United States Patent

Sterner

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[54] **PIVOT STRUCTURE FOR CANTILEVERED CRANE BOOM**

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[52] **U.S. Cl.** **287/100**, 308/22, 212/70

[51] **Int. Cl.**.....**F16c 11/00**

[58] **Field of Search**....248/291; 212/70; 308/2 R, 15, 308/22, 28; 52/116, 117, 118, 119, 120; 287/100

[56] **References Cited**

UNITED STATES PATENTS

331,497	12/1885	Hardie	308/28 X
843,591	2/1907	Edwards	308/28 X
1,204,094	11/1916	Waits	308/15 UX
1,423,376	7/1922	Watts	212/70
2,679,910	6/1954	Moore	52/116

FOREIGN PATENTS OR APPLICATIONS

24,991	11/1912	Great Britain	212/70

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[57] **ABSTRACT**

The boom support of a mobile crane features a pivot structure which is capable of withstanding the heavy impact forces transmitted through the cantilevered boom. The improved pivot structure embodies journal blocks secured to side plates of the boom support and separable journal caps mountable upon the blocks when the main pivot shaft of the boom is in place. The heavy forces at the pivot tending to pull the journal blocks from the boom support are resisted by long tension bolts whose inherent elasticity is utilized to absorb shock loads. The tension bolts are anchored to the side plates of the boom support by anchor blocks which are in turn secured by sturdy shear bolts.

