntable support 73 is fixed to the lower end of leg 29. The bogie may be rotated by means of electric gear motor 75 having an output pinion 77 which engages and rotates turntable ring gear 79. In this way once bogie 31 has been lifted from the ground it may be positioned to effect any degree of steer. Ordinarily, as indicated hereinbefore, the movement of the crane will be along its longitudinal or lateral axis, which may be arbitrarily chosen if the crane is symmetrical as illustrated. To facilitate alinement of bogies 31 with the respective lateral and longitudinal axis, limit means in the form of limit switches 85 and 87 are provided to automatically stop rotation of the bogies when these positions are attained.

Once crane 11 has been positioned and the bogies have their longitudinal axes properly alined with the lineal loading area, it is desirable to also aline the extended supporting means with the longitudinal axis of the bogie. To effect rotation to achieve the desired positioning, sector gear 89 is fixed to upper sleeve 47 and support member 43. Gear motor 91 is fixed to base platform 25 and has an output pinion 93 engaging sector gear 89 whereby the outriggers may be rotated through an angle of at least 90°.

In operation, crane 11 may be moved from one loading position to another as follows. Motor 59 is energized to raise pads 39 off the ground. Driving means 35 is energized and the crane proceeds to move forward along the longitudinal axis of the bogies. An advantage of such movement is that traffic can still proceed along a dock and along one axis of the crane beneath the base platform since outriggers are alined with the longitudinal axis of the bogies. If it is desired to turn 90° in either direction, pads 39 are lowered into contact with the ground and by manual override the crane is lifted. Bogies 31 are rotated through 90° by energizing gear motor 75 rotating pinion 77 and turntable ring gear 79. Once the particular limit switch automatically stops rotation, the weight of the crane may be lowered back onto the bogies by rotating motor 59 in the opposite direction, raising pad 39 from the surface. If movement along this axis is only for a short distance, extended supporting means may be retained in their position. If movement is for an extended interval, it is ordinarily advantageous to rotate the extended supporting means through 90° so they again aline with the longitudinal axis of the bogies and present a narrow profile allowing traffic to proceed along the other axis of the crane. In a preferred embodiment, the crane is symmetrical in form such that it may travel in either the longitudinal axis directions and present an identical form to that presented traveling in the lateral axis directions.

While, as indicated hereinbefore, any position can be effected by a series of such movements along the longitudinal and lateral axes, it may be preferable to steer at some diagonal, or oblique angle, to arrive at a new position more rapidly. Again, as indicated hereinbefore, the degree of steer imparted to each of the bogies is relatively the same since they are connected in parallel. In this way, there is no strain induced upon supporting means 29 by improper degrees of steer of one or more of the bogies such that the tracks tend to converge.

Once the new position is achieved, the crane may be raised and the bogies alined to facilitate traffic flow and the pads 39 lowered toward contact with the surface, being stopped automatically by activation of their respective limit switch 63. Thereafter, the desired onloading or off-loading of a vehicle, such as a ship, can be accomplished by the usual manipulation of the draw works, boom and load-carrying means.

Although the invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

I claim:

1. In a heavy duty crane for use on a surface, having a main base carrying a positionable boom, load-carrying means operable in conjunction with said boom, draw works for controlling said boom and said load-carrying means, the improvement comprising: a. *a.* a base platform supporting said main base for relative rotational movement;

b. a plurality of bogies each containing a plurality of wheels, each bogie connected with and supporting said base platform and each bogie rotatable through at least 90° about a substantially vertical axis, at least one of said wheels on at least one of said bogies being reversibly driven by a driving means to effect movement of said crane in either direction along the longitudinal axis of said bogie; and

c. a plurality of extended supporting means adapted together to support the entire weight of said crane and to lift said crane to allow rotation of said bogies, each extended supporting means connected with said base platform and rotatable through at least 90° about a substantially vertical axis, and consisting essentially of an outrigger, a ground engaging pad, and an adjusting means adapted to move said pad into and out of contact with said surface.

2. In a heavy duty crane for use on a surface, having a main base carrying a positionable boom, load-carrying means operable in conjunction with said boom, draw works for controlling said boom and said load-carrying means, the improvement comprising:

a. a base platform supporting said main base;

b. connecting means rotatably connecting said main base with said base platform;

c. a plurality of supporting means stably supporting said base platform above said surface at a height sufficient to allow traffic to pass thereunder;

d. a plurality of bogies each containing a plurality of wheels, each bogie connected with and supporting respective ones of said supporting means and each bogie rotatable through at least 90° about a substantially vertical axis, at least one of said wheels on at least one of said bogies being reversibly driven by a driving means to effect movement of said crane in either direction along the longitudinal axis of said bogie;

e. a plurality of extended supporting means adapted to support the entire weight of said crane and to lift said crane to allow rotation of said bogies, each extended supporting means connected with a respective one of said supporting means and rotatable through at least 90° about a substantially vertical axis, and consisting essentially of an outrigger, a ground engaging pad, and an adjusting means connected with said pad and with said outrigger and adapted to move said pad into and out of contact with said surface.

3. The crane of either claim 1 or claim 2 wherein said base platform is supported on four supporting means, said bogies are connected with the respective supporting means and are positionable for moving in any direction and means are provided for effecting alinement of said bogies and said extended supporting means with either the longitudinal or the lateral axis of said crane to present a narrow profile along a lineal loading area and minimize obstruction to traffic.

4. The crane of either claim 1 or claim 2 wherein said pad also contains limit means operable to stop the lowering of said

pad responsive to contact of the limit means actuator with said surface whereby the weight of said crane and its load may be selectively shared by said bogies and said extended supporting means.

5. The crane of claim 4 wherein said pad is located on the longitudinal axis of said bogie and outboard thereof when said crane is in a static position for loading.

6. The crane of either claim 1 or claim 2 wherein limit means are provided for automatically stopping rotation of said bogies when said bogies are alined with either the longitudinal axis or the lateral axis of said crane.

7. The crane of claim 6 wherein limit means are also provided for stopping rotation of said extended support means when alined with either the longitudinal or the lateral axis of said crane.

8. The crane of claim 7 wherein said pad is substantially rectangular such that the longitudinal axis of said pad may be alined with the longitudinal axis of said bogie to support its load without obstructing traffic.

9. The crane of either claim 1 or claim 2 wherein there is provided torque inducing means for rotating the respective bogies in parallel to effect the same degree of steer of each of the bogies.