

March 14, 1967

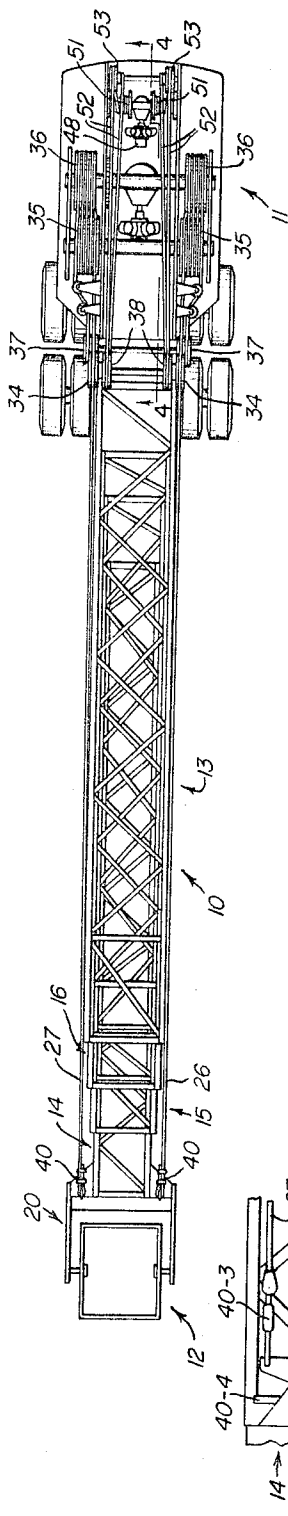
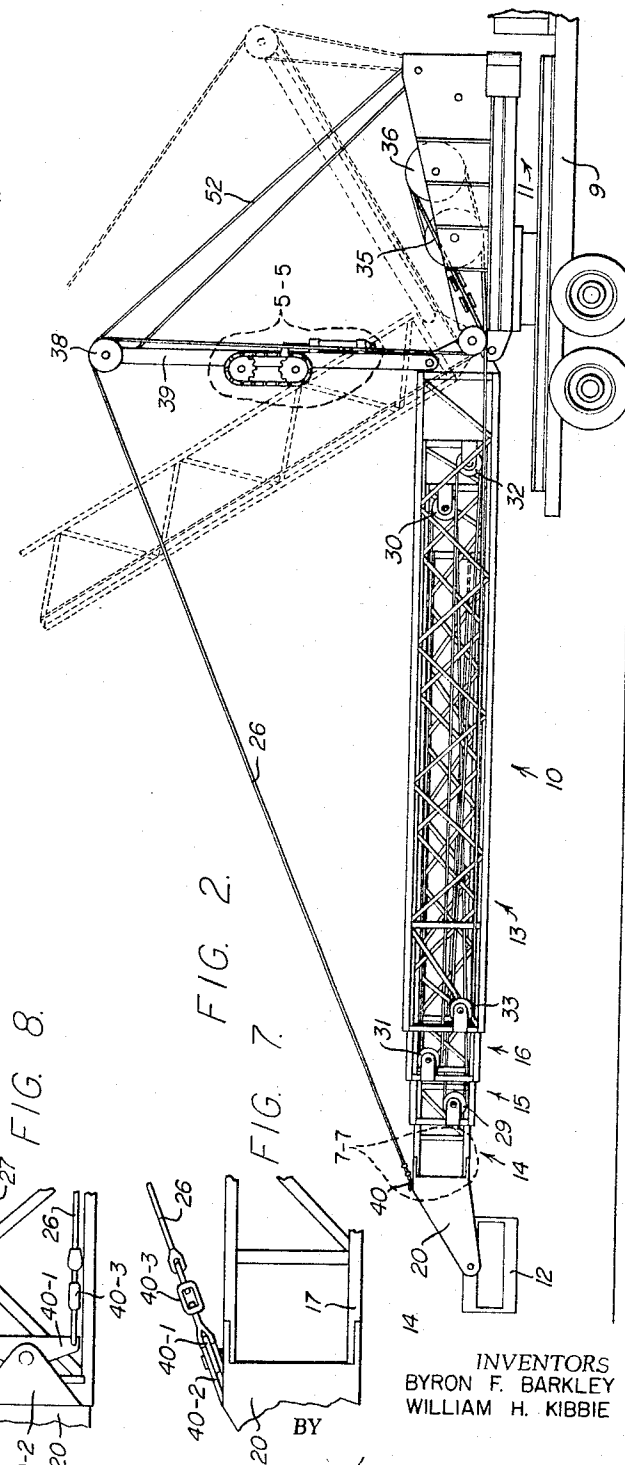
B. F. BARKLEY ET AL

