

March 10, 1931.

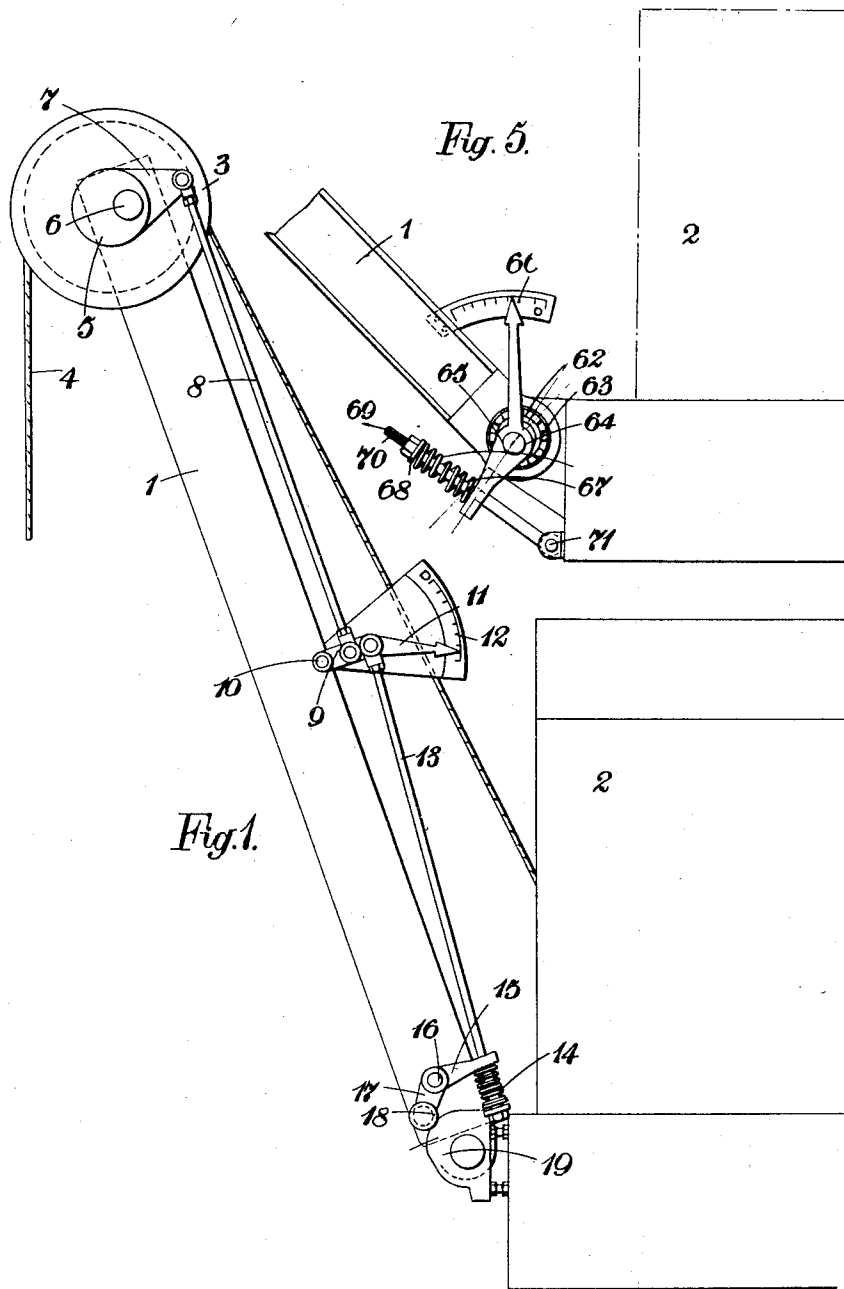
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1,795,406

