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Lamer et al.

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[54] SAFETY CONTROL FOR LOAD LINE

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[52] **U.S. Cl.** .....**212/39 R,** 212/39 B, 212/55, 254/173 B

[51] **Int. Cl.**.....**B66c 13/50,** B66d 3/24

[58] **Field of Search** .....212/39, 39 B, 39 DB, 55; 254/173 B, 173

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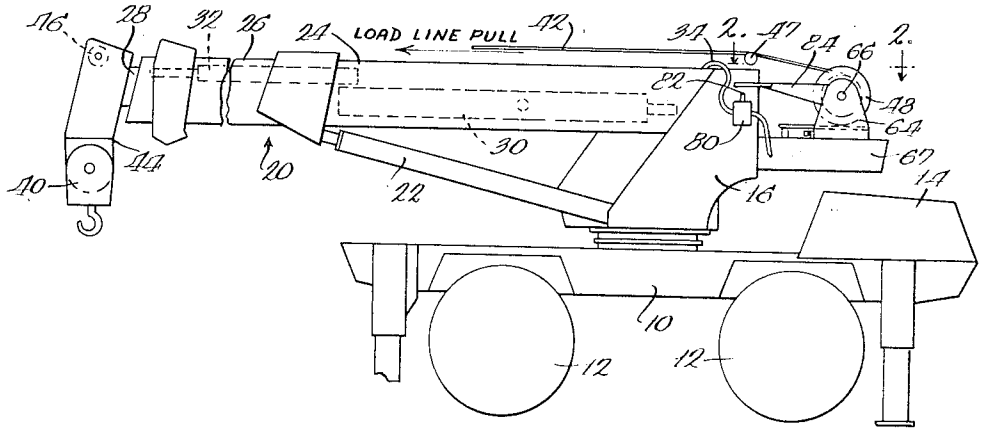
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[57] **ABSTRACT**

A safety control mechanism for a load line forming part of an extensible boom crane which has a plurality of sections moved relative to each other by power means. The cable supports a load supporting member on one of the crane sections and is reeled or unreeled from a driven drum supported adjacent another of the sections. The safety control means incorporates mechanism which will render the power means inoperative when the tension on the cable reaches a certain level. The safety control means consists of a bracket pivotally supporting the drum and pivoted about an axis. The bracket is normally biased to a first position, with the biasing means accommodating movement from the first position after the tensile load exceeds a lower level to actuate control means, forming part of the power means, to render the power means inoperative when the tensile load on the cable exceeds a desired maximum level.

