

Nov. 7, 1950

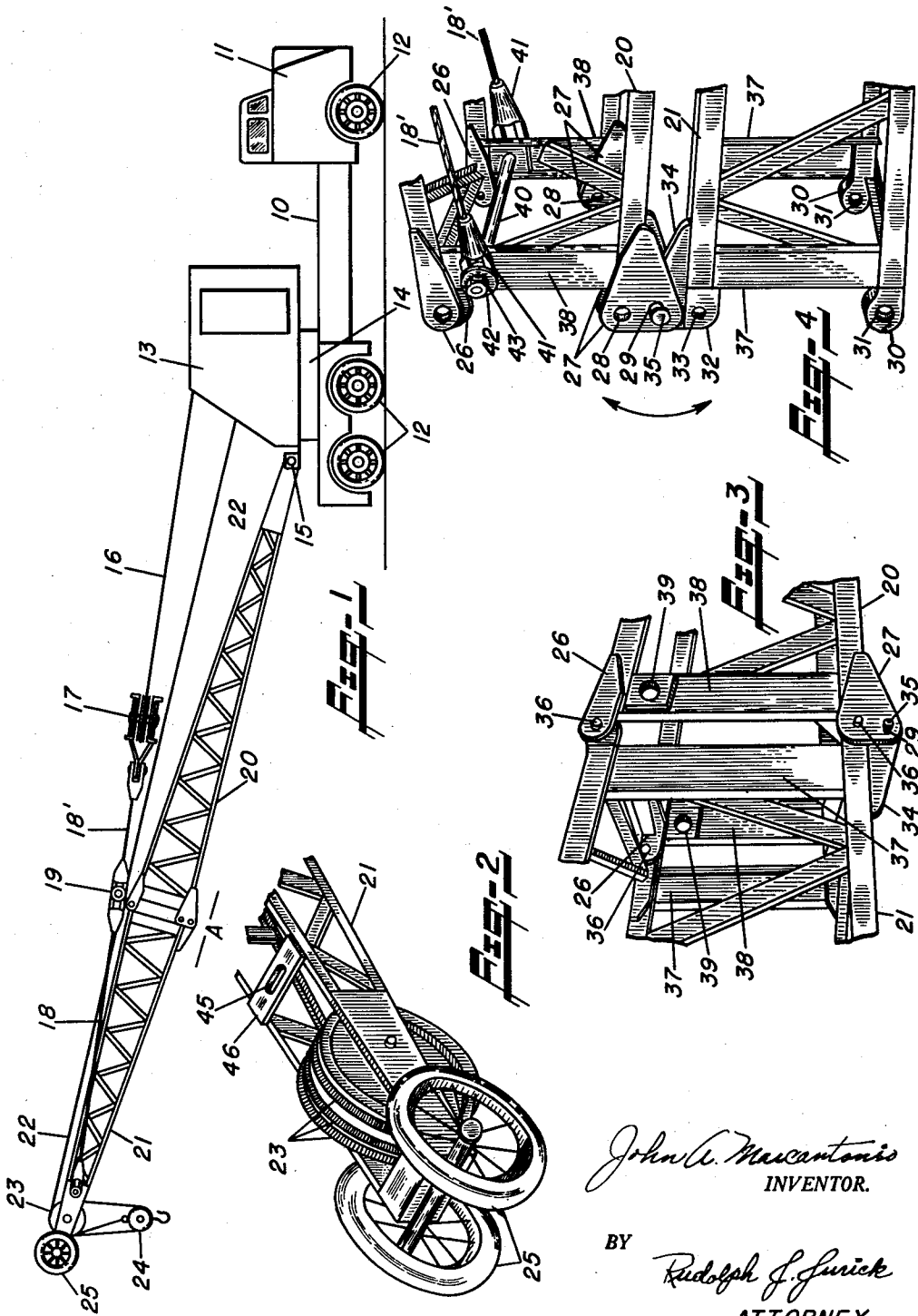
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FOLDABLE BOOM