CRANE, DERRICK, SHEAR LEG, AND LIKE LIFTING DEVICE

Filed March 14, 1930

3 Sheets-Sheet 1.



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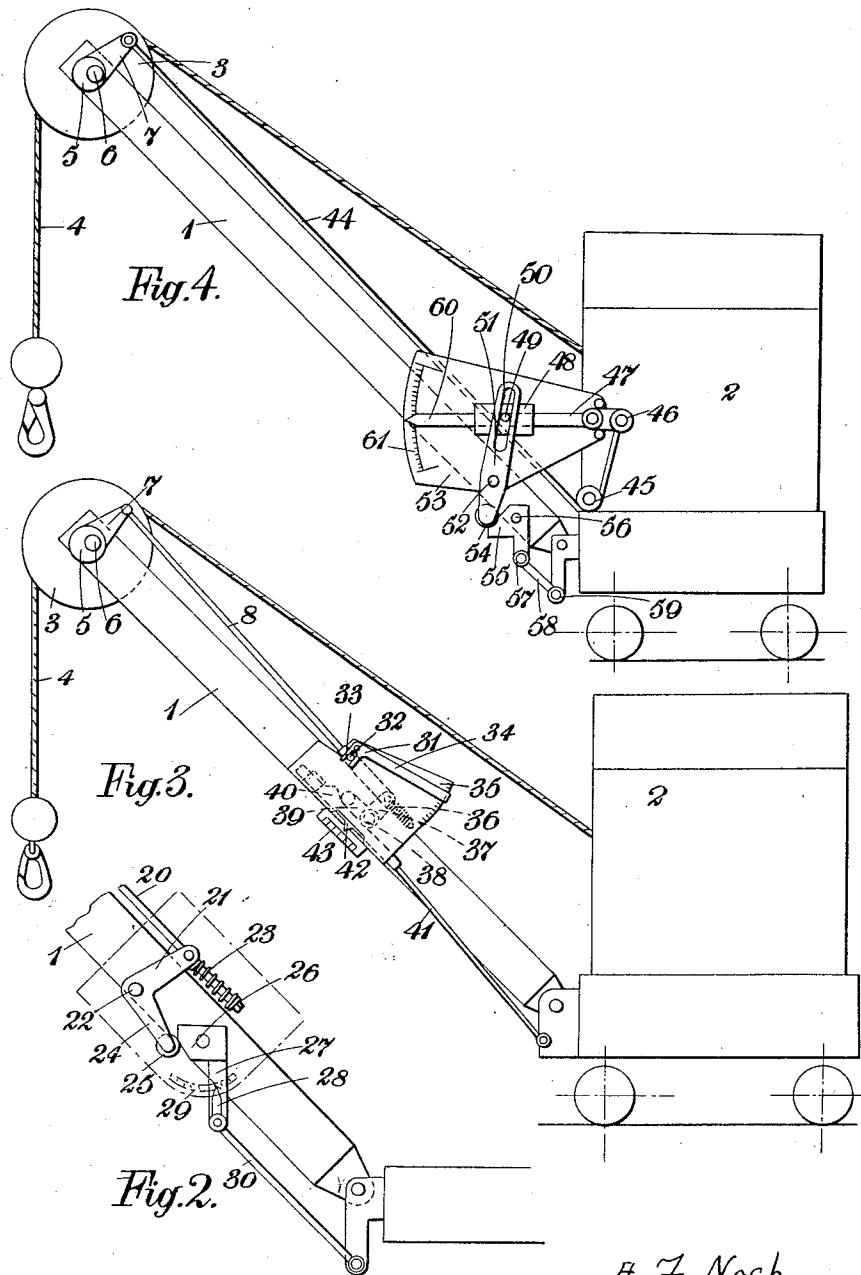
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CRANE, DERRICK, SHEAR LEG, AND LIKE LIFTING DEVICE

