United States Patent

Holmes

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[54] **SAFETY DEVICE FOR MOBILE CRANES**

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[51] **Int. Cl.**.....**B66c 23/62**

[58] **Field of Search**.....212/39, 145, 39 MS, 39 I; 340/267 C, 272

[56] **References Cited**

UNITED STATES PATENTS

3,550,506 12/1970 Gardenhour.....212/145

3,090,226 5/1963 Corti.....340/272

FOREIGN PATENTS OR APPLICATIONS

1,162,987 2/1964 Germany.....212/39

1,212,263 3/1966 Germany.....212/39

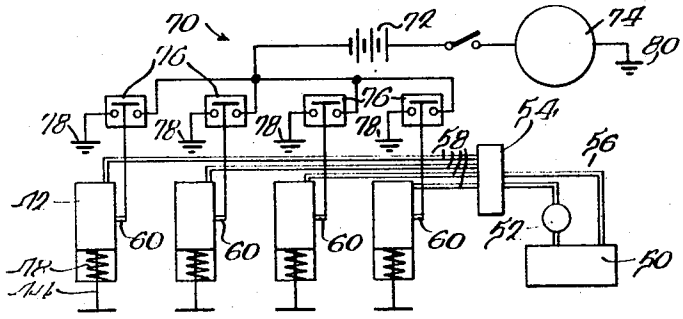
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[57] **ABSTRACT**

A safety device for indicating a tipping condition for a mobile crane having a base supported by outriggers and a boom support for vertical and horizontal swinging movement on the base. The safety device includes a plurality of pressure responsive switches respectively cooperating with the head ends of fluid cylinders forming part of the outriggers and sensing the pressure of the fluid in the cylinders. The pressure responsive means are actuated when the pressure of the cylinder drops below a predetermined level to close a switch in an electrical circuit having a warning device incorporated therein to warn the operator of a tipping condition.

3 Claims, 2 Drawing Figures



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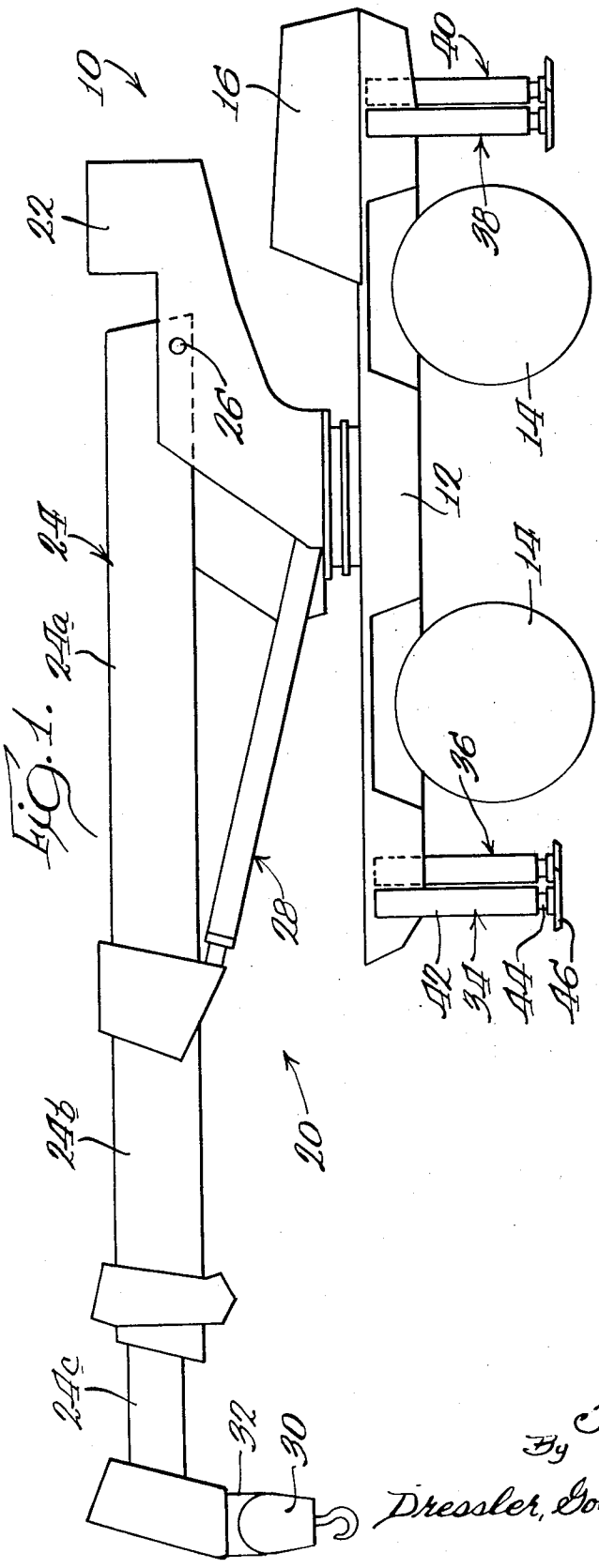