2 Claims, 3 Drawing Figures



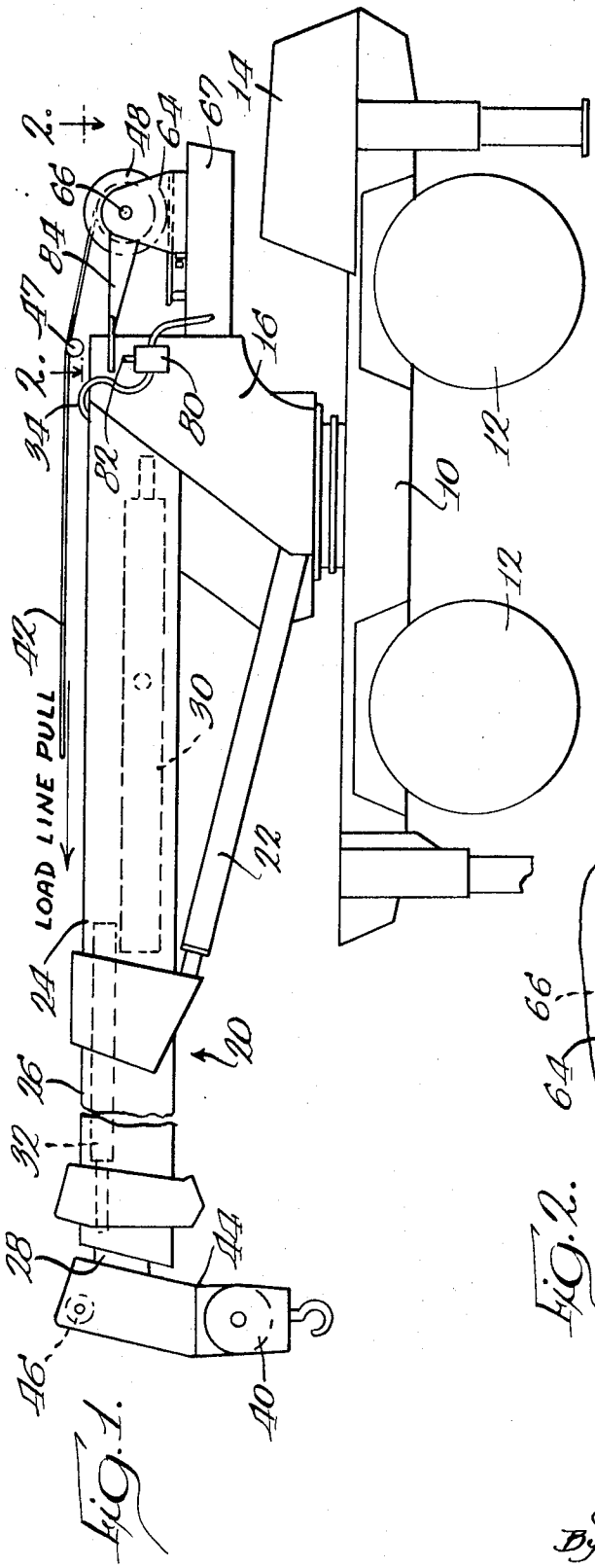


Fig. 1.

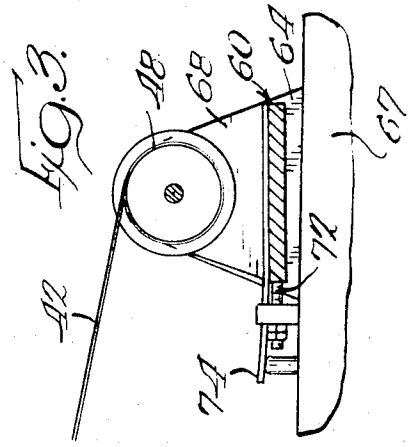


Fig. 3.

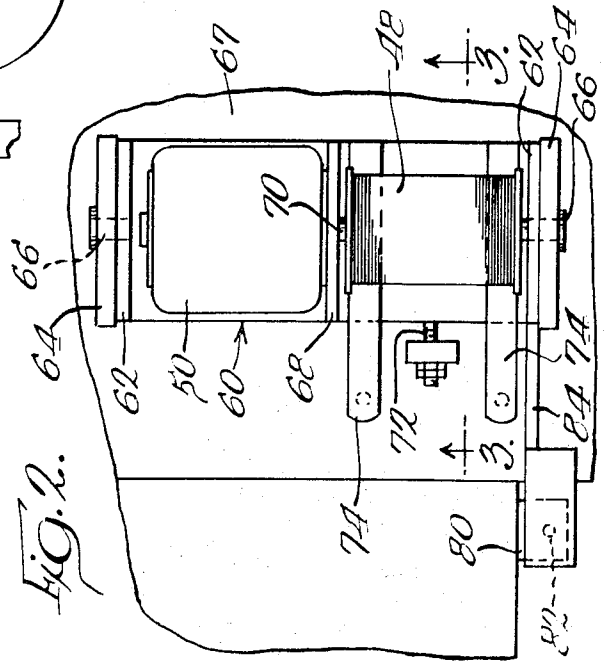


Fig. 2.

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SAFETY CONTROL FOR LOAD LINE

BACKGROUND OF THE INVENTION

The present invention relates generally to mobile hoisting equipment and, more particularly, to overload safety control mechanism for extensible crane sections and the like.

Present day heavy duty cranes generally consist of a plurality of crane sections defining an extensible boom which has a load supporting block movably supported on the outer free end of the boom. The load supporting block is normally raised and lowered relative to the free end of the boom by a winch drum supported adjacent the innermost boom section and entrained over a pulley rotatable on the outer end of the boom. The crane assembly is generally supported on a self-propelled vehicle by a rotating base section for the crane.

Various proposals have been made for controlling the maximum load which may be supported on the cantilevered boom as well as cooperating control mechanisms to prevent the extension of the boom sections and the angular position of the boom beyond predetermined limits while a load is supported on the block, which would tend to tip the vehicle. While these safety controls have been effectively incorporated into mobile cranes to prevent damage to the vehicle or the crane, one area which has not received any attention is prevention of the cable from being fractured while the boom is being extended.

The extension and retraction of the boom sections is presently, generally, being accomplished through the use of fluid rams with hydraulic fluid delivered from a source to opposite ends of the rams. Generally, such extension and retraction occurs when no load is being supported by the load supporting member. One of the problems which has arisen in connection with the use of hydraulic motors for extension and retraction of the boom sections is that it becomes necessary for the operator to at all times be cognizant of the position of the load supporting member relative to the crane to prevent snapping of the cable. Thus, it is necessary for the operator to devote his entire attention to the extension of the boom sections when such need arises.