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3 Sheets-Sheet 2



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CRANE, DERRICK, SHEAR LEG, AND LIKE LIFTING DEVICE

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3 Sheets-Sheet 3

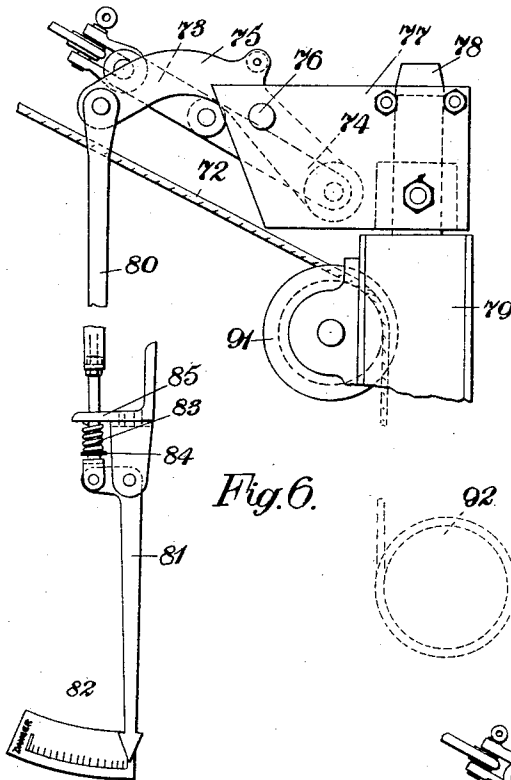


Fig. 6.

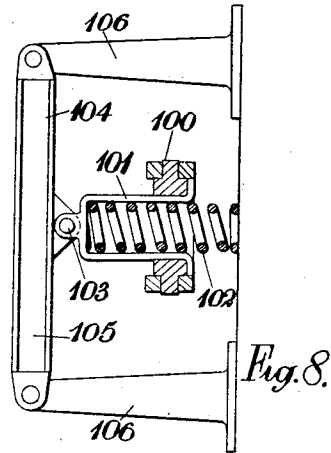


Fig. 8.

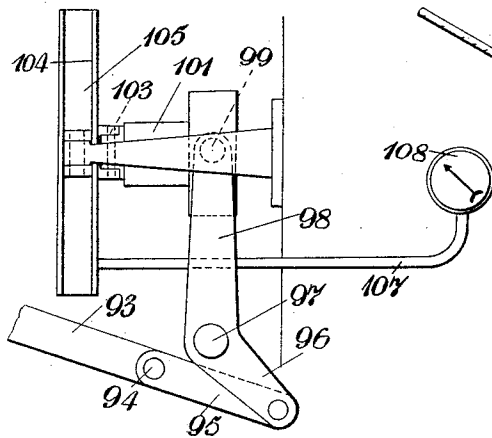
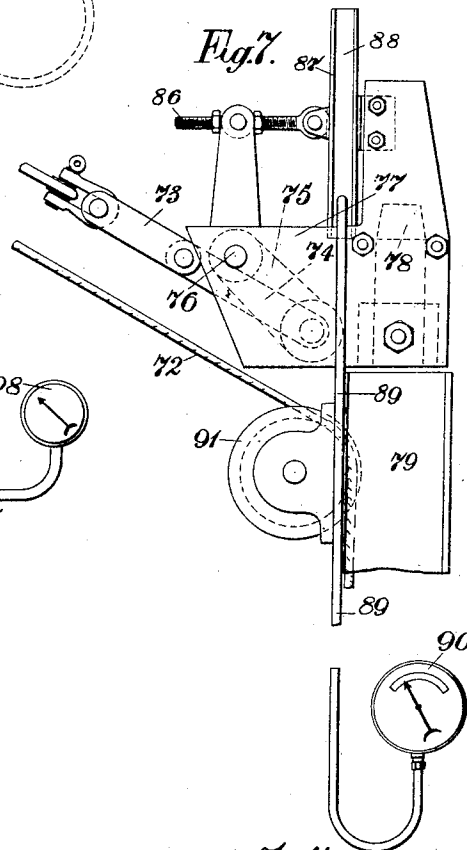


Fig.9.



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CRANE, DERRICK, SHEAR LEG, AND LIKE LIFTING DEVICE

Application filed March 14, 1930, Serial No. 435,927, and in Great Britain November 29, 1929.

This invention relates to cranes, derricks, shear-legs and other lifting devices adapted to operate at different radii by varying the angle of inclination of the jib or the like.