3,308,967

EXTENSIBLE BOOM CRANE

Filed Oct. 6, 1965

2 Sheets-Sheet 1



INVENTORS
BYRON F. BARKLEY
WILLIAM H. KIBBIE

~~Mallinckrodt~~ and
~~Mallinckrodt~~
ATTORNEYS

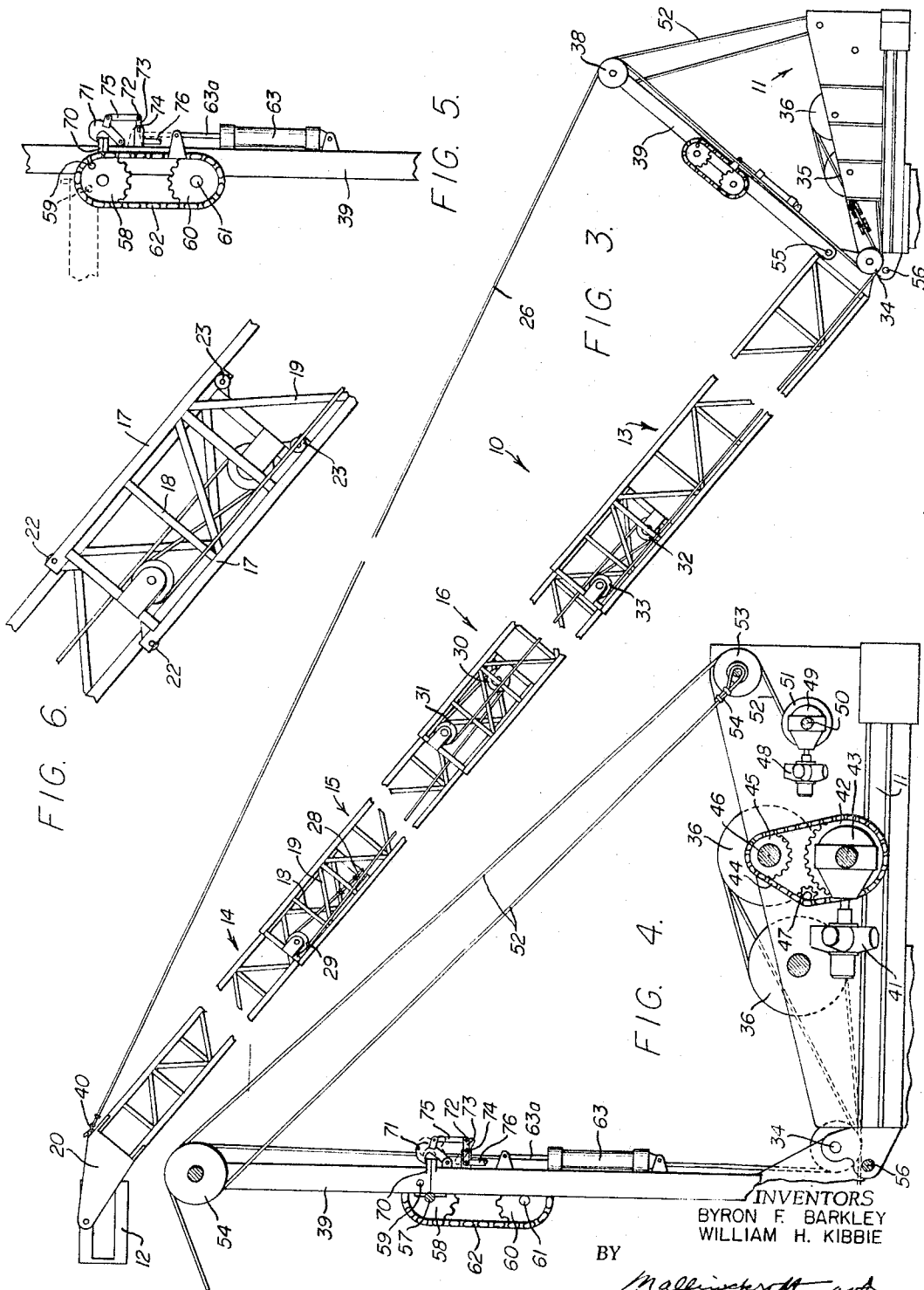
March 14, 1967

B. F. BARKLEY ET AL
EXTENSIBLE BOOM CRANE

3,308,967

Filed Oct. 6, 1965

2 Sheets-Sheet 2



INVENTORS
BYRON F. BARKLEY
WILLIAM H. KIBBIE

BY

*Mallinckrodt and
Mallinckrodt*
ATTORNEYS

1

3,308,967

EXTENSIBLE BOOM CRANE

Byron F. Barkley and William H. Kibbie, both of 717 South 4th West St., Salt Lake City, Utah 84102