Fig. 1.

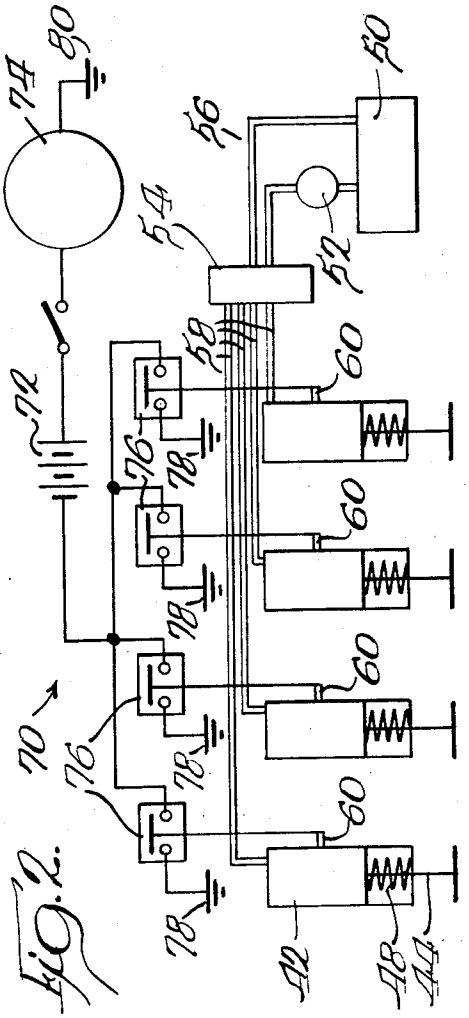


Fig. 2.

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SAFETY DEVICE FOR MOBILE CRANES

BACKGROUND OF THE INVENTION

The present invention relates generally to mobile cranes and more particularly to a safety device for such cranes.

In recent years, crane constructors have designed cranes for greater versatility and ease in transportation. Thus, in heavy duty cranes, it has become customary to support the base on wheels or tracks so that the unit can readily be transported from one location to another.

In order to further increase the versatility of the unit, the boom is generally of the extensible type and is pivoted about a horizontal axis on a turntable that is capable of being rotated 360° about the base. In order to provide a stable unit during operation, mobile cranes of this type generally include outriggers which are extended to stabilize the base. One type of outrigger presently being used for this purpose is the fluid ram type having a cylinder and a piston rod extending therefrom with a pad secured to the free end of the piston rod.

In mobile cranes of this type, the boom and supporting structure is subject to tilting or tipping when the moment of force exerted by the load on the outer end of the boom approaches a value greater than the moment of resistance exerted by the stationary structure. Thus, it has become customary to provide some type of safety control for preventing an overload condition which would tend to tip the crane.

Because the tipping moment of the lifting boom and supporting equipment is dependent upon the effective transverse length, determined by the extended length and angular position of the boom in the vertical plane, and the weight of the load on the outer end of the boom, overload safety controls heretofore known require complicated mechanism which correlates the variables used to determine the moment of force. For example, one type of safety load control device for cranes is shown in Grove U.S. Pat. No. 3,371,800 which correlates the angular position of the boom with the load thereon. However, such an arrangement requires mechanism which must necessarily be designed for each individual crane. In the particular arrangement shown in the above patent, the safety control requires a mechanical linkage connection between a movable element and the control element.