10 Claims, 3 Drawing Figures

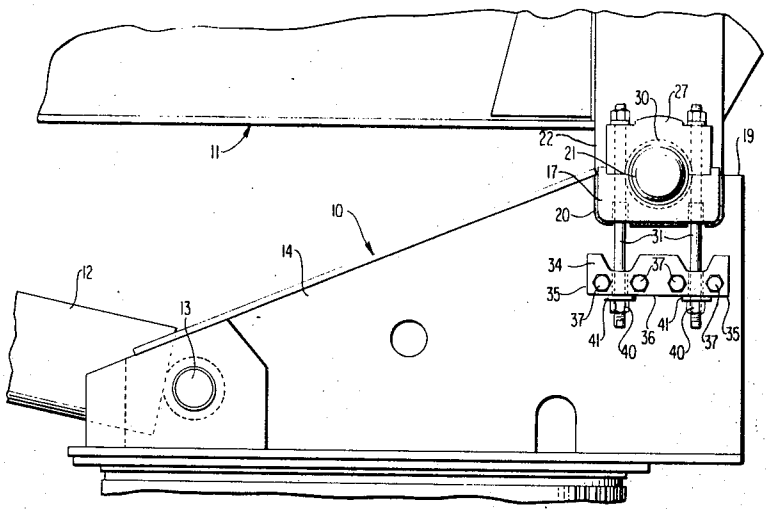


FIG. 1

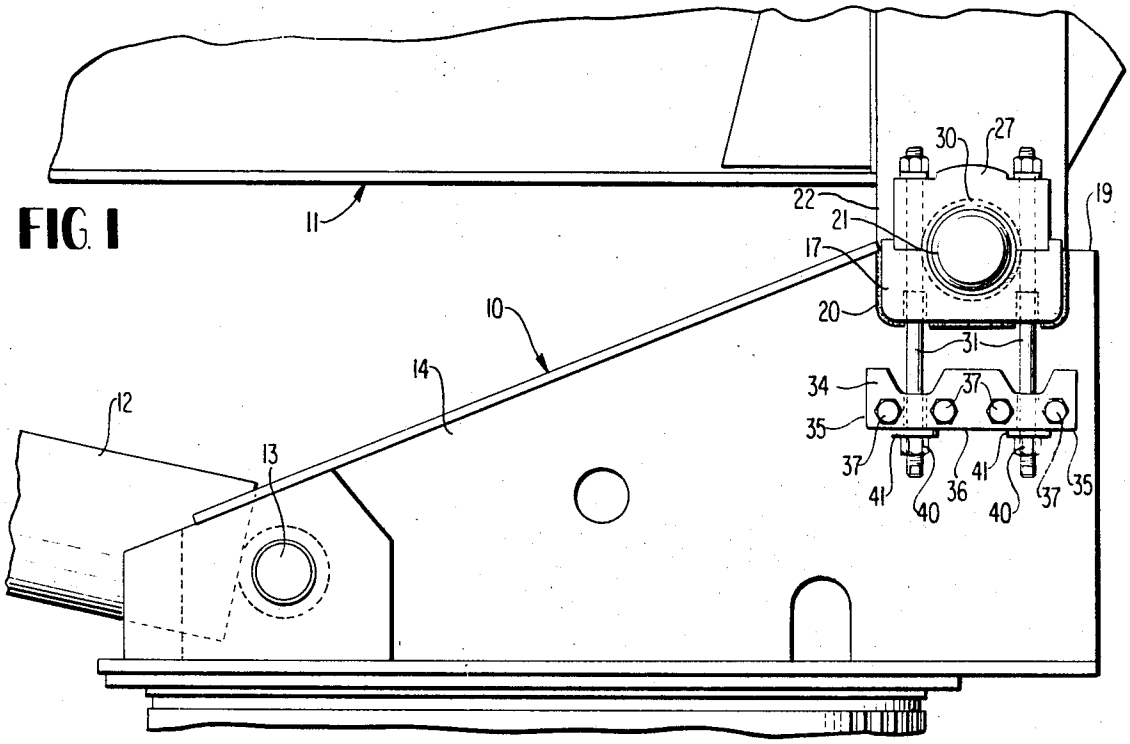


FIG. 2

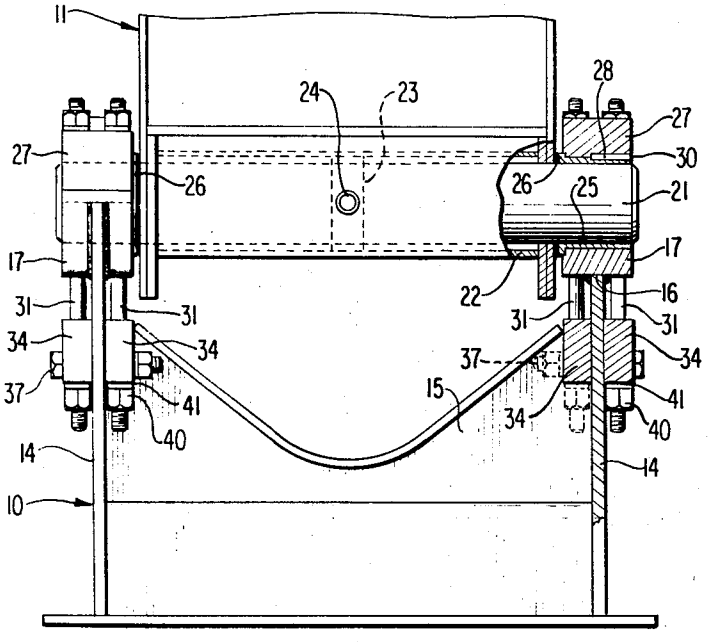
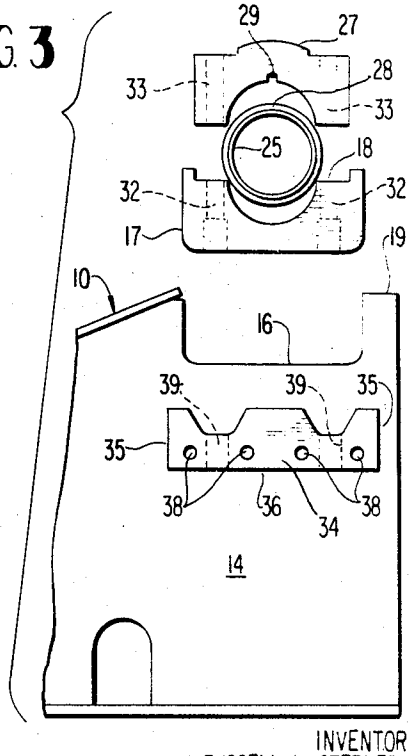


FIG. 3



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PIVOT STRUCTURE FOR CANTILEVERED CRANE BOOM

BACKGROUND OF THE INVENTION

In the prior art it has been customary to form the main pivot for a cantilevered crane boom in a simple manner which involves forming aligned openings through the space side plates of the turntable mounted boom support on the crane carrier. The openings in these side plates receive journal bushings therein, which in turn receive and support the main pivot shaft for the crane boom. The ends of the main pivot shaft carry heavy removable discs or washers which serve as end thrust bearings to keep the boom structure properly centered laterally.