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2 Sheets-Sheet 1



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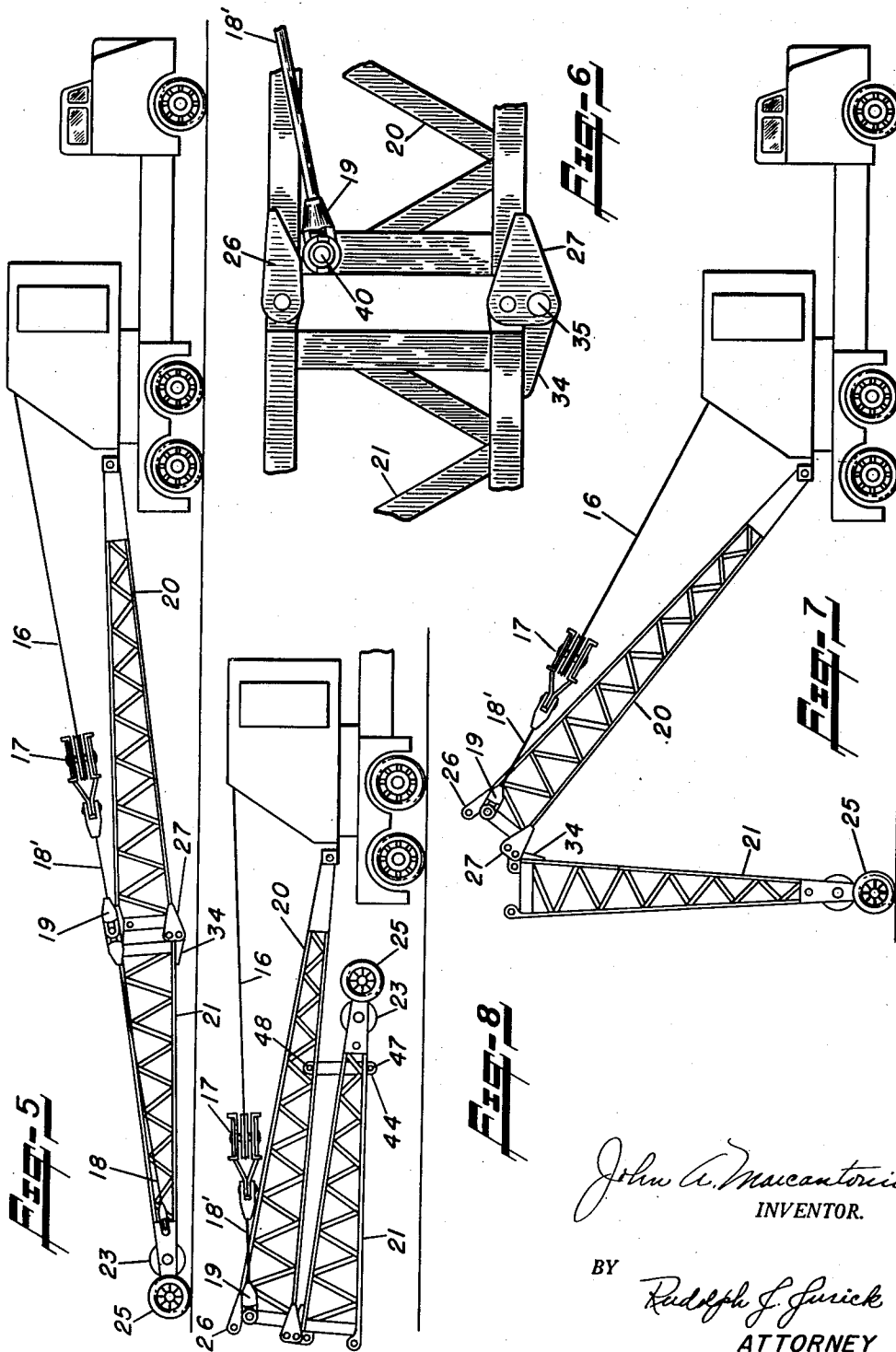
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FOLDABLE BOOM

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This invention relates to booms of the type employed on mobile cranes and more particularly to the novel construction of a relatively long boom that may be folded to facilitate movement of the crane over established right of ways.

Mobile cranes are usually mounted upon a truck vehicle for transportation or movement from the site of one operation to the next. A revolving superstructure is mounted on the truck body and houses the power machinery and controls for operating the boom hoist cable, load hoisting cable, etc. Such cranes are provided with a single boom of box-like construction and modern building operations present a requirement for longer and longer booms. However, there is a definite limit to the length of a boom that can be moved about over established streets, highways, etc.