Thus, while various attempts have been made to provide a safety control device for cranes, to date no satisfactory solution has been proposed.

SUMMARY OF THE INVENTION

The present invention provides a simple and inexpensive overload safety device for mobile cranes of the type having a base supported by outriggers with an extensible and retractable boom supported for vertical and horizontal swinging movement above the base. The mechanism is simple and inexpensive in construction, utilizing only commercially available parts, and the device can readily be incorporated into existing cranes in a matter of minutes.

The safety control device of the present invention includes a plurality of pressure responsive means, such as pressure transducers, respectively cooperating with cylinders forming part of fluid actuated outriggers and

actuated when the pressure of the actuating fluid for the cylinders drops below a predetermined level. Actuation of the pressure transducers closes a normally opened micro-switch in an electrical circuit having a warning device incorporated therein to actuate the warning device and signal the operator that a tipping condition for the crane has been reached.

The present safety control mechanism eliminates the need for determining the various variables which must be considered in calculating the value of the moment of force which causes a tipping or pitching action for the mobile crane.

DETAILED DESCRIPTION OF THE SEVERAL VIEWS OF DRAWINGS

FIG. 1 discloses a mobile crane into which the present invention may be incorporated; and

FIG. 2 is a schematic illustration of the electric and hydraulic control circuit of the present invention.

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.

FIG. 1 of the drawings discloses a mobile crane, generally designated by the reference numeral 10. The mobile crane consists of a chassis or base 12 supported on wheels 14. The suitable power plant 16, such as an engine, is carried by the base or frame 12 and may be connected to the wheels 14 to transport the entire unit between locations of operation.

A boom assembly, generally designated by the reference numeral 20, is supported for vertical and horizontal swinging movement on the base 12. For this purpose, the boom assembly consists of a boom base or turntable 22 supported for rotation about a vertical axis on the base 12. One end of a sectional boom 24 is supported for pivotal movement about a horizontal axis 26 on the turntable 22 and the pivotal movement is accomplished through a fluid ram 28 interposed between the turntable 22 and the boom 24.

The boom 24 is formed in a plurality of sections 24*a*, 24*b* and 24*c* arranged in telescoping relation to each other. The sections are extended and retracted relative to each other to produce any desired boom length by suitable means, such as hydraulic rams interposed between the respective sections. The boom also has a load engaging member 30 supported on the outer free end thereof and movable relative to the boom through a hoist cable 32 connected to a winch (not shown). Since all of the structure described above is well known in the art and forms no part of the present invention, no detailed description thereof appears necessary.

In order to stabilize the mobile crane at a location of operation, the crane generally includes a plurality of outriggers 34, 36, 38 and 40. For purposes of the present invention, the outriggers 34-40 are of the fluid actuated type and, for this purpose, include a cylinder 42 having a piston rod 44 extending therefrom with a ground engaging element or pad 46 connected to the free end of the piston rod. The respective fluid rams

may be of the single acting or double acting type and the single acting type will be described herein. Thus, the piston rods **44** may be biased to the retracted position by suitable biasing means **48** and are extended by fluid under pressure pumped from a reservoir **50** by a pump **52** through a control valve **54**, also connected to the reservoir through a conduit **56**. The control valve is in communication with each of the cylinders **42** through conduits **58**. By extending the piston rods **44**, the wheels **14** may be raised above the ground to stabilize the base **12**.

According to the present invention, a safety control device cooperates with the respective outriggers and signals the operator whenever the moment of pitching or tipping force reaches a level to produce a tipping or tilting condition for the mobile crane. The safety control mechanism of the present invention is designed to eliminate the need for separately monitoring the angle of the boom, the load on the boom, and the length of the boom.

Thus, according to the present invention, the safety device comprises pressure responsive means **60** cooperating with each of the cylinders, adjacent the head end thereof, and actuated by a predetermined pressure of the fluid in the base end of the cylinder. The pressure responsive means **60** may be pressure transducers preset to be actuated when the pressure of the fluid in the associated cylinder is reduced below a predetermined level.