With the ever increasing size and lifting capacity of mobile cranes and crane booms the conventional main pivot structure has proved to be inadequate and not sufficiently strong, particularly when subjected to impact loads or pulsating loads, as where a heavy bucket of concrete at the tip of the boom is suddenly emptied. Under such conditions of loading the boom tends to fulcrum around its connections with the main lift cylinders and the base of the boom tends to lift or tear the pivot journal structure from the boom support. The aforementioned journal bushings are merely welded to the side plates of the support and the welds are not strong enough to resist the extremely heavy forces involved. Another limiting factor is the thickness of the metal in the side plates which have the openings forming the ultimate support for the journal bushings. There simply is insufficient metal supporting the journal bushings to safely resist the forces involved. Because of weight factors and considerations of economy it is not practical to continually increase the thickness of the side plates on the boom support and in any case welding of the bushings to the side plates without other securing means is not adequate to resist the heavy forces transmitted through the boom pivot.

The main object of this invention is to cope with the above problem in cantilevered crane booms by providing a new form of main pivot for the boom, and in so doing not only greatly increasing the strength and durability of the pivot and journal means but also rendering it much more simplified and practical to remove the crane boom from its carrier for shipment in certain cases where this is required. In larger cranes, the boom pivot shaft may weigh up to 600 Lbs. and such a shaft cannot as a practical matter be slid axially from its bearings or journals. With the invention arrangement the journal caps may be removed and the pivot shaft may be lifted bodily from the journal blocks on the boom support while assembled with the boom.

Additionally when the invention is used welding is not relied upon for anchoring the journals to the vertical side plates of the boom support. Instead the main forces involved are resisted by a plurality of tension bolts whose lengths are sufficient to take advantage of a rather high degree of elasticity in the bolts so that shock loads and pulsating loads can be coped with. Welding is utilized in the improved structure merely for locating the journal blocks on the side plates of the boom support and for resisting relatively light horizontal forces.

Other features and advantages of the invention will be apparent during the course of the following detailed description.

BRIEF DESCRIPTION OF DRAWING FIGURES

FIG. 1 is a fragmentary side elevation of a crane boom support and main pivot structure.

FIG. 2 is a fragmentary vertical section taken through one journal of the main pivot structure, the remainder of the structure being in elevation.

FIG. 3 is a fragmentary exploded side elevational view of the pivot structure and associated elements.

DETAILED DESCRIPTION

Referring to the drawings in detail wherein like numerals designate like parts, the numeral **10** designates generally the turntable mounted support for an extensible cantilevered boom **11** of a mobile crane. The base end of the boom **11** is pivoted to the support **10** by a main pivot structure forming the subject matter of the invention. The boom **11** is raised and lowered on the axis of the main pivot by the usual lift cylinder **12** having its rear end securely pivoted at **13** to the support **10** as shown in FIG. **1**. The forward end of the lift cylinder unit **12** is attached to the boom at a suitable point thereon.

The boom support **10** includes a pair of laterally spaced vertical side plates **14** both secured to the turntable of the crane carrier. The side plates **14** are braced by a transverse web **15** welded thereto or by other similar means. The top edges of the side plates **14** are cut or notched as best shown in FIG. **3** to provide generally rectangular notches **16** therein and seated within these notches are relatively thick journal blocks **17** whose top faces **18** are substantially flush with the upper edges **19** of the side plates **14**, FIG. **1**. Each journal block **17** is welded substantially entirely around the margin of the notch **16** on both sides of the plate **14**, and such welding is indicated in FIG. **1** by the numeral **20**. While these welds are quite strong they are not relied upon to resist the main forces transmitted by the boom **11** which actually tend to tear the journal blocks **17** upwardly from their mountings on the side plates **14**. Instead the welding **20** is only relied upon to resist the relatively light horizontal forces transmitted axially of the boom main pivot shaft **21**.