SUMMARY OF THE INVENTION

The present invention contemplates a safety control means for a crane having a plurality of boom sections and power means to extend and retract the sections relative to each other and, in which a load supporting member is movable relative to the outer end of the outer boom section through a cable having one end connected to a driven reel supported adjacent the inner end of the boom. The safety control means corporates with the driven reel and the power means for the crane section to render the power means inoperative when the tension on the cable reaches a predetermined level.

More specifically, the present invention contemplates a drive means for the cable in the form of a powered winch or reel which is rotated in opposite directions to raise and lower the load supporting member or block with the safety control means including mechanism for movably supporting the reel and biasing means normally urging the mechanism to a first position. The mechanism includes a bracket supporting the cable drum for rotation about a pivoted axis with the bracket in turn being pivoted about an axis on a support member and urged to a first position by a spring. Thus, as the tension on the cable increases, the bracket is pivoted from the first position and upon reaching a second position, renders the power means inoperative. The means for rendering the power means inoperative includes a normally open valve located in a conduit leading from a fluid pressured source to fluid rams with an actuating member carried by the bracket to close the valve when the bracket is moved to the second position.

With the present arrangement, the spring biased bracket acts as sensing means for determining the load or tension on the cable and the valve is operated by the sensing means to render the power means inoperative when the load or tension reaches a predetermined level.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF DRAWINGS

FIG. 1 is a side elevation view of a vehicle mounted crane, having the invention incorporated therein;

FIG. 2 is a fragmentary plan view taken generally along line 2—2 of FIG. 1; and

FIG. 3 is a vertical sectional view taken along line 3—3 of FIG. 2.

DETAILED DESCRIPTION

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail one specific embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated.

The safety control means of the present invention is illustrated as embodied in a self-propelled crane having a frame or chassis 10 supported on wheels 12 (FIG. 1). A suitable power plant 14 is carried by the frame and may be connected to the wheels to move the frame. The vehicle frame 10 supports a crane consisting of a base section 16 rotatable about the vertical axis on the frame 10. An extensible boom 20 is pivoted adjacent the upper end of the base section 16 to swing about a horizontal axis through extension and retraction of a fluid ram 22 having opposite ends respectively connected to the base section 16 and the crane 20.

The extensible boom 20 consists of a plurality of boom sections 24, 26, and 28 with the section 26 being telescoped within the section 24 and the section 28 being telescoped within section 26. The extension and retraction of the respective boom sections relative to each other is accomplished through first and second rams 30 and 32 with fluid ram 30 being pivotally connected at one end to the boom section 24 and at its opposite end to boom section 28. Likewise, fluid ram 32 is pivotally connected at one end to the intermediate boom section 26 and at the opposite end to the outer boom section 28. Pressured fluid is supplied from a source (not shown) through conduits, one of which is shown at 34, to the respective fluid rams 30 and 32 to cause extension and retraction of the boom sections relative to each other.

The crane further includes a block or load supporting means 40 supported on the outer free end of the outer boom section 28 through a cable 42. The cable 42 has one end connected at 44 to the outer crane section 28 and extends around a pulley within the block 40 and across at least one guide pulley 46 on the outer crane section 28 and a second guide pulley 47 rotated on the inner end of boom section 24. The opposite end of the cable is connected to a driven reel or winching drum 48 which is capable of being rotated in opposite directions through suitable drive means 50. Thus, rotation of the reel 48 in a counterclockwise direction as viewed in FIG. 1 will allow the block 40 to be lowered relative to the outer end of the boom, while clockwise rotation will raise the block or load supporting member relative to the crane boom 20.

An inspection of FIG. 1 reveals that the reel or drum having one end of the cable affixed thereto is essentially fixed relative to the inner boom section 24 while the opposite end of the cable is fixed at 44 to the outer boom section 28. With the load supporting member 40 located in the position shown in FIG. 1, extension of the boom sections relative to each other cannot be accomplished without first unreeling a portion of the cable sufficient to lower the block 40 an amount that will accommodate extension of the boom sections without having the block engage the boom section 28. Thus, if the operator inadvertently fails to unreel the cable 42 and begins extension of the boom sections, the pressure of the fluid received into the rams 30 and 32 will produce sufficient forces to cause the cable to snap. Such an arrangement produces a safety hazard, since the cable may cause injury to the operator as well as damage to the vehicle. Furthermore, if the cable is fractured, it necessitates a considerable shut down period to remove and replace the entire cable.