While various types of foldable and telescopic booms have been proposed these have been restricted for use on relatively light duty cranes. Long booms provided on cranes for heavy duty service still require a partial or complete dismantling prior to transit to the next site of operations. The boom then must again be reassembled and bolted together preparatory to actual operations. This procedure requires the services of as many as six skilled workers and is both time consuming and costly.

A boom made in accordance with my invention may have any required length yet can be folded for transit simply and quickly without removal from the superstructure. The boom is made in sections that can be secured together by simple pin means to form a rigid boom of desired length. Adjoining sections are provided with self-aligning pivotal hinges for folding the boom back on itself to reduce the overall length. Further, the terminal end of the boom is provided with a pair of freely rotatable wheels making it possible to use the power of the crane for the boom folding operation as will be described in detail hereinbelow.

An object of this invention is the provision of a foldable boom adapted for use with heavy duty cranes whereby the boom may be folded to facilitate movement of the machine over existing right of ways.

An object of this invention is the provision of a foldable boom provided with terminal wheels whereby the crane power can be employed to fold the boom preparatory to transit.

An object of this invention is the provision of a boom comprising individual sections, the cooperating ends of each section being provided with aligned apertures whereby the sections can be

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united by simple pin means to provide a rigid boom of desired length.

An object of this invention is the provision of boom comprising individual sections, each section made of four spaced, longitudinally extending angle bars interconnected by diagonal cross-bars, pin and aperture means carried by the lower angle bars of cooperating boom sections and adapted to form a pivotal joint when the sections are connected together, pin and aperture means carried by the upper angle bars of cooperating boom sections and adapted to provide a rigid joint when the sections are connected together, and means for connecting the boom-hoist cable to the inboard boom section whereby removal of the pins from the upper boom sections will result in a folding of the boom as the boom is elevated by means of the boom-hoist cable.

An object of this invention is the provision of a relatively long boom that may be folded quickly and easily and which is of simple construction and low manufacturing cost.

An object of this invention is the provision of a novel method for folding long booms without removing the boom from the superstructure.

These and other objects and advantages will be apparent from the following description when taken with the accompanying drawings. The drawings are for purposes of illustration and are not to be construed as defining the scope or limits of the invention, reference being had for this purpose to the appended claims.

In the drawings wherein like characters denote like parts in the several views:

Figure 1 is an elevation view of a mobile crane provided with a relatively long boom made in accordance with this invention;

Figure 2 is an enlarged, isometric view of the terminal end of the boom and showing the wheels employed in folding and unfolding the boom;

Figure 3 is an enlarged, fragmentary view showing the inboard and outboard sections of the boom joined together in the boom operative position;

Figure 4 is similar to Figure 3 but viewed from a different angle to clearly illustrate the pivotal separation of the boom sections when the boom is folded and in position for transit;

Figure 5 is an elevation view similar to Figure 1 and showing the first step of the boom-folding operation, that is, with the boom supported on the terminal wheels;

Figure 6 is an enlarged fragmentary view of the boom section joint and showing the second step of the boom-folding operation;

Figure 7 is an elevation view showing the

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intermediate position of the boom sections during the boom-folding operation; and

Figure 8 is an elevation view showing the outboard section of the boom completely folded under the inboard section, that is, the in transit position.

Referring now to Figure 1, a mobile crane of the type contemplated by this invention comprises a truck vehicle having a body section 10 and a prime mover engine (not shown) located under the hood 11, the vehicle adapted for road movement on the wheels 12. The crane unit comprises a superstructure 13 rotatably mounted on a base 14 and housing a suitable power engine, cable drums, and controls (not shown). A boom constructed of spaced, longitudinally extending angle bars and diagonal reinforcing bars is pivotally attached to the superstructure by a boom hinge 15, as is well known in the art. The angular position of the boom is controlled by the boom-hoist cables 16 attached to the bridle 17 and the pennant cables 18, 18' as is also well known. I prefer to make the pennant cables in sections secured together by means of a pair of wire rope sockets 19 for purposes described in more detail below.