5 The object of the invention is to provide improved means of the kind adapted to prevent or avoid overloading.

In the case of luffing cranes, derricks, shear-legs and the like lifting devices, while
10 at certain inclinations of the jib or its equivalent the forces acting to overturn the device, due to the weight of the load and the angle of inclination of the jib, are chiefly to be taken into consideration from the point of
15 view of safety, at other angles of inclination of the jib or its equivalent, other factors assume importance or increase in importance, for instance, when the jib approaches the vertical, the compression stresses in the jib
20 and the forces acting upon other parts of the mechanism, for instance, the strength of the rope or chain and the gearing become increasingly important factor.

The invention consists, broadly, in providing
25 in such lifting devices means adapted to prevent or avoid overloading actuated not only by the dead weight of the load but also in accordance with such factors as the forces tending to crush the jib and to cause failure
30 or destruction of other elements of the lifting device.

Thus, in accordance with the invention, the means adapted to prevent or avoid overloading may comprise a member, operating as an
35 indicator or optionally, alternately or in addition to prevent, defer or interrupt the operation of the lifting device, adapted to be moved under the action of the dead weight of the load and in accordance with variations
40 in the inclination of the jib or the like.

Conveniently, a member influenced by the load is arranged to co-operate with an abutment member so formed or arranged as to impart to a moving element of the safety
45 means motion in proportion to the sum of the factors due to the weight of the load and to variations in the angle of inclination of the jib.

Where, in accordance with the invention,
50 the pulley over which the burden rope passes

is mounted upon an eccentric sleeve or equivalent eccentric member at the head of the crane, the eccentric member may be connected by an arm to a rod furnished with an abutment between which and a second abutment a spring is arranged, the second abutment being connected, in turn, by a rod or the like with means adapted to co-operate with a cam at the lower end of the jib in such manner that in varying the angle of inclination of the jib the position of the second mentioned abutment is varied in order to modify the operation of the indicator or equivalent element of the safety device.

Optionally, with such an arrangement in order to facilitate securing the safety means in position on the jib of a luffing crane after dismantling, the pointer or index or equivalent element of the safety device is pivotally connected to a casing adapted to be secured to the jib, a scale being provided on the casing to co-operate with the index or pointer and an operative connection between the pointer and the eccentric sleeve or the like is permanently associated with the casing and is connected at one end with a bell crank lever mounted in the casing and associated with a spring, one end of the bell crank lever being arranged to co-operate with a cam member also associated with the casing and provided with means whereby it may be connected with a fixed portion of the base of the crane, the cam optionally being provided also with a pointer co-operating with a second scale on the casing whereby in mounting the device on the jib the said pointer may be brought into a predetermined position on the scale.

With derricks in accordance with the invention, one end of the rope whereby the angle of inclination of the jib may be varied may be connected with indicating means or the like associated with a cam or stops whereby as the result of varying the angle of inclination of the jib other factors applicable to the mechanism or structure of the device will be caused to influence the readings of the indicating means.

With such a construction one end of the rope supporting the end of the jib may be connected with a member pivotally mounted and

associated with means adapted to balance the forces tending to move the member about its pivot, means being provided whereby in consequence of the increase in the angle of inclination of the jib the forces tending to move the member about its pivot will be increased.

Thus, in accordance with this phase of the invention, one end of the rope supporting the end of the jib may be connected by a plurality of links with one end of a lever pivotally mounted and associated with a suitable balancing means and with the links one or more stops are arranged to co-operate to cause the lever to be subjected to an increased force tending to move it about its pivot in consequence of increase in the angle of inclination of the jib and thereby introduce into the readings given by the indicator other factors applicable to the mechanism or structure of the derrick or the like.

The invention will be described further in detail with reference to the accompanying drawings in which certain constructions in accordance with the invention are illustrated by way of example and in which:—

Figure 1 is a side elevation of a jib crane furnished with one form of indicator in accordance with the invention.

Figure 2 is a fragmentary view of a second construction.

Figure 3 illustrates a third construction.

Figure 4 illustrates a fourth construction.

Figure 5 is a fragmentary view of a fifth construction.

Figure 6 is a fragmentary view of a sixth construction.

Figure 7 is a fragmentary view of a seventh construction.

Figures 8 and 9 illustrate respectively in plan view and side elevation a modification of the type of construction illustrated in Figure 7.

