June 18, 1963 C. W. GALUSKA 3,094,221

BOOM LIMIT SAFETY DEVICE

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Fig. 4

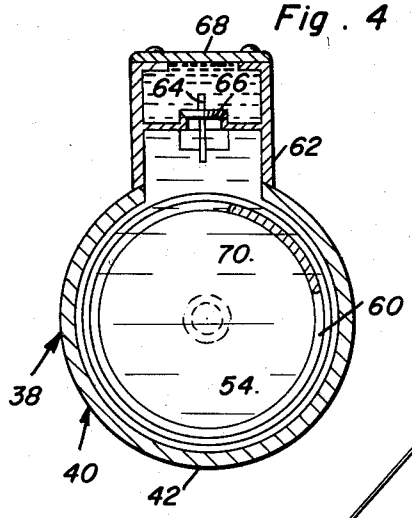


Fig. 1

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Fig . 2

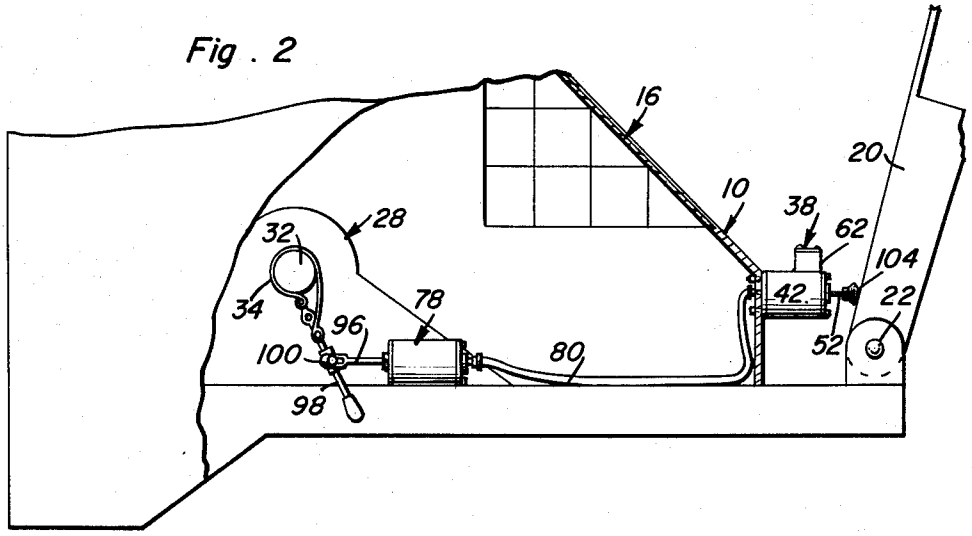


Fig . 5

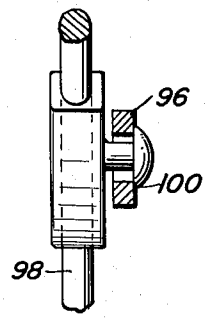
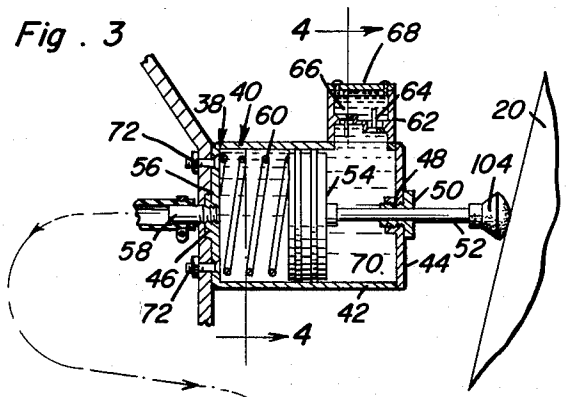
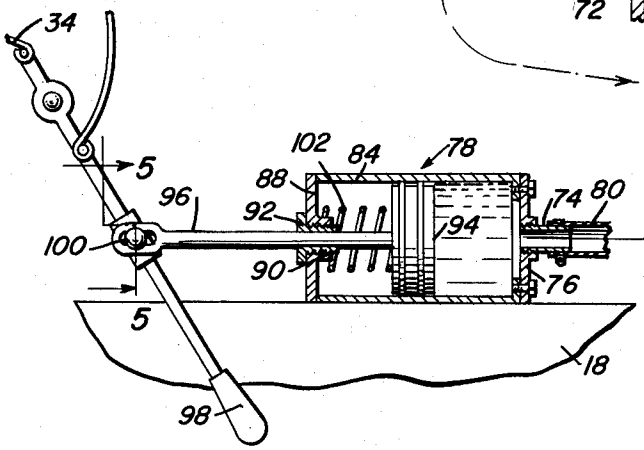


Fig . 3





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BOOM LIMIT SAFETY DEVICE

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4 Claims. (Cl. 212—39)

This invention relates to a novel and useful boom limit safety device and more specifically to a safety device which is adapted to be used on cranes provided with pivoted booms.