The boom, as shown in Figure 1, comprises two sections, an inboard section 20 and an outboard section 21 secured together in the region identified by the letter A. When the boom sections 20 and 21 are secured together the boom may be operated in the usual manner to raise and lower a load by means of the hoisting cable 22 operating over the sheaves 23 and around the pulley block 24.

The terminal end of the boom is provided with a pair of wheels 25 that are freely rotatable about an axle secured to the end of the boom by any suitable means such as welding. The wheels 25 (Figure 2) do not interfere with the normal operation of the crane and may, therefore, be retained on the boom at all times. However, the wheels may be removed, if so desired, and need only be installed during the actual folding or unfolding of the boom as the wheels serve only to carry the outboard section of boom during the folding and unfolding operation.

The joint area A (Figure 1), between the inboard and outboard sections of the boom, is illustrated in Figures 3 and 4. A pair of apertured plates 26 is welded to the end of each of the upper angle bars of the inboard boom section 20. A somewhat larger, triangular pair of plates 27 are welded to each end of the lower angle bars of the inboard boom section, each pair of plates 27 having alined apertures 28 and 29 therein.

The upper angle bars of the outboard boom section 21 have studs 30 welded thereto each stud having an aperture 31 therein. A similar set of studs 32 having apertures 33 therein are welded to the lower angle bars of the outboard boom section. It is pointed out that the studs 30 and 32 carried by the outboard boom section 21 are designed to fit between the paired plates 26 and 27 respectively carried by the inboard boom section 20. Further, a plate 34 is welded to each of the lower angle bars of the outboard boom section 21, said plates 34 lying in a vertical plane and substantially flush with the outside surface of the adjacent angle bar. The thickness of each plate 34 is such that the plates 34 slide within the paired plates 27.

The two boom sections 20 and 21 are pivotally secured together by means of two headed pins 35, each pin passing through the alined aper-

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tures in the coating plates 27 and 34. These two pins form the axles permitting relative rotation of the two boom sections during the folding and unfolding operation. Each of the pins 35 is prevented from falling out of position by individual cotter pins (not shown) as is well known.

In the boom operative position (Figure 3) the boom sections 20, 21 are held together firmly and in longitudinal alinement by means of four tapered pins 36 individually driven through the alined apertures in the coating plates 26 and studs 30 carried by the upper angle bars, and alined apertures in the coating plates 27 and studs 32 on the lower angle bars. The studs 32 and the plates 34 of the outboard boom section slide between the paired plates 27 of the inboard boom section. The plates 27 and 34 have a substantial thickness and a surface area sufficiently large to maintain the two sections of the boom in proper alinement during the folding and unfolding operation.

By simply driving out the four tapered pins 36 the two boom sections are free to rotate about the axle pins 35. It is pointed out the pins 35 are located outside of the perimeter of the boom sections, that is, the rotational axis of the boom sections lies below the horizontal planes passing through the lower angle bars of each boom section. This construction affords substantially 180 degree relative rotation of the boom sections such that the outboard boom section 21 may be folded completely underneath the inboard boom section 20, as shown in Figure 4.

Vertical channel bars 37 are welded between upper and lower angle bars of the outboard boom section for purposes of added strength. A similar set of channel bars 38 are welded between the upper and lower angle bars of the inboard boom section. Each bar 38 is provided with a hole 39 to accommodate a steel bar 40 (Figure 4) that is placed into position preparatory to folding the boom for transit. The pennant cables 18' are attached to the bar 40 by means of the wire rope sockets 41 and are retained in position by a washer 42 and pin 43 that passes through a hole in the bar 40.

The operation and function of the various parts described above will become more apparent from the following detailed description of the boom folding operation.

The crane operator first lowers the boom so that the terminal wheels 25 rest on the ground, as shown in Figure 5. Next the four tapered pins 36 (shown in Figure 3) are removed and the bar 40 placed into position as shown in Figure 6. The pennant cables are then separated at the wire rope sockets 19 and the sections of the pennant cables 18' coming from the bridle 17 are attached to opposite ends of the bar 40.