The safety device for indicating a tipping condition for the crane further includes means cooperating with each of the pressure responsive means for indicating a tipping condition when any of the pressure responsive means is actuated. This means is preferably an electrical circuit **70** having a power source **72**, such as the battery, and a warning device **74** incorporated therein. The electrical circuit further includes a plurality of normally open switches **76** interposed between a ground **78** and the battery **72**. The respective switches, which may be normally open microswitches, each cooperate with a pressure transducer **60** to be closed when the pressure transducer is actuated. To complete the circuit **70**, the warning device is also grounded at **80**.

It is believed that the operation of the present invention is readily understood from the above description but will be briefly summarized now. When the mobile crane has been located at a position for operation, the outriggers **34–40** are hydraulically actuated to move the ground engaging elements **46** outwardly and raise the entire base or frame **12** as well as the wheels **14** above the ground. This is accomplished by actuating control valve **54** to supply pressured fluid to the head ends of the cylinders **42**. When the unit is in a stable condition, the pressure of the fluid in the respective cylinders **42** will be substantially the same. However, should the moment of force be sufficient to approach a tipping condition for the vehicle, the fluid ram located on the side opposite the side at which the moment of force is being applied will experience a decrease in pressure of the fluid in the base end of the cylinder. Thus, when the pressure of fluid drops below the preset minimum for the transducers **60**, the associated microswitch **76** will be closed to complete the circuit to the warning device and signal the operator that the crane is in a tipping condition.

It will be appreciated that any type of warning device, such as buzzer, bell or light, may be utilized as an indicator. In addition, if it is desired, the pressure responsive means **60** may be utilized to prevent the flow of fluid to the extensible fluid rams in the boom **24**, the fluid ram **28** or render the winch (not shown) controlling cable **32** inoperative. Furthermore, if desired, any combination of the above may be incorporated into the safety control system of the present invention.

Thus, it will be appreciated that the present invention provides a simple, inexpensive safety mechanism utilizing commercially available parts which may readily be incorporated into existing machinery or cranes having fluid actuated outriggers. Furthermore, the control mechanism need not monitor the various variables which must be considered in connection with calculating a tipping moment of force.

What is claimed is:

1. In combination with a mobile crane having a base; a turntable rotatable about a vertical axis on said base; a boom supported for pivotal movement about a horizontal axis on said turntable; a plurality of outriggers at peripherally spaced locations on said base, each outrigger comprising a cylinder attached to said base and a piston rod extending from said cylinder and a ground engaging element on a free end thereof; and means for directing fluid to base ends of said cylinders to extend said piston rods and stabilize said base, a safety device for indicating a tipping condition for said crane, said device comprising individual pressure responsive means cooperating respectively with said cylinders and actuated by a predetermined pressure of said fluid in the base end of the associated cylinder; and means cooperating with each of said pressure responsive means for indicating a tipping condition when any of said pressure responsive means is actuated when said predetermined pressure of said fluid drops below a predetermined level.

2. The combination as defined in claim 1, in which said last means comprises an electrical circuit having a warning device and power means incorporated therein and a normally open switch in said circuit for each of said pressure responsive means, said switches being closed in response to actuation of said pressure responsive means.

3. In a mobile crane having a base with a plurality of fluid actuated outriggers depending from said base and ground elements on the ends of said outriggers, and a boom supported above said base for horizontal and vertical swinging movement relative to said base, the improvement of means for indicating a tipping condition for said mobile crane, said means comprising individual pressure responsive means cooperating with each outrigger for sensing a predetermined pressure of fluid in said outriggers; and indicating means cooperating with said responsive means to warn an operator of a tipping condition for said mobile crane said outriggers each include a fluid ram having a cylinder with a base end connected to said base and a piston rod extensible and retractable in said cylinder with said ground engaging elements connected to the free ends of said piston rods, and in which said pressure responsive means sense the pressure of fluid in the base ends of said cylinders and are actuated when the pressure of fluid is reduced below a predetermined level.

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