May 15, 1928. 1,670,124

J. E. REED

WELL DRILLING APPARATUS

Filed Feb. 12, 1924

Fig. 1.

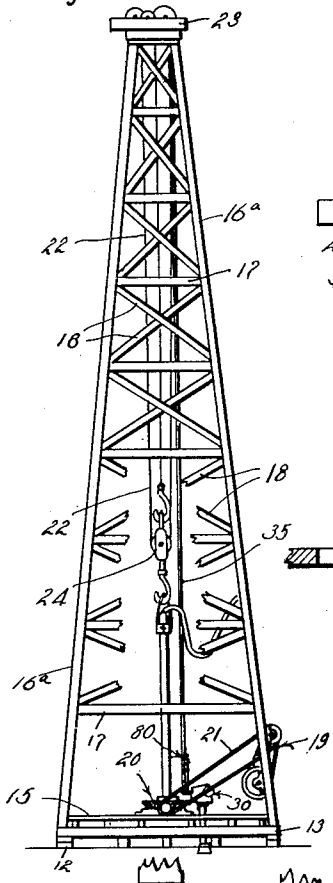


Fig. 2.