Filed Oct. 6, 1965, Ser. No. 493,450

9 Claims. (Cl. 212-55)

This invention relates to cranes and other structures provided with extensible booms, and is particularly concerned with those utilizing cable rigging for extending and retracting the boom.

It has long been common practice to pivotally mount the boom of a crane so that it can be raised and lowered to different heights and swung around to different positions and to utilize the cable rigging or tackle of the crane to help support the boom in its various cantilevered positions. Such booms have also been made extensible and retractable for varying their lengths. Booms of this type are shown, for example in U.S. Patent No. 2,819,803, granted Jan. 14, 1958, U.S. Patent No. 3,029,954, granted Apr. 17, 1962, U.S. Patent No. 2,999,600, granted Sept. 12, 1961, and U.S. Patent No. 3,194,413 granted July 13, 1965. The latter two patents are also concerned with automatically maintaining constant boom angles during extension and retraction of the boom. U.S. Patent No. 2,999,600 does so by means of a special cable rigging in combination with a hydraulic piston and cylinder boom-extending mechanism, and U.S. Patent No. 3,194,413 utilizes both a cable rigging to extend and retract the boom and separate pennant lines to maintain the boom angle constant.

In accordance with the present invention, a single cable rigging functions both to maintain the boom angle constant and to extend the boom. Any desired number of sections can be employed for the boom and, if desired or found necessary from a safety standpoint, the single cable rigging may be employed in multiple.

It is an object of the present invention to provide a simplified extensible and adjustable boom suitable for mounting on a road vehicle and made up of any desired number of sections that can be extended and retracted to lengthen or shorten the boom without changing the angle with the horizontal at which it has been initially set.

In accomplishing the foregoing objects, we employ as a principal feature of the invention extensible boom sections rigged with at least one length of cable that passes around drive wheels at the pivoted large or base end of the boom to provide both the means for changing the boom length and an overhead support cable. A normally upright support or mast, pivotally connected to the large end of the boom, holds the overhead cable in position and prevents the free end of the boom being raised from its aimed path as it is extended.

The normally upright support is specially constructed to be folded, so that the overall height of the boom and a vehicle on which it is mounted does not exceed the clearance limits imposed on highway vehicles by overpasses and other such obstacles.

There is shown in the accompanying drawings a specific embodiment of the invention representing what is presently regarded as the best mode of carrying out the generic concepts of the invention in actual practice. From the detailed description of this presently preferred form of the invention, other more specific objects and features will become apparent.

In the drawings:

FIG. 1 is a top plan view of an extensible boom crane conforming to the invention and shown in its retracted condition mounted on a truck, which is shown fragmentarily;

2

FIG. 2, a side elevation;

FIG. 3, a side elevation of the boom in its extended condition intermediate portions being broken out for convenience of illustration;

FIG. 4, an enlarged vertical section taken on the line 4-4 of FIG. 1;

FIG. 5, a similarly enlarged side elevation of the operating mechanism enclosed within the line 5-5 of FIG. 2;

FIG. 6, a more enlarged, fragmentary, side elevation showing a typical extensible construction of a boom having sections equipped with roller wheels;

FIG. 7, a similarly enlarged, fragmentary, side view showing a bridle-type of equalizing attachment for the rigging to the extensible end of the boom; and

FIG. 8 is a top plan of the bridle construction shown in FIG. 7.

Referring now to the drawings:

In the illustrated preferred embodiment, the boom 10 of the invention is pivotally mounted on supporting base 11. The base can be mounted on a truck or other vehicle, shown fragmentarily at 9. A personnel carrier basket 12 is shown pivotally suspended from the free end of boom 10, but it should be obvious that the boom can also be equipped with a hoisting cable and used as a crane and may also be used for many other purposes.