Most cranes which are provided with pivoted booms utilize winding drums for raising and lowering the free end of the boom by means of a tension member which is wound about the winding drum and attached to the free end of the boom.

The main object of this invention is to provide a limit stop for the boom of a crane which will be capable of sensing when the boom of a crane approaches a substantially vertical position when being raised in order that means may be provided for preventing the free end of the boom from swinging upwardly past a vertical plane in which the axis of rotation of the boom is contained.

Another object of this invention is to provide a means whereby a clutch mechanism utilized to drivingly connect a prime mover with the winding drum of the crane may be actuated to declutch the winding drum from driving engagement with the prime mover as the boom of the crane reaches its predetermined limit position.

Yet another object of this invention is to provide a boom limit stop which will also be capable of actuating a brake mechanism operatively associated with the winding drum utilized to raise and lower the free end of the boom at the same time the winding drum is declutched from driving engageemnt with the prime mover of the crane.

Another object of this invention is to provide a boom limit safety device which may be readily incorporated into the manufacture of new cranes and which may also be readily adapted to existing cranes.

A final object of this invention to be specifically enumerated herein is to provide a boom limit safety device in accordance with the preceding objects which will conform to conventional forms of manufacture, be of simple construction and automatic in operation so as to provide a device that will be economically feasible, long lasting and is relatively trouble free in operation.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a side elevational view of a crane into which the boom limit safety device of the instant invention has been incorporated;

FIGURE 2 is an enlarged fragmentary side elevational view of the embodiment illustrated in FIGURE 1;

FIGURE 3 is a fragmentary further enlarged side elevational view of the crane shown with the ram and fluid motor of the boom limit safety device in vertical section;

FIGURE 4 is an enlarged transverse vertical sectional view taken substantially upon the plane indicated by section line 4—4 of FIGURE 3; and

FIGURE 5 is an enlarged vertical transverse sectional view taken substantially upon the plane indicated by section line 5—5 of FIGURE 3.

While most crane operators have exceptional skill and aptitude for operating cranes, accidents caused by the free end of the boom of a crane swinging past its vertical position occur with alarming frequency. These accidents are usually caused by instances where the boom of a crane must be raised to almost its maximum elevation. In these instances, it is sometimes difficult for the operator of a crane to know exactly the angle at which the boom is disposed relative to the horizontal support for the boom. While inclined indicators may be utilized to indicate the angle of the boom relative to the horizontal support to which it is secured, at times, a crane, and especially those which are mobile, are disposed on even ground and if the forward end of the horizontal support for the boom is inclined forwardly and upwardly, the inclined indicator for indicating the angular relationship between the boom and the horizontal support does not render an accurate reading with regard to the inclination of the boom relative to the true horizontal. In such an instance, it is possible for even the most experienced crane operator to raise the boom of the crane too high and have the boom fall backwardly over the cab of the crane.

Referring now more specifically to the drawings, the numeral 10 generally designates a crane of conventional design which includes a crawler-type carriage generally referred to by the reference numeral 14 and a cab generally referred to by the reference numeral 16 which is pivotally secured to the crawler-type carriage for movement about a vertical axis.

The cab 16 includes a main horizontal support 18 and one end of an elongated boom 20 is pivotally secured to the horizontal support 18 by means of a pivot connection 22 for rotation about an axis which is horizontal when the ground 24 supporting the crane 10 is itself horizontal.

The cab 16 includes suitable controls 26 for operating the crane 10 and a winding drum assembly 28 is provided. It is to be noted that a prime mover (not shown) is also enclosed within the cab 16 and the prime mover is drivingly connected to the winding drum assembly 28 by means of a clutch mechanism having a movable actuator 30. In addition, the winding drum assembly 28 includes a shaft portion 32 with which a brake assembly 34 is operatively associated and the actuator 30 also comprises an actuator for the brake mechanism or assembly 34.

An elongated flexible tension member 36 has one end wound about the drum of the winding drum assembly 28 and the other end is operatively connected to the upper end of the boom 20.

From FIGURE 1 of the drawings it may be seen that the free end of the boom 20 may be moved between raised and lowered positions about the pivot connection 22 and it may also be observed from FIGURE 1 of the drawings that the boom 20 is disposed in a position close to a vertical position. If the free end of the boom 20 were raised further, it would approach the vertical position and there would be danger of the boom 20 falling backwardly over the cab 16.

