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LOAD INDICATING AND ANCHORING DEVICE FOR CABLES AND OTHER LINES

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Fig. 1

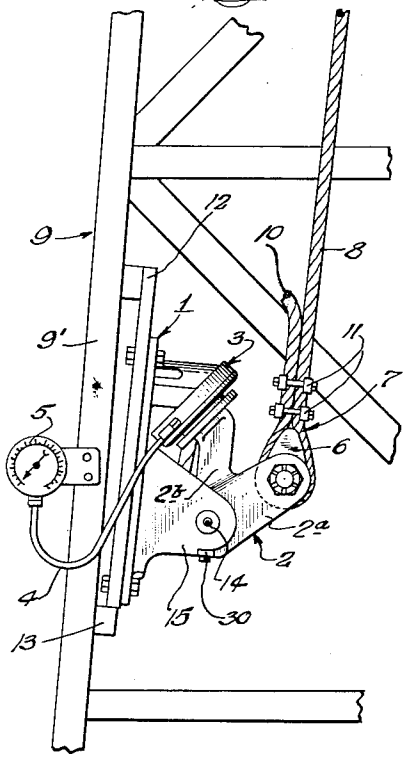


Fig. 2

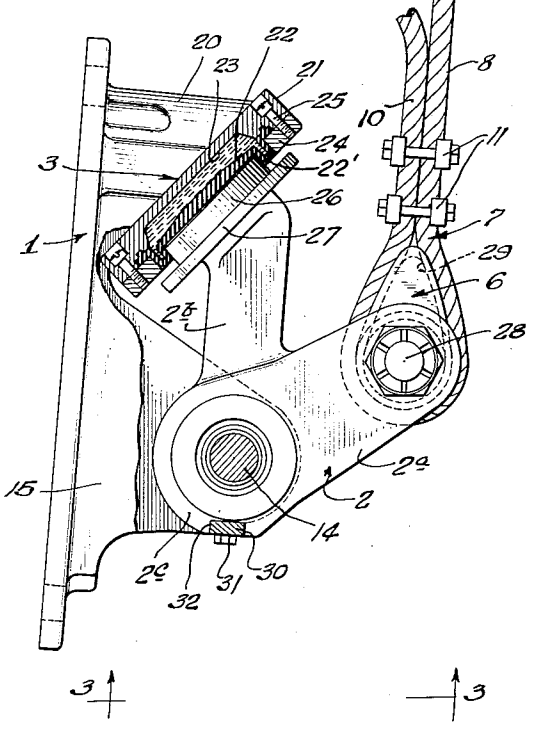
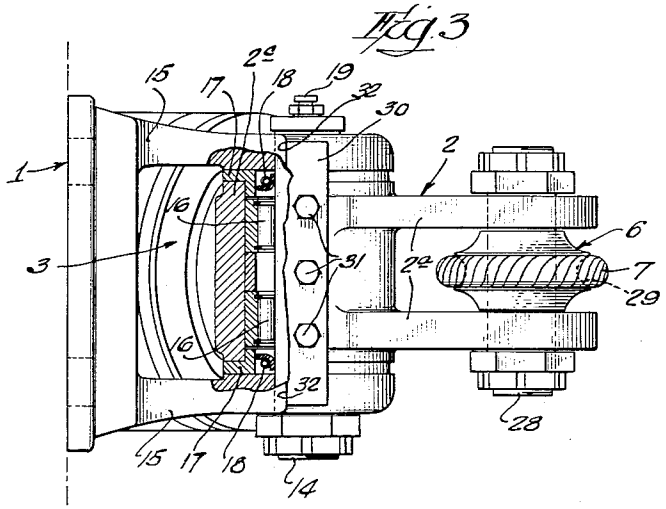


Fig. 3



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LOAD INDICATING AND ANCHORING DEVICE FOR CABLES AND OTHER LINES

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9 Claims. (Cl. 73—143)

This invention relates to apparatus for indicating the loads on cables or other lines and for anchoring such lines, for example, the dead lines of cable hoist systems used in well drilling rigs.

It is an object of this invention to provide a load indicator and anchor for load-sustaining cables or other lines, which is an improvement in this field in point of its compactness, small size, low weight, simplicity of construction and reliability and accuracy of performance.

It is another object of this invention to provide a device of the character described which makes it possible to employ as a part thereof, a hydraulic load sensing unit that is of small size, compact, light as to weight, simple as to construction and reliable as an accurate actuator for a load indicating gauge.

It is an additional object of this invention to provide a device of the character described which comprises a novel construction and arrangement of a base, a lever fulcrumed on the base, a hydraulic sensing element on the base actuated responsive to movement of the lever, and an anchor member mounted on the lever for receiving a loop of a load sustaining line to anchor the line to the lever.