The boom 10 is made up of a plurality of elongate boom sections interfitted for longitudinal extension and retraction to lengthen and shorten the boom. These sections are shown as base section 13, a tip section 14, and intermediate sections 15 and 16. More or fewer intermediate sections can be employed, as desired. Naturally, however, the total extended length of the boom must be governed by good engineering design principles, taking into consideration such factors as the weights of the boom sections, the load carried, the weight of the supporting base and the weight of the truck or other mounting, and the manner in which the boom is constructed. Although the sections are shown to be interfitted to one another in a telescoping fashion, it will be apparent that the sections can be of different configurations and can be interfitted in other manners. For example, the sections can be interfitted one on top of the other as in a common extensible ladder construction. As illustrated, the presently preferred construction of each section of the boom is of box-column construction, having four parallel structural steel angles 17, FIG. 6, as corners, interconnected by straight and diagonal bracing bars 18 and 19, respectively.

The intermediate boom sections 15 and 16 are dimensioned so that section 15 will easily telescope into section 16, and so that section 16 will easily telescope into the non-extensible base section 13. The tip section 14, which has an end extension 20 adapted to support the swinging personnel carrier basket 12, is dimensioned to freely telescope into the next lower intermediate section 15.

To reduce friction, it is desirable that rollers 22, FIG. 6, be provided as bearings at the four corners of the upper end of each boom section that receives another section, so that the received section can slide freely on the bearing surfaces provided. Similarly, rollers 23 are desirably provided at the lower end of each extensible section that is received by another, such that the rollers will act as bearings to roll freely on the inside surfaces of the receiving section.

The boom is extended by a pair of riggings, each including only a single cable, see cables 26 and 27, FIG. 1. One cable alone could accomplish the extension; however, for safety purposes, it is preferred that the two cables be used, with the cables arranged at opposite sides of the boom to insure an even pulling action. Alterna-

tively, the cables can be arranged at the top and bottom of the boom, or at any other convenient location.

As is best seen in FIG. 3, cables 26 and 27 are each anchored at one end to the telescoping end of the tip section 14 of the boom by a cable clamp 28. The cables pass between the bracings of the tip section and the intermediate section 15, around respective pulleys 29 at the upper end of such intermediate section and between that section and the intermediate section 16 to respective pulleys 30 at the telescoping end of section 15. After passing around the pulleys 30, the cables pass between the bracings of sections 15 and 16 and around respective pulleys 31 at the upper end of section 16. The cables then pass between section 16 and base section 13 to respective pulleys 32 at the telescoping or received end of section 16. After passing around the respective pulleys 32, the cables pass between the bracings of section 16 and the base section and around respective pulleys 33 at the upper end of the base section. From there they pass to and beneath respective guide pulleys 34 carried by the supporting base 11, wrap tightly around respective drive wheels 35 and 36 enough times to provide effective friction for proper operation, pass around respective sets of guide pulleys 37, FIG. 1, pass up to and over respective pulleys 38 carried by a normally upright gantry mast 39, and are anchored to the tip section, as by means of cable clamps 40, FIGS. 1 and 2, or more preferably, by an equalizing bridle construction as shown in FIGS. 7 and 8. The bridle construction illustrated has a bridle plate 40-1, pivotally mounted on clevis 40-2 that is fixed to extension 20. The cables 26 and 27 are attached to the bridle plate by turnbuckles 40-3. Stop 40-4, FIG. 8, is provided to limit the movement of bridle plate 40-1. Differences in the lengths of cables 26 and 27 are compensated by pivoting movement of the bridle plates. The final reaches of cables 26 and 27 provide overhead support for the boom.

It is also possible to employ a single cable for double rigging of the boom. In this arrangement a pulley, not shown, is installed in place of the cable clamps 40 or the bridle construction of FIGS. 7 and 8, and the cable is passed therearound. Other attachment devices such as swedge fittings, poured cable sockets, etc. can also be used.

Drive wheels 36 are powered and located as they are, intermediate the lengths of cables 26 and 27, respectively, serve to simultaneously reel in and pay out the reaches of the cables. Counterclockwise rotation of the drive wheels will extend the boom whereas clockwise rotation will shorten the overhead support reaches of the cables to assist the weight of the sections in retracting the boom. Cable payed out by the drive wheels will be taken up within the boom between the pulleys, as they separate, in the manner indicated in FIG. 2.

Although the drive wheels 36 can be powered in any conventional manner, or the drive wheels 35 can be powered instead, the arrangement shown in FIGS. 1 and 4 has proven satisfactory. As illustrated, a conventional hydraulic motor 41, drives a sprocket 42, and through universal gearing in housing 43 and the chain 44 a drive sprocket 45 mounted to an axle shaft 46 to which the drive wheels 36 are fixed. An idler sprocket 47 maintains the necessary tension in chain 44.