However, according the present invention, the above problem is alleviated by a simple and inexpensive mechanism which will automatically render the fluid rams or power means inoperative when the tension or load on the cable reaches a predetermined level. The safety control means of the present invention consists of a minimum number of parts which are extremely inexpensive and which cooperate in an effective manner to achieve the intended results. More specifically, the entire mechanism consists of a valve, a bracket and at least one spring. The three elements are arranged in such a manner that the flow of pressured fluid to the rams or power means **30** and **32** is blocked whenever the tension on the cable reaches a desired maximum level. The three elements cooperate to define sensing means for determining the load on the cable and means responsive to said sensing means for rendering the fluid rams inoperative when the load reaches a predetermined maximum level. Referring to the drawings, the sensing means consists of a substantially U-shaped bracket **60** having leg portions **62** pivotally supported on upwardly extending standards **64** through pivot pins **66**. The standards are part of a base **67** extending from the base section **16**. The bracket **60** has an additional leg **68** extending upwardly from the web portion at a location betwen the two legs **62** with the drive means or motor **50** secured to the leg **68**. The drive means has a driven shaft **70** extending through the leg **68** and connected to the drum **48**, which is rotatably supported between one leg **62** and the opposite intermediate leg **68**.

The bracket cooperates with biasing means and a stop to define a first position for the sensing means. For this purpose, an adjustable stop **72** is fixedly secured to the base **67** defining the support means for the uprights **64**. The adjustable stop is located in alignment with the web portion of the bracket **60** and the bracket **60** is biased to a first position, where the bracket engages the stop, by biasing means **74** in the form of a pair of leaf springs.

Thus, the sensing means including the U-shaped bracket **60** and the springs **74**, as well as the stop **72**, cooperate to define a first position for the bracket when the tension on the cable is below a predetermined level. However, once the tension on the cable exceeds this power level, the tangential force developed by the load along the periphery of the drum **48** will cause the bracket to pivot from the first position as a function of the tension or load on the cable. When the tension or load on the cable reaches a desired maximum level, a stop mechanism or means, to be described later, cooperating with the power means, is actuated to render the power means inoperative.

In the illustrated embodiment, the stop mechanism or means includes a normally open valve **80** incorporated in the conduits connecting the power source to the fluid rams or motor means **30** and **32**. An actuating element **82** extends from the valve means **80** and the bracket **60** has an arm **84** extending to a position in alignment with the actuating member **82** so that rotational movement or pivoting of the bracket will cause the free end of the arm to move the actuating member **82** to a second position and close the valve. Closure of the valve, will block the flow of fluid through conduit means **34** and thereby render the fluid rams inoperative.

It will be appreciated that the present invention is a simple, inexpensive and effective way of preventing the snapping of the cable because of the inattention of the operator. This arrangement allows the operator more freedom in performing other functions while he is extending the boom sections relative to each other. In addition, the mechanism includes a minimum number of parts, which can readily be incorporated into existing cranes so that any crane of this general character can readily be converted to include the safety control means.

While the driven reel and the valve have been shown as being supported on the rotatable base, it is readily apparent that these elements could be mounted directly on the inner boom section **24**. It should also be noted that, it may be desirable for the predetermined maximum load on the cable, which will render the power means inoperative, to be greater than the desired maximum load on the block so that the boom sections may, if desired, be extended and retracted while a load is being supported by the block and the cable.

What is claimed is:

1. An implement comprising: a frame; a boom supported on said frame and including a plurality of boom sections; means for adjusting the angular orientation of the boom relative to a horizontal axis on the frame; power means for extending said boom sections relative to each other; load support means on one of said sections; a cable supporting said load support means; a driven reel connected to said cable and operable to move said load support means relative to said one of said sections; means mounting said reel at a fixed location relative to said boom including a bracket supporting said reel for rotation about an axis; sensing means for determining the load on said cable and including mounting means pivotally supporting said bracket for movement about said axis, spring means urging said bracket to a first position and permitting said bracket to pivot about said axis when the load on said cable reaches a predetermined level; and means responsive to pivotal movement of said bracket for rendering said power means inoperative when the load on said cable reaches said predetermined level.

2. An implement as defined in claim 1, in which said power means includes a fluid ram, a fluid source and conduit means connecting said source to said ram and in which said means responsive to pivotal movement of said bracket includes valve means in said conduit means and mounted at a fixed location relative to said bracket, and an actuator carried by said bracket and adapted to operate said valve means upon pivotal movement of said bracket.

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