In the drawings 1 indicates the jib of a crane and 2 in the Figures 1, 3, 4 and 5 indicates the cab to which the jib is secured.

In the constructions illustrated in Figures 1, 3 and 4, 3 is the chain pulley at the head of the jib over which the chain 4 passes, and the pulley is mounted upon an eccentric sleeve 5 which in turn is mounted upon a spindle 6 rigidly secured to the jib head. The eccentric sleeve, in the case of the constructions illustrated in Figures 1, 3 and 4, is provided with an arm 7, connected by means of the rod 8 with means for constraining the sleeve to occupy a position such that regarded in elevation it stands with the longer axis of eccentricity nearly approaching the horizontal.

In the construction illustrated in Figure 1, the rod 8 pivoted to the arm 7 is connected with the arm 9 mounted upon a pivot 10 on the jib and provided with a pointer 11 co-operating with the scale 12, the pointer by means of the rod 13 being associated with a spring 14 which is arranged to bear upon one

end of the arm 15 of a bell crank lever mounted upon the pivot 16 secured to the jib, the other arm 17 of the bell crank lever being provided at its extremity with a roller 18 co-operating with the cam member 19 located at the base of the crane.

In this construction variations in the angle of the jib will cause the roller 18 to move over the face of the cam 19 and thereby correspondingly cause variations in the tension of the spring 14 and hence variations in the magnitude of the couple opposing the forces acting on the eccentric sleeve due to tension in the burden rope.

In the construction illustrated in Figure 2, the eccentric sleeve is connected by means of the rod 20 with one end 21 of a bell crank lever pivoted at 22 to a fixed point in the jib, the spring 23 on the rod 20 being adapted to bear against the arm 21 of the bell crank lever. To the other arm 24 of the bell crank lever is pivoted the roller 25 adapted to bear against the face of the cam member 26 to which is connected by means of the arm 27 a pointer 28 adapted to cooperate with the scale 29, the said pointer being connected by means of the rod 30 to a fixed portion of the cab.

In the construction illustrated in Figure 3, the rod 8 forms a connection between the eccentric sleeve and the crank 31 by means of the pin 32 on the rod engaging within a slot formed in the arm 33 of the crank, the other arm 34 of which constitutes an index co-operating with the scale 35. At the lower extremity of the rod 8 is located a spring 36 adapted to bear against the end 37 of a bell crank lever mounted on a fixed pivot 38 in the casing, the other end 39 of the bell crank lever co-operating with a cam 40 adapted, by means of the rod 41 connecting it with the cab or base of the crane, to be moved in varying the inclination of the jib. With the cam is associated a second index or pointer 42 adapted to co-operate with the scale 43. The cam is suitably formed to modify the motion of the index in order to compensate for factors, such as the crushing strength of the jib, the strength of the gearing and the like, all of which factors are normally taken into consideration by the crane makers in determining the safe load of the lifting device when operated at different radii and may be referred to as factors determined by the "makers' law."

In the construction illustrated in Figure 4, the arm 7 of the eccentric sleeve is connected to a flexible member 44 passing round a pulley 45 mounted upon the cab, the said flexible member being connected at 46 with the steelyard 47 upon which is slidably mounted a weight member 48 having a pin 49 projecting through a slot 50 formed in the lever 51. The lever 51 is pivoted at 52 to the frame member 53 secured to the cab and is pro-

vided at its lower extremity with a roller 54 adapted to engage the face of the cam member 55 pivoted at 56 to the jib, and having at its lower extremity 57 a pivotal connection with the rod 58 which rod is pivoted at 59 to a fixed portion of the cab, the pointer 60 being adapted to co-operate with a scale 61.

In the construction illustrated in Figure 5, the jib is mounted on a sleeve 62 so as to be freely rotated about the same on a ball or roller bearing 63 and the sleeve 62 is eccentrically mounted on the pin 64 to which is secured the double arm lever 65, one arm of which forms a pointer co-operating with the scale 66, while the other arm bears upon one end of the spring 67, the other end of which bears upon a washer 68 contacted with the nut 69 secured on the eye bolt 70 pivoted about the pin 71.