As shown, the main pivot shaft **21** extends transversely of the boom **11** at its base end and on its under side. The pivot shaft **21** is received through the interior of a box extension **22** formed on the base of the boom. An interior anchor block **23** welded within the box extension **22** at the transverse center of the boom is apertured to receive a transverse locking pin **24** which also engages through registering openings in the shaft **21** and box extension **22**, thus securely locking the pivot shaft **21** against rotation and axial movement relative to the boom. The opposite end portions of the pivot shaft **21** project outwardly of the sides of the boom **11**, FIG. **2**, to be received within the seats of journal blocks **17** as shown.

The end portions of the shaft **21** receive thereover cylindrical bushings **25** preferably formed of bronze and each having an interior end flange **26** to serve as a thrust bearing between the adjacent side of the boom and the journal structures. Thus the bushings serve the dual function of supporting the pivot shaft ends for easy rotation and maintaining the boom **11** properly spaced and centered between the shaft journals.

Steel journal caps 27 are provided and rest upon the top faces 18 of the journal blocks 17 in assembly. The bushings 25 have flats 28 formed on their peripheries at any desired circumferential location and the journal caps 27 have keyways 29 formed therein so that a single key 30 may be utilized on each journal to prevent rotation of the bushing 25 relative to the block 17 and cap 27. This assures turning of the pivot shaft 21 within the bushings 25 rather than with the bushings.

A very important feature of the invention resides in the provision of long vertical tension bolts 31 arranged in spaced pairs on opposite sides of each plate 14 and extending vertically in parallel relation through aligned openings 32 and 33 of the journal blocks 17 and caps 27 respectively. Long tension bolts are employed for the important purpose of utilizing their increased elasticity, which is a function of the amount of metal in each bolt, and for a given diameter bolt is a function of its length. The principle involved corresponds to the principle of using a very long tow rope for towing a heavy barge behind a tug boat. A short tow line will snap readily because of limited material and limited elasticity. A longer tow line of the same diameter will stretch to a much greater extent and therefore will resist much greater loads. In practice the long tension bolts 31 are steel bolts which may be approximately 28 inches long and 1½ inches in diameter. Four such bolts are employed for each journal assembly associated with each side plate 14.

The bolts 31 are tensioned in the following manner. A pair of anchor blocks or plates 34 is mounted on each side plate 14 in straddling relation thereto, FIG. 2, substantially downwardly from the journal block 17. Each block or plate 34 may be welded to the adjacent face of the side plate 14 by interrupted welds 35 and 36, FIG. 1. These welds are conveniently employed to locate the elements 34 on the side plates 14 but are not relied upon to resist heavy forces and are not actually required and could be omitted in some cases. Each pair of anchor blocks 34 is securely tied structurally to the side plate 14 by preferably four horizontal shear bolts 37 disposed at right angles to the tension bolts 31 and arranged in pairs, which straddle the bolts 31 as shown in FIG. 1. The anchor blocks 34 and the side plates 14 have registering openings 38 which receive the shear bolts 37. The blocks 34 also have vertical openings 39 to receive the tension bolts 31 therethrough. Nuts 40 and flat washers 41 are preferably applied to the lower ends of the tension bolts 31 and the washers engage the bottom faces of the anchor blocks 34 in the places where the welds 35 and 36 are interrupted as shown in FIG. 1. The nuts 40 are adjustable to produce the desired tension in the bolts 31. In practice with some cranes the shear bolts 37 may be approximately 1¼ inches in diameter. While illustrative bolt sizes have been specified in the application it should be understood that these sizes will vary somewhat depending upon the size and lifting capacity of the particular crane. However in all cases the tension bolts 31 will be long to take advantage of the elasticity factor and the shear bolts 37 will be sufficiently large to assure adequate strength for the main pivot or journal structure.