Further it is an object of this invention to provide a device such as described wherein the base is adapted to be mounted on a support in a plane parallel to the load sustaining line that is anchored to the lever, and wherein essential working parts of the device are disposed between the line and the base in a novel and compact arrangement providing the advantages herein noted.

Another object of this invention is the provision of a device such as described wherein the anchor member is mounted on one end of the lever, and the hydraulic sensing device is contacted and actuated under compression by the other end of the lever, thereby providing a simple construction assuring reliability and accuracy of performance of the device.

A further object of this invention is the provision of a device such as described wherein the anchor member is mounted on one end of the lever for rotative or pivotal self-aligning movement in a manner assuring that the load transmitted from the line to the lever through the anchor member will be accurately indicated.

Another object of this invention is the provision of a device of the character described wherein the end of the lever opposite the end to which the load sustaining line is anchored, is in contact with a diaphragm forming a part of the expansible hydraulic chamber of the sensing unit, whereby the sensing unit is operated directly by movement of the end of the lever contacting the diaphragm, thereby eliminating use of linkage or similar means of connection heretofore employed in load indicators.

Another object of this invention is the provision in a device such as described of elements on the lever and the mounting for the lever, respectively, which cooperate to limit movement of the lever as effected by filling the hydraulic expansible chamber, whereby proper charging of the hydraulic chamber readily may be effected and the lever positioned to accurately transmit the line load to the sensing element.

This invention possesses many other advantages and has other objects which may be made more easily apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawings accompanying and forming part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Fig. 1 is a side elevation of a device embodying the present invention as it would appear when installed on a well drilling rig for anchoring the lead line of the hoist system and indicating the load on such line;

Fig. 2 is an enlarged elevational view of the device shown in Fig. 1; and

Fig. 3 is an elevational view partly in section looking in the direction of the arrows 3—3 on Fig. 2, on an enlarged scale.

Referring more specifically to the accompanying drawing, it will be seen that one form of load indicator and anchor embodying the present invention generally comprises a plate-like base 1, a lever 2 fulcrumed on the base, a hydraulic load sensing unit 3 mounted on the base for actuation by direct contact with the lever, a fluid line 4 between the sensing unit and a load indicating gauge 5, and an anchor member 6 mounted on the lever for receiving a loop 7 of a load sustaining line 8 to anchor the line to the lever.

Fig. 1 shows a typical installation of the device of this invention on the derrick 9 of a well drilling rig, the line 8 being the dead line of the hoist system of the rig. From the loop 7 a non-tensioned portion 10 of the line 8 is extended so as to lie alongside the load sustaining portion of the line in outwardly spaced relation to the anchor member 6 and then clamped to the load sustaining portion by means of suitable cable clamps 11.

It is desired to mount the base 1 so that the transmission of the load on the line 8 to the lever 2 will result in an accurate indication of the load, for example in pounds, at the gauge 5 in response to movement of the lever and resultant actuation of the sensing unit 3. It is also desired that this mounting of the base 1 be such that the lever 2 may be comparatively small and mounted in close compass with the anchor member 6 and the sensing unit 3, whereby the device as a whole may be constructed of but few parts of light weight in a compact arrangement.

As shown in Fig. 1, the base 1 is adapted to be mounted on the derrick 9 so that it is in a plane substantially parallel with the line 8. This may be accomplished by bolting the base to a mounting plate 12 which latter may be fastened to an upright member 9' of the derrick 9, at the proper angle. As here shown, shims 13 are employed to set the mounting plate in the proper position and these shims may be secured to the derrick member 9' and to the plate 12 in any suitable manner, for example by being welded thereto.

Compactness, light weight and accuracy of performance of the device are achieved in part by making the lever 2 in the form of a bell crank having short arms 2*a* and 2*b* perferably spaced less than 90° apart, so that the lever is substantially V-shaped. At the juncture of the arms 2*a* and 2*b* is a tubular hub portion 2*c* through which a mounting pin 14 extends. This pin is removably supported in any suitable manner by a pair of ears 15 provided ad-

jacent one end of the base 1. Suitable anti-friction bearings 16 for rotatably mounting the lever 2 are contained in the hub portion 2c around the pin 14. Thrust washers 17 are interposed between the ends of the hub and the inner sides of the ears 15. Suitable seals 18 are provided between the washers 17 and the pin 14 to retain a lubricant in the tubular hub 2c. The pin 14 may be provided with a lubricating passage 19 leading into the tubular hub 2c.