For the purpose of raising and lowering the boom 10, another hydraulic motor 48, FIGS. 1 and 4, carried by the base 11 is arranged to act through a gear box 49 to drive a shaft 50 carrying a pair of drums 51. Cables 52 each have one end fixed to a drum 51 and are then passed around a pulley 53 mounted on the base and a pulley 54 carried by the upper end of normally upright gantry mast 39 before being anchored with cable clamps to the axis of pulleys 53.

Counterclockwise rotation of shaft 50 and drums 51 takes up the cables 50 to rotate normally upright gantry mast 39 clockwise around its pivot connections

55, FIG. 3, with the base section 13 of the boom 10, and, since rigging cables 26 are taut, this raises the boom about its pivot connection 56 with the supporting base 11. In the same manner, clockwise rotation of shaft 50 and drums 51 releases the cables 52, so that the weight of the boom will cause it to lower about pivot connection 56.

It would normally be expected that, as the boom is extended and the overhead support leg of the cable and the length of the cable leg extending the boom become more nearly equal, the free end of the boom will be raised, thus changing the angle of the boom with respect to the horizontal. However, as the boom is extended, it is maintained at the same angle with the horizontal at which it was originally set because normally upright gantry mast 39 is pivotally connected at 55 to base section 13 of the boom. Thus, as the lengths of the opposite reaches of each rigging cable approach each other, pivot connection 55 acts as an elbow to change the length of the cable between pulleys 38 and clamp 40 as required to take up slack developed by retraction of the boom and to provide slack as the boom is extended, all without changing the angle of the boom.

With the present invention it is a simple matter to retract the boom from a one-hundred and fifty foot length, for example, to a length of as little as forty feet. This is very important, especially when it is desired to transport the boom over public highways and through narrow city streets. Moreover, the overall height of the equipment can also be easily reduced for travel purposes. Thus, normally upright gantry mast 39 is preferably constructed of upper and lower sections hinged together at 57. Sprockets 58 are mounted for rotation about the axis of the hinge 57 at opposite sides of the sections and are fixed eccentrically to the upper section by respective pins 59. Additional sprockets 60 at opposite sides of the lower section are mounted for rotation about respective axes 61 carried by the lower section, and a sprocket chain 62 is passed around each set of sprockets 58 and 60.

A hydraulic cylinder 63 is fixed to each of the opposite sides of the lower support and has the end of its rod 63a fixed to an ear 62a carried by the chain at that side. Expulsion of the rods 63a drives the chains to pivot the upper section of the normally upright gantry mast 39 about the hinge connection 57 to its lowered position, whereas retraction of the rods will pivot the upper section to the full line, or raised position, whereat the gantry mast sections are abutted, end-to-end. In FIG. 5 the upper section of normally upright gantry mast 39 is shown in phantom in a position intermediate its fully lowered and fully raised positions. After the upper section has been moved to its lowered position, the entire normally upright gantry mast 39 can be rotated about its pivot connection 55 until it rests on the friction wheels 36 and the entire assembly has a low profile suitable for highway and city street travel.

Normally upright gantry mast 39 is held in position by the opposing forces exerted upon it by the overhead support leg of the cables 26 and 27 on one side and cable 52 on the opposite side.

In order to insure that the upper and lower sections of normally upright gantry mast 39 can be rigidly locked when the support is in use, a locking device as shown in FIGS. 4 and 5 is provided. Mating flanges 70 are attached to the upper and lower sections of normally upright gantry mast 39 and a hook 71 is adapted to maintain the flanges 70 in an abutting, locked relationship when engaged. Pivotally mounted actuating lever 72 is mounted on brackets 73, by pivot pin 74. Connecting rod 75 connects hook 71 and lever 72, in such a manner that the hook 71 will be in an unlocked position when lever 72 is pivoted clockwise. Operating rod 76 which is attached to lever 72 can either be manually or automatically operated by any suitable means to actuate the

locking mechanism. For example, the operating rod can be connected to piston rod 63a to automatically unlock and fold normally upright gantry mast 39 in one operation.

Pressure fluid for the hydraulic motors 41 and 43 and for the hydraulic cylinders 63 is supplied from a hydraulic reservoir through the usual pump and control valve system carried by the base, but not illustrated.