The crane operator now raises the boom by "taking up" the boom hoist cable 16 on the power drum whereby the boom sections 20, 21 separate as shown in Figure 7. As the end of the outboard boom section 21 rests upon the wheels 25 the terminal end of the outboard boom section moves in a direction toward the superstructure. Once the wheels 25 have passed through the vertical line extending through the bar 40 the crane operator lowers the boom by "playing out" the boom hoist cable and the weight of boom structure will cause the terminal end of the outboard boom section to continue movement toward the superstructure. Consequently, the boom is folded back on itself when

the inboard boom section reaches a horizontal position. This operation of folding the boom by use of the crane power is fairly simple and the average operator readily can master the technique of folding the boom in one continuous motion. It is apparent that if the diameter of the wheels 25 is somewhat greater than the height of the boom sides in the region of the wheels no portion of the outboard boom section will contact the ground as the boom section rides toward the superstructure during the boom folding operation.

Once the outboard section of the boom is folded underneath the inboard section the crane operator "slackens" the boom hoist cable so that the two boom sections are brought close together. A flat bar 44 (Figure 8) having a transverse stud 47 at one end is inserted upward through the slot 45 in the stiffener plate 46 carried by the top surface of the outboard boom section (see Figure 2). The flat bar 44 extends through a slot in a similar stiffener plate attached to the lower side of the inboard boom section and a bolt 48 is inserted through the upper section of the flat bar 44. The crane operator now "takes up" on the boom hoist cable until the wheels 25 leave the ground and the machine is now in condition for transit, as shown in Figure 8. It will be apparent the flat bar 44 merely serves to suspend the outboard boom section from the inboard section to facilitate movement of the machine over the road. This may be accomplished by any other suitable means such as an S shaped hook, rope, etc.

The weight of the entire boom is supported by the boom hinge 15, the boom hoist cables 16 and pennant cables 18'. Consequently, the entire boom is clear of the ground as the machine is moved from one site to another. When in transit the entire machine is motionally stable as the folding back of the boom reduces substantially the effective lever arm through which the overall weight of the boom tends to tip over the superstructure.

It will also be apparent the weight of the boom remains constant, that is, the boom weighs as much in the folded, in transit position as it does in the extended, operative position. Consequently, there is no need to change the usual counterbalance weights carried by the back end of the superstructure. This factor is of primary consideration with respect to crawler cranes, that is, cranes which move about under their own power on a set of tractor treads. In these machines the weight of the boom must be balanced by a set of counterweights attached to the opposite side of the superstructure. Under the present practice of dismantling long booms for transit the counterweights must also be removed to maintain stability of the machine as a whole.

When a crane provided with my boom reaches the new site of operations the boom is unfolded and placed into operative condition in a matter of a few minutes by reversing the procedure set forth above with respect to the folding operation.

While I have illustrated and described a two section boom my invention is not restricted thereto. Any number of sections may be provided to form a boom of desired length. In a multisectional boom I prefer to provide pennant cables having a corresponding number of sections secured together by means of conventional wire rope sockets. Each section of the boom may be provided with pin connecting means as described

with reference to Figures 3 and 4. Thus, the boom may be folded at any sectional joint by merely removing the four tapered pins, inserting the cross-bar into the holes provided in the upright angle plates of an inboard boom section and attaching to the bar the pennant cables adjacent to that particular sectional joint. As a practical consideration the point at which the boom is to be folded is predetermined in advance and only that joint need be provided with pins for the rotational separation of the adjoining boom sections. The remaining boom sections are then semi-permanently secured together by means of four tapered pins such as the pins 36 shown in Figure 3.

Having now described my invention its utility and time saving features are apparent. Often the time during which a crane is employed in actual service on a given job is only a matter of a few hours. With present long booms the task of dismantling and reassembling the boom consumes more time than the actual working hours of the crane. I have found that a boom made in accordance with my invention can be folded by the crane operator and one helper in less than ten minutes. Substantially the same amount of time (10 minutes) is required to unfold the boom and place it into operation.

In folding and transporting a boom of my construction the pulley block, loose pennant cables, etc. are merely placed inside the box-like boom structure and may be secured to, or disposed over, the diagonal cross-bars to prevent said parts from falling to the ground. The load hoisting cable merely loops around the folded section of the boom. Thus, there is no need to remove any of the operating components as is the case when the boom is dismantled in accordance with prior practice.