The boom limit safety device of the present invention is generally designated by the reference numeral 38 and includes a spring loaded ram generally referred to by the reference numeral 40. The ram 40 includes a cylinder 42 provided with opposite end walls 44 and 46 and it may be observed from FIGURE 3 of the drawings that the end wall 44 is provided with a centrally disposed threaded bore 48 in which there is secured a sleeve or packing gland 50 which slidably receives the piston rod 52 whose inner end is secured to a piston 54 slidable in the bore of the cylinder 42. The end wall 46 is also provided with a threaded bore 56 and an outlet neck 58 is threadedly engaged in the bore 56. A compression spring 60 is disposed between the confronting surfaces of the end wall 46 and the piston 54 and a fluid reservoir 62 is mounted atop the cylinder 42 and communicated therewith by means of a pair of check valves 64 and 66.

The fluid reservoir is provided with a removable closure **68** by which the supply of hydraulic fluid **70** within the ram **40** may be replenished. The ram **40** is secured to the cab **16** by means of suitable fasteners **72** and the outlet neck or nipple **58** is communicated with a similar nipple **74** which opens through a removable end wall **76** of an extensible fluid motor **78** by means of a flexible fluid conduit **80**.

The fluid motor **78** includes a cylinder member **82** which is closed at one end by means of the end wall **76** and at the other end by means of an end wall **88** which has a centrally disposed threaded bore **90** formed therein in which there is disposed a bushing or packing gland **92** similar to packing gland **50**. A piston **94** is slidably disposed in the cylinder member **84** and one end of a piston rod **96** is secured to the piston and is slidably received through the packing gland **92** and has its other end pivotally connected to an actuating lever **98** by means of a pin and slot connection **100**.

An expansion spring **102** is disposed between the confronting surfaces of the piston **94** and the end wall **88** and therefore normally urges the piston **94** toward the end wall **76** whereas the expansion spring **60** normally urges the piston **54** toward the end wall **44**.

In operation, as the boom **20** reaches the desired predetermined limit position of movement toward the vertical position, the abutment **104** of the outer end of the piston rod **52** is engaged by the boom **20**. Further movement of the boom **20** toward a vertical position will push the piston **54** toward the end wall **46** thereby effecting movement of the piston **94** toward the end wall **88** and extension of the piston rod **96** to pivot the actuating lever **98** in a lockwise direction as viewed in FIGURE 3 of the drawings to declutch the winding drum assembly **28** from the prime mover and apply the brake assembly **34** to the shaft **32**. Accordingly, it may be seen that the boom limit safety device **38** will not only declutch the winding drum mechanism or assembly **28** from the prime mover (not shown) but will also apply the brake assembly or mechanism **34**. Thus, even though the winding drum mechanism **28** may be declutched from the prime mover, further swinging movement of the boom **20** toward the vertical position, which movement is possible by the inertia of the boom **20**, will be prevented by means of the brake mechanism **34**.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In combination with a support having one end of a beam pivotally secured thereto, a winding drum journalled from said support and having a tension member wound thereabout and operatively connected to said beam for effecting swinging movement of said beam in response to rotation of said drum, clutch means operatively connected to said drum and including means adapted for driving connection with a prime mover and including a movable actuator for rendering said clutch means inoperative to transmit power from said prime mover to rotate said drum, a spring loaded ram including a closed cylinder having a piston snugly and slidably disposed therein with one end of a piston rod secured thereto whose other end projects outwardly of one closed end of said cylinder and is provided with an abutment, an extensible motor including a closed cylinder member having a piston snugly and slidably disposed therein with one end of a piston rod secured thereto whose other end projects outwardly of one closed end of said cylinder member, means operatively connecting said other end of the last mentioned piston rod to said actuator, fluid conduit means communicating the other closed ends of said cylinder and cylinder member, hydraulic fluid disposed in said fluid conduit and said other ends of said cylinder and cylinder member, and means mounting said ram on said support with said piston rod disposed in the plane of movement of said beam and said abutment disposed for engagement with a portion of said beam spaced laterally of its axis of rotation defining a limit position of swinging movement of said beam toward said ram whereby as said abutment is engaged by said beam to move the piston of said ram, the piston of said fluid motor will be moved and thereby effect movement of said actuator to declutch said winding drum.

2. The combination of claim 1 including brake means operatively associated with said drum for selectively preventing rotation of said drum, said clutch actuator also comprising an actuator for actuating said brake means in response to movement of said actuator to declutch said winding drum.

3. The combination of claim 1 wherein said ram includes fluid reservoir means communicable with said other end thereof.

4. The combination of claim 1 wherein said fluid motor includes means normally urging its piston rod toward a retracted position in said cylinder member.

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