The sensing unit 3 is mounted on a lateral extension 20 of the base 1 and comprises a plate-like body 21 having therein a cavity which with a flexible diaphragm 22, forms an expansible chamber 23 for containing hydraulic fluid. The diaphragm is secured to body 21 by means of clamping ring 24 and fastenings 25. This construction provides a plate-like sensing unit which is of small size and compact. The fluid line 4 is communicated with the chamber 23 and leads to the gauge 5 which may be mounted at any suitable location on the derrick 9. Movement of the diaphragm 22 creates a hydraulic pressure which is reflected by the gauge 5.

In order to maintain compactness and simplicity in the construction of the device, the sensing unit 3 may be mounted at an angle to the plane of the base 1 as here shown. This will permit the use of the comparatively short lever 2 wherein the outer end of the lever arm 2b is angularly offset and engaged with the diaphragm 22. This offset end of the lever is provided with a pressure plate 26 which is substantially parallel with the plane of the diaphragm and in contact therewith. An annular stop flange 27 on the arm 2b is engageable with the ring 24 to limit the movement of the pressure plate in the direction forcing the diaphragm inwardly. With this arrangement no linkage or similar means is necessary to connect the lever with the diaphragm, since in effect, one end of the lever is in direct contact with and operates the diaphragm.

It should be noted that the diaphragm 22 is provided with an annular fold 22' which surrounds the periphery of the pressure plate 26 carried on the free end of the lever arm 2b. With this arrangement, the pressure plate 26, in other words, one end of the lever 2, is maintained in intimate contact throughout the area thereof, with substantially all of that portion of the diaphragm bounded by the annular fold 22'. Moreover all of that portion of the diaphragm engaged by one end of the lever is movable bodily like a piston but without the friction produced by a piston. Accordingly, the device as a whole will operate without friction or movement which would cause error in the indication of the load. Also in this arrangement the diaphragm serves as a true structural member affording the desired strength and stability and assuring a friction free load transmission with a resultant true load indication.

The anchor member 6 is here shown in the form of a pear-shaped thimble mounted in the bifurcated outer end of the lever arm 2a so that it will move relative to the lever arm and will be self-aligning with respect to the line 8. As here shown, the anchor member 6 is pivotally mounted on a pin 28 which is removably held in the bifurcated end of the arm 2a in any suitable manner. A groove 29 is formed in the periphery of the member 6 for the reception of the loop 7 of the line 8. The bifurcated end of the arm 2a facilitates reeving of the line 8 for forming the loop 7 and anchoring the line to the lever 2.

A stop bar 30 is secured by fastenings 31 to the hub portion 2c of the lever 2. This bar is adapted to engage shoulders 32 formed on the ears 15 so as to limit the diaphragm-effected movement of the lever that takes place responsive to the filling of the hydraulic expansive chamber 23 and the hydraulic system including the line 4 and gauge 5. When the stop bar 30 is engaged with the shoulder 32 the device is in readiness for operation for indicating the load on the line.

It is important to note that the pivot or fulcrum pin 14 is between the plane of the base 1 and the load sustaining line 8 and is parallel with the plane of the base 1. The pivot pin 28 for the anchor member 6 is parallel with the pin 14 and is in line with the load sustaining line 8. These arrangements provide a compact closely coupled device making possible the use of a short, lightweight lever and a similar lightweight and compact sensing unit assuring accuracy of performance of the device as a load or weight indicator and cable anchor.

In having the line of action of the cable parallel to the plane of the base and in employing the lever 2 and sensing element 3 in the manner here disclosed, the load on the cable induces a rotating moment of the lever and this moment is opposed by an equal and opposite reaction induced by the hydraulic expansible chamber of the load sensing unit. This reaction of the sensing unit generates a hydraulic pressure which is a constant function of the line load and is indicated on the gauge 5. This gauge may be calibrated to indicate the cable load in pounds.

With reference to the foregoing description and drawings, it will be apparent that a device embodying the present invention will provide the advantages herein noted in a particularly efficacious manner.

I claim:

1. A weight indicator and anchor for a load sustaining line comprising: a base adapted to be mounted on a support; a bell crank mounted on said base; an expansible chamber on said base; said chamber including a diaphragm having a fold therein defining a bodily movable portion; one end of said bell crank being surrounded by said fold and bearing against said portion of said diaphragm; and an anchor member on the other end of said bell crank constructed and arranged for receiving a loop of said line to anchor the line to said other end of the bell crank.

2. A weight indicator and anchor for a load sustaining line comprising: a base adapted to be mounted on a support; a pair of ears projecting outwardly from the base; a bell crank pivoted on said ears; an expansible hydraulic chamber on said base; said chamber including a diaphragm; said chamber and diaphragm being angularly related to the plane of the base; said bell crank having one end angularly disposed and in contact with said diaphragm; means for connecting a line to the other end of said bell crank; and stop members on said ears and said bell crank respectively, cooperable to limit movement of said bell crank in one direction.