Whereas there is here illustrated and specifically described a certain preferred construction of apparatus which is presented regarded as the best mode of carrying out the invention, it should be understood that various changes may be made and other constructions adopted without departing from the inventive subject matter particularly pointed out and claimed herebelow.

We claim:

1. An extensible boom crane comprising in combination:

a supporting base;

an extensible boom pivotally mounted on said base so that it can be raised and lowered, said boom having a plurality of boom sections interfitted for longitudinal extension and retraction to lengthen and shorten the boom, with the section extensible the greatest distance from the supporting base comprising a tip section and a section connected to the supporting base comprising a base section;

means for raising and lowering the boom and for holding it at any given angular relationship with the horizontal during use;

a normally upright gantry mast pivoted to the boom adjacent to said base;

at least one drive wheel mounted on said base;

rigging for extending and retracting said boom without altering its said angular relationship with the horizontal, said rigging including at least one system of pulleys secured to the respective boom sections and a single cable for each said system of pulleys, the pulleys of each said system being arranged and its cable being wrapped around them to extend the boom sections when the cable is pulled and to permit the boom sections to retract when the cable is payed out, said cable having one of its ends anchored to the non-received end of the tip section, its other end anchored adjacent to an upper portion of said tip section, and, intermediate its said ends, being wrapped around said drive wheel and passed over said upright gantry mast;

and means for rotating said drive wheel.

2. An extensible boom crane according to claim 1, wherein the rigging further includes a pulley attached to the supporting base adjacent the extensible boom.

3. An extensible boom crane according to claim 1, further including at least one intermediate section between the base section and the tip section, and wherein the system of pulleys includes

a pulley mounted on the supporting base adjacent to the extensible boom;

a pulley attached to the free end of the base section;

a pulley attached to each end of each intermediate section, the cable passing sequentially around the pulleys attached to the intermediate sections and then around the pulley attached to base section.

4. An extensible boom crane according to claim 3, wherein the means for raising and lowering the boom com-

prises a first pulley attached to the normally upright gantry mast; a second pulley attached to the supporting base; a winch; a winch cable having one end attached to the winch and its opposite end anchored at a point adjacent the axis of said second pulley, said cable being passed around said first and second pulleys intermediate its ends.

5. An extensible boom crane according to claim 1, wherein the normally upright gantry mast comprises upper and lower elongate support sections, a hinge for joining said sections, at least one sprocket journaled about said hinge, said sprocket being eccentrically attached to the upper support section, at least one other sprocket rotatably carried by said lower elongate support section, a chain passing around said sprockets; and a hydraulic cylinder attached to said lower support section, the rod of said cylinder being attached to said chain, whereby actuation of said hydraulic cylinder drives said chain to rotate said at least one first sprocket to swing said upper section into folded relationship with the lower section.

6. A foldable mast comprising; upper and lower elongate support sections; a hinge interconnecting said sections in end-to-end relationship; at least one sprocket journaled about the pivot axis of said hinge, said sprocket being eccentrically attached to the upper support section; an axis carried by the lower support section; at least one other sprocket journaled on said axis; at least one chain passing around said sprockets; and a hydraulic cylinder attached to said lower support section and said at least one chain, whereby said upper section can be folded upon said lower section by actuating said cylinder.

7. A foldable mast according to claim 6, including two sprockets journaled on the pivot axis of the hinge, one each on opposite sides of the support sections; two sprockets journaled on the axis carried by the lower support section, one each on the opposite sides of the said section; two chains, one passing around each pair of sprockets on the same side of the lower support section; and means connecting the cylinder to drive both said chains.

8. A foldable mast according to claim 6, further including means for locking said upper and lower elongate support sections in their end-to-end abutting position.

9. A foldable mast according to claim 6, further comprising:

flanges at the abutting edges of said upper and lower support sections;

and a locking mechanism for said mast comprising a hook adapted to maintain said flanges in abutting locked relationship, when engaged, a pivotally mounted actuated lever; a connector rod connecting said lock and said lever; and an operating rod, connected to said lever and slidably mounted on said lower support section whereby said lever can be actuated to either lock or unlock said mast sections.

References Cited by the Examiner

UNITED STATES PATENTS

2,521,861	9/1950	Mathias	212-144
2,819,803	1/1958	Obenchain	212-55
2,999,600	9/1961	Gates	212-55
3,029,954	4/1962	Grant	212-55
3,194,413	7/1965	Landry	212-55

ANDRES H. NIELSEN, *Primary Examiner*.