Having now described my invention certain variations and modifications in the relative disposition and arrangement of the parts will be apparent to those skilled in the art. Such variations and modifications may be made without departing from the spirit and scope of the invention as set forth in the following claims.

I claim:

1. A foldable boom comprising an inboard and an outboard section, each section comprising four longitudinally extending angle bars interconnected by diagonal cross-bars; a pair of vertically downward extending plates secured to each of the lower angle bars of one boom section; aligned apertures in each pair of said plates; single vertically downward extending plates secured to each of the lower angle bars of the other boom section said single plates adapted to slide between the coacting paired plates on the first boom section; an aperture in each single plate; a pin disposed through the apertures in each coacting set of single and paired plates; and removable means securing the two boom sections together in longitudinal boom operative position.
2. The invention as recited in claim 1, wherein the removable means securing the two boom sections together comprises tapered pins driven through aligned apertures extending from members secured to the adjacent ends of the angle bars of the boom sections.
3. A boom section comprising four longitudinally extending angle bars, diagonal cross-bars interconnecting the angle bars, means carried by the inner end of the boom section for pivotally attaching the section to a superstructure, verti-

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cal bars secured one each between the upper and lower angle bars at the outer end of the boom section, an aperture in each of said vertical bars, a pair of plates secured to each of the lower angle bars at the outer end of the boom section each pair of said plates having alined apertures whose center lies below a plane passing through the lower angle bars, and a pair of plates secured to each of the upper angle bars at the outer end of the boom section each pair of said plates having alined apertures.

4. A foldable boom comprising an inboard section and an outboard section each section comprising four longitudinally extending angle bars and diagonal cross-bars, means at one end of the inboard section for pivotally securing said section to the superstructure of a crane, vertical bars secured between the upper and lower angle bars at the other end of the inboard boom section, an aperture in each vertical bar, a rod extending through the boom and through the apertures in said vertical bars, a pennant cable removably secured to each end of the said rod, a pivotal hinge joining together the lower angle bars of the two boom sections, and means for disconnecting the upper angle bars of the boom sections whereby an upward tension force exerted on the pennant cables results in a relative rotational separation of the boom sections.

5. A boom section comprising four longitudinally extending angle bars, diagonal cross-bars interconnecting the angle bars, a sheave rotatably mounted at the terminal end of the boom section, an axle carried by the terminal end of the boom, a pair of wheels rotatably mounted on the axle, a stud secured to and extending longitudinally from each of the angle bars at the other end of the boom section, and an aperture in each of said studs.

6. A foldable boom comprising an inboard section and an outboard section, pivotal means connecting the boom sections together and effective to permit substantially 180 degree relative rotation of the boom sections, removable connecting means rigidly connecting the boom sections together in end to end boom-operative position, and a pair of wheels rotatably mounted on the terminal end of the outboard boom section, said wheels having an outside diameter greater than the height of the vertical sides of the outboard boom section in the region of the wheels.

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7. A crane comprising a superstructure housing a power source; a foldable boom pivotally hinged at one end to the superstructure and comprising an inboard section and an outboard section; a pivotal joint between the inboard and outboard boom sections; removable connection means rigidly connecting the inboard and outboard boom sections together in the boom operative position; a boom hoist cable operated by the power source; a bridle connected to the said boom hoist cable; pennant cables connected between the bridle and the terminal end of the boom; a separable joint in the pennant cables, said joint disposed in the region of contact between the inboard and outboard boom sections; a pair of vertical plates secured to the outer end of the inboard boom section; a rod passing through alined apertures in the said vertical plates, said rod serving as a means for attaching the pennant cables to the inboard boom section when said cables are disconnected at the separable joint; and a pair of wheels rotatably secured to an axle that is carried by the terminal end of the outboard boom section, said wheels having a diameter greater than the height of the vertical sides of the boom in the region of the wheels.

8. A crane comprising a superstructure, a power source, a foldable boom pivotally secured to the superstructure and comprising an inboard section and an outboard section, a pivoted joint between the boom sections, means for attaching a cable from the power source to the terminal end of the inboard boom section, and a pair of wheels rotatably attached to the terminal end of the outboard boom section, said wheels having a diameter greater than the height of the vertical sides of the outboard boom section in the region of the wheels.

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