In the construction illustrated in Figures 6 and 7 72 represents the rope supporting the end of a derrick one end of which rope is connected by links 73, 74 to the double armed lever 75 pivoted at 76 to the member 77 which in turn is rigidly mounted upon the pin 78 on the derrick mast 79.

In the construction illustrated in Figure 6, the lever 75 is connected by the rod 80 with the pointer 81 cooperating with the scale 82 in such manner as to move the same in opposition to the spring 83 arranged between the shoulder 84 and the fixed abutment 85.

In the construction illustrated in Figure 7, one arm of the lever 75 is adjustably connected through the eyebolt 86 with the relatively flexible diaphragm 87, forming a wall of the chamber 88 and is filled with oil or some suitable fluid so that the effective load on the derrick will vary the fluid pressure within the device which by way of the tube 89 is in communication with the manometer of pressure gauge 90 calibrated to indicate the effective load upon the derrick or the sum of the factors to be taken into account in determining the safe load. In both of these constructions the rope for raising or lowering the derrick passes over the pulley 91 secured to be derrick mast 79 and, as shown in Figure 6, the rope is arranged to be wound on to or unwound from a drum 92 for the purpose of raising or lowering the derrick.

In the constructions illustrated in Figures 6 and 7 when the derrick is raised beyond a certain limit the link 74 will be caused to bear against the pivot 76 with the result that the lever 75 will be subjected to an additional force tending to move it about the pivot 76 or alternatively about a stop and thereby will introduce into the readings given by the indicator other factors applicable to the mechanism or structure of the device derived from the experience of crane manufacturers who find that the variation

of safe load in relation to the radius of lift does not vary according to a simple law. For instance, with a given derrick it has been found that the safe load at a radius of 30 feet is one ton whereas at 26 feet it is two tons and at 22 feet, three tons and with radii less than 22 feet the load should in no case exceed three tons.

In the construction illustrated in Figures 8 and 9 one end of a rope supporting the end of the derrick is connected through the member 93 pivotally connected at 94 with the link 95, to one arm 96 of a bell crank lever pivoted at 97, the arm 98 of the bell crank lever being pivotally connected at 99 to a collar 100 secured to the casing 101 of a spring 102. The spring casing is connected at 103 with the relatively flexible diaphragm 104 forming a wall for the chamber 105 pivotally supported in position by means of the supporting members 106. As in the case of the construction illustrated in Figure 7, the chamber is filled with oil or some other suitable fluid and is connected by way of the tube 107 with the manometer or pressure gauge 108 serving to indicate the combined forces acting on the diaphragm.

I claim:

1. A lifting device having a luffing jib and means adapted to ensure that the limits of safety shall not be exceeded, said means comprising a member subjected to the action of the load, balancing means adapted to oppose the action of the load on the said member, a member the position of which is varied by variations in the angle of inclination of the jib, and an abutment member adapted to co-operate therewith in such manner that by varying the angle of inclination of the jib the balancing means is influenced to modify the operation thereof in accordance with factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

2. A lifting device having a luffing jib and means adapted to ensure that the limits of safety shall not be exceeded comprising a pulley mounting located at the head of the jib and arranged to rotate about a given axis, a pulley rotatably associated with the said pulley mounting and adapted to rotate about a second axis parallel with the first-mentioned axis, means adapted to balance the forces tending to rotate the said pulley mounting about its axis due to the action of the load being raised, and an abutment member associated with the said pulley mounting adapted as a result of varying the angle of inclination of the jib to influence the action of the balancing means and to modify the operation thereof in accordance with factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

3. A lifting device having a luffing jib and means adapted to ensure that the limits of safety shall not be exceeded, said means comprising a member movably secured to the device, a flexible member supporting one end of the jib connected with said member and adapted to move the same under the action of the load being raised and an abutment member adapted in consequence of an increase in the angle of inclination of the jib with respect to the horizontal to modify the forces tending to move the said member in order to introduce into the operation of the same factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

4. A lifting device having a luffing jib and means adapted to ensure that the limits of safety shall not be exceeded, said means comprising a member movably secured to the device, a flexible member supporting one end of the jib connected with said member, and adapted to move the same under the action of the load being raised, means adapted to oppose the forces tending to move the said member due to the action of the load being raised, indicating means adapted to be actuated by the said member and an abutment member adapted in consequence of an increase in the angle of inclination of the jib with respect to the horizontal to modify the forces tending to move the said member in order to introduce into the operation of the indicating means factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

5. A lifting device having a luffing jib and means adapted to ensure that the limits of safety shall not be exceeded, said means comprising a flexible member connected with and supporting one end of the jib, a lever mounted on a pivot secured to the device, a system of links interconnecting one arm of the said lever with the flexible member, means adapted to balance the forces tending to move the said lever about its pivot due to the action of the load being raised, and stops associated with the said system of links adapted to cooperate with the said lever and to subject the same to an increased force tending to move it about its pivot in consequence of an increase in the angle of inclination of the jib with respect to the horizontal and thereby to introduce into the operation of the same factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

6. A lifting device having a luffing jib and means adapted to ensure that the limits of safety shall not be exceeded said means comprising a flexible member connected with and supporting one end of the jib, a lever mounted on a pivot secured to the device, means

adapted to balance the forces tending to move the said lever about its pivot due to the action of the load being raised, indicating means adapted to be actuated by the said lever, a system of links interconnecting one arm of the said lever with the said flexible member adapted to co-operate with the said pivot and to subject the lever to an increased force tending to move it about its pivot in consequence of an increase in the angle of inclination of the jib with respect to the horizontal and thereby to introduce into the readings of the indicating means factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

7. A lifting device having a luffing jib and means adapted to ensure that the limits of safety shall not be exceeded, said means comprising a lever mounted on a pivot secured to the device, a flexible member connected with and supporting one end of the jib adapted to move the said lever about its pivot under the action of the load being raised, a link member pivotally connected at one end with one arm of the said lever and at the other end with a pointer, a spring associated with the pointer adapted to oppose motion of the same consequent upon movement of the said lever, a scale co-operating with the said pointer, a system of links interconnecting the lever with the said flexible member adapted to cooperate with the said pivot and to subject the lever to an increased force tending to move it about the pivot in consequence of an increase in the angle of inclination of the jib with respect to the horizontal and thereby to introduce into the readings of the scale factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

8. A lifting device having a luffing jib and means adapted to ensure that the limits of safety shall not be exceeded, said means comprising a lever mounted on a pivot secured to the device, a flexible member connected with and supporting one end of the jib adapted to move the said lever about its pivot, a spring adapted to bear at one end against a fixed portion of the device, a casing located on the said spring and adapted to bear against the other end of the same, a pivotal connection between the said casing and the other arm of the said lever, a flexible diaphragm containing fluid rigidly connected at its periphery with a fixed portion of the device, a pivotal connection between one wall of the said flexible diaphragm and the spring casing, a manometer connected with the said flexible diaphragm, a system of links interconnecting one arm of the said lever with the said flexible member adapted to cooperate with the said pivot and to subject the lever to an increased

force tending to move it about its pivot in consequence of an increase in the angle of inclination of the jib with respect to the horizontal and thereby to introduce into the readings of the manometer factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

9. Means adapted to ensure that the limits of safety of a lifting device having a luffing jib shall not be exceeded said means comprising a member adapted to be subjected to the action of the load, balancing means adapted to oppose the action of the load on the said member, a member the position of which is adapted to be varied by variations in the angle of inclination of the jib and an abutment member adapted to co-operate therewith in such manner that by varying the angle of inclination of the jib the balancing means may be influenced to modify the operation thereof in accordance with factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

10. Means adapted to ensure that the limits of safety of a lifting device having a luffing jib shall not be exceeded said means comprising a pulley mounting adapted to be located at the head of the jib and arranged to rotate about a given axis, a pulley rotatably associated with the said pulley mounting and adapted to rotate about a second axis parallel with the first-mentioned axis, means adapted to balance the forces tending to rotate the said pulley mounting about its axis and an abutment member associated with the said pulley mounting adapted as a result of varying the angle of inclination of the jib to influence the action of the balancing means and to modify the operation thereof in accordance with factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

11. Means adapted to ensure that the limits of safety of a lifting device having a luffing jib shall not be exceeded comprising a member adapted to be movably secured to the device, a flexible member adapted to support one end of the jib connected with said member and adapted to move the same under the action of the load being raised, and an abutment member adapted in consequence of an increase in the angle of inclination of the jib with respect to the horizontal, to modify the forces tending to move the said member in order to introduce into the operation of the same factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

12. Means adapted to ensure that the limits of safety of a lifting device having a luffing jib shall not be exceeded comprising a mem-

ber adapted to be movably secured to the device, a flexible member adapted to support one end of the jib connected with said member, and adapted to move the same under the action of the load being raised, means adapted to oppose the forces tending to move the said member due to the action of the load being raised, indicating means adapted to be actuated by the said member and an abutment member adapted in consequence of an increase in the angle of inclination of the jib with respect to the horizontal to modify the forces tending to move the said member in order to introduce into the operation of the indicating means factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

13. Means adapted to ensure that the limits of safety of a lifting device having a luffing jib shall not be exceeded comprising a flexible member adapted to be connected with and to support one end of the jib, a lever mounted on a pivot adapted to be secured to the device, a system of links interconnecting one arm of the said lever with the flexible member, means adapted to balance the forces tending to move the said lever about its pivot due to the action of the load being raised, and stops associated with the said system of links adapted to co-operate with the said lever and to subject the same to an increased force tending to move it about its pivot in consequence of an increase in the angle of inclination of the jib with respect to the horizontal and thereby to introduce into the operation of the same factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

14. Means adapted to ensure that the limits of safety of a lifting device having a luffing jib shall not be exceeded comprising a flexible member adapted to be connected with and to support one end of the jib, a lever mounted on a pivot adapted to be secured to the device, means adapted to balance the forces tending to move the said lever about its pivot due to the action of the load being raised, indicating means adapted to be actuated by the said lever, a system of links interconnecting one arm of the said lever with the said flexible member adapted to co-operate with the said pivot and to subject the lever to an increased force tending to move it about its pivot in consequence of an increase in the angle of inclination of the jib with respect to the horizontal and thereby to introduce into the readings of the indicating means factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

15. Means adapted to ensure that the limits of safety of a lifting device having a luffing jib shall not be exceeded comprising a lever

mounted on a pivot secured to the device, a flexible member adapted to be connected with and to support one end of the jib, adapted to move the said lever about its pivot under the action of the load being raised, a link member pivotally connected at one end with one arm of the said lever and at the other end with a pointer, a spring associated with the pointer adapted to oppose motion of the same consequent upon movement of the said lever, a scale co-operating with the said pointer, a system of links interconnecting the other arm of the lever with the said flexible member adapted to co-operate with the said pivot and to subject the lever to an increased force tending to move it about its pivot in consequence of an increase in the angle of inclination of the jib with respect to the horizontal, and thereby to introduce into the readings of the scale factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

16. Means adapted to ensure that the limits of safety of a lifting device having a luffing jib shall not be exceeded comprising a lever mounted on a pivot adapted to be secured to the device, a flexible member adapted to be connected with and to support one end of the jib adapted under the action of the load being raised to move the said lever about its pivot, a spring adapted to bear at one end against a fixed portion of the device, a casing located on the said spring, and adapted to bear against the other end of the same, a pivotal connection between the said casing and the other arm of the said lever, a flexible diaphragm containing fluid rigidly connected at its periphery with a fixed portion of the device, a pivotal connection between one wall of the said flexible diaphragm and the spring casing, a manometer connected with the said flexible diaphragm, a system of links interconnecting one arm of the said lever with the said flexible member adapted to co-operate with the said pivot and to subject the lever to an increased force tending to move it about its pivot in consequence of an increase in the angle of inclination of the jib with respect to the horizontal and thereby to introduce into the readings of the manometer factors depending upon the crushing strength of the jib and the resistance to failure or destruction of other elements of the lifting device.

In testimony whereof I have signed my name to this specification.

ARCHIBALD FRAZER NASH.