3. A weight indicator and anchor for a load sustaining line comprising: a base adapted to be mounted on a support; a lever fulcrumed on said base; means providing an expansible chamber on said base; said chamber including a diaphragm in contact with one end of said lever; means for connecting a line to the other end of said lever; elements on said lever and said base respectively, cooperable to limit movement of said lever in one direction; and means on said chamber and said lever, respectively, cooperable to limit movement of said lever in the opposite direction.

4. A weight indicator and anchor for a load sustaining line comprising: a base adapted to be mounted on a support; a bell crank fulcrumed on said base; a hydraulic load sensing unit mounted on said base; said unit including an element having a bodily movable portion providing a surface exposed to fluid pressure in said unit and another surface contacting one end of said bell crank; said bell crank being movable in one direction responsive to movement of said element under fluid pressure in said unit; an anchor member adapted to have said line anchored thereto; means mounting said anchor member on the other end of said bell crank; said bell crank moving in the other direction responsive to the load on the line; stop elements on said unit and said

bell crank respectively, cooperable to limit movement of said bell crank in said other direction; and other stop elements on said base and said bell crank respectively, cooperable to limit movement of said bell crank in said one direction.

5. A weight indicator and anchor for a load sustaining line comprising: an elongated plate-like base adapted to be mounted on a support in a plane parallel with said line; a pair of ears extending laterally from one end portion of said base; a bell crank fulcrumed between its ends on said ears with the arms thereof extending generally in the direction of said line; a hydraulic load sensing unit including an actuating element having a surface exposed to the hydraulic fluid in said unit and a second surface in contact with one end of said bell crank; means mounting said unit adjacent the other end portion of said base at an angle to the plane of said base; said end of said bell crank being angularly offset from the adjacent arm of said bell crank so as to be parallel with said second surface; an anchor member adapted to have said line anchored thereto; and means mounting said anchor member on the other end of said bell crank.

6. In a weight indicator for a load sustaining line comprising: a longitudinally extended base; an hydraulic sensing unit including a fluid chamber communicable with a meter device and a shiftable pressure member responsive to pressure applied thereto to force fluid from said chamber; a lever pivotally supported on said base in spaced relation to said sensing unit; said lever having an arm connectable with a line and an arm extending into operative relation to said sensing unit; the improvement wherein the last mentioned lever arm is provided with a head disposed at an angle relative to the arm and engaged with said pressure member; and said pressure member and head being disposed in alignment, whereby angular movement of said lever will impart substantially linear movement to said head through its range of operative movement; said pressure member being in the form of a diaphragm and said head engaging said diaphragm substantially over its entire working area.

7. In a weight indicator for a load sustaining line comprising: a base; a lever pivotally supported on said base; an hydraulic sensing unit on said base; said lever having an arm engageable with said sensing unit for operating the latter responsive to pivotal movement of the lever; the improvement wherein said arm extends substantially parallel to the line of pull on the lever from a load sustaining line; said lever also having an arm projecting at an angle to the line of pull from said load sustaining line and adapted to be connected to the latter; and coengageable pressure responsive means on said sensing unit and pressure applying means on the first mentioned lever arm for operating said sensing unit upon upon pivotal movement of said lever, said pressure means being aligned and movable substantially in the direction of arcuate movement of said pressure applying means.

8. In a weight indicator for a load sustaining line comprising: a base; a lever pivotally supported on said base; an hydraulic sensing unit on said base; said lever having an arm engageable with said sensing unit for operating the latter responsive to pivotal movement of the lever; the improvement wherein said arm extends substantially parallel to the line of pull on the lever from a load sustaining line; said lever also having an arm projecting at an angle to the line of pull from said load sustaining line and adapted to be connected to the latter; and coengageable pressure responsive means on said sensing unit and pressure applying means on the first mentioned lever arm for operating said sensing unit upon pivotal movement of said lever, said pressure means being aligned and movable substantially in the direction of arcuate movement of said pressure applying means; said pressure responsive means comprising a diaphragm and said pressure applying means comprising a pressure head contacting said diaphragm over substantially its entire operating area.

9. A weight indicator and anchor for a load sustaining line comprising: an elongated plate-like base adapted to be mounted on a support in a plane parallel with said line; a pair of ears extending laterally from one end portion of said base; a bell crank fulcrumed between its ends on said ears with the arms thereof extending generally in the direction of said line; a hydraulic load sensing unit including an actuating element having a surface exposed to the hydraulic fluid in said unit and a second surface in contact with one end of said bell crank; means mounting said unit adjacent the other end portion of said base; said end of said bell crank being parallel with said second surface; an anchor member adapted to have said line anchored thereto; and means mounting said anchor member on the other end of said bell crank.

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