As previously pointed out the chief purposes behind the invention are to provide a pivot or journal structure which can resist the extreme forces including pulsating forces that are transmitted to the pivot through the base of the boom 11 tending to pull the entire journal means upwardly from the side plates 14 of the boom support. The long tension bolts 31 are the key elements in successfully resisting these forces. Additionally the construction eliminates reliance on welds to resist the forces involved, and the construction enables the entire boom to be separated from the carrier mounted boom support without difficulty. When this is required it is merely necessary to release and remove the journal caps 27 and lift the boom 11 with the pivot shaft 21 and bushings 25 from the journal blocks 17. This greatly facilitates the shipment of cranes particularly the larger size cranes.

To reassemble the crane the reverse procedure is followed. The pivot shaft 21 will be mounted on the boom 11 and locked in place with the pin 24 and the bushings 25 will be applied to the shaft ends. The anchor blocks 34 will be secured to the side plates 14 and the ends of the pivot shaft 21 with the bushings will be laid into the journal blocks 17. After this the caps 27 are applied with the tension bolts 31 and the latter are brought under proper tension by tightening the nuts 40 and the blocks 34 will strongly resist this tension.

It is believed that the significant advantages of the invention over the prior art will be apparent to those skilled in the art without further elaboration.

The terms and expressions which have been employed herein are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof but it is recognized that various modifications are possible within the scope of the invention claimed.

I claim:

1. In a support structure for a cantilevered crane boom, a pair of laterally spaced upstanding plates forming parts of a turntable mounted crane boom support, a journal block mounted upon each plate and having a shaft seat, a separable journal cap mountable upon each journal block, a main pivot shaft for a cantilevered crane boom secured to the boom near its face and having shaft end portions projecting beyond opposite sides of the boom and engaging within the seats of said journal blocks, anchor means secured to each plate substantially below the journal blocks and projecting beyond the opposite sides of each plate, the journal blocks, journal caps and anchor means having aligned openings formed therethrough substantially vertically on the opposite sides of the upstanding plates, and substantially vertical long tension bolts engaging through said aligned openings on opposite sides of said plates and carrying nuts which are adjustable to regulate the tension of said bolts, the bottom faces of said anchor means being engaged by the tension bolts and the anchor means resisting the tension forces transmitted through said bolts.

2. The structure of claim 1 and said anchor means comprising a pair of separately formed anchor blocks secured to opposite sides of each upstanding plate.

3. The structure of claim 2 and plural substantially horizontal shear bolts extending through each upstanding plate and the anchor blocks on the opposite sides of

each plate and being disposed substantially at right angles to said long tension bolts.

4. The structure of claim 3 and said tension bolts including a laterally spaced pair of tension bolts on opposite sides of each upstanding plate, said plural shear bolts including pairs of shear bolts arranged substantially in a horizontal row near the lower ends of the tension bolts and with the shear bolts of each pair on opposite sides of the tension bolts in straddling relation thereto.

5. The structure of claim 1 and each upstanding plate provided in its upper edge with a notch, each journal block seated within one of said notches and projecting on opposite sides of the upstanding plate and welded to the opposite sides of the plate substantially around the margins of the notch in said plate.

6. The structure of claim 1 and journal bushings engaging telescopically over said shaft end portions and lying between the shaft end portions and said journal blocks and caps.

7. The structure of claim 6 and radial flanges on the interior ends of said bushings and disposed between the sides of the crane boom and the inner sides of the journal blocks and serving as thrust bearings and maintaining the boom centered with respect to the upstanding plates and journal blocks.

8. The structure of claim 7 and a keying means interconnecting each bushing and the adjacent shaft journal and resisting rotation of the bushing relative to the journal and assuring that the shaft end portions will turn within the bushings.

9. The structure of claim 1 and said crane boom including a lower side box projection near its base, the main pivot shaft extending transversely through said box projection and the box projection engaging between the upstanding plates and journal blocks, an interior anchor block within said box projection near the transverse center of the boom, and a locking pin engaging through the box projection, interior anchor block and said main pivot shaft to lock the main pivot shaft to the boom so that it will pivot with the boom and will be held against axial displacement relative to the boom, said pivot shaft, interior anchor block and box projection having registering openings for said locking pin.

10. The structure of claim 4 and said nuts on the long tension bolts being on the lower ends of the tension bolts below the bottom faces of said anchor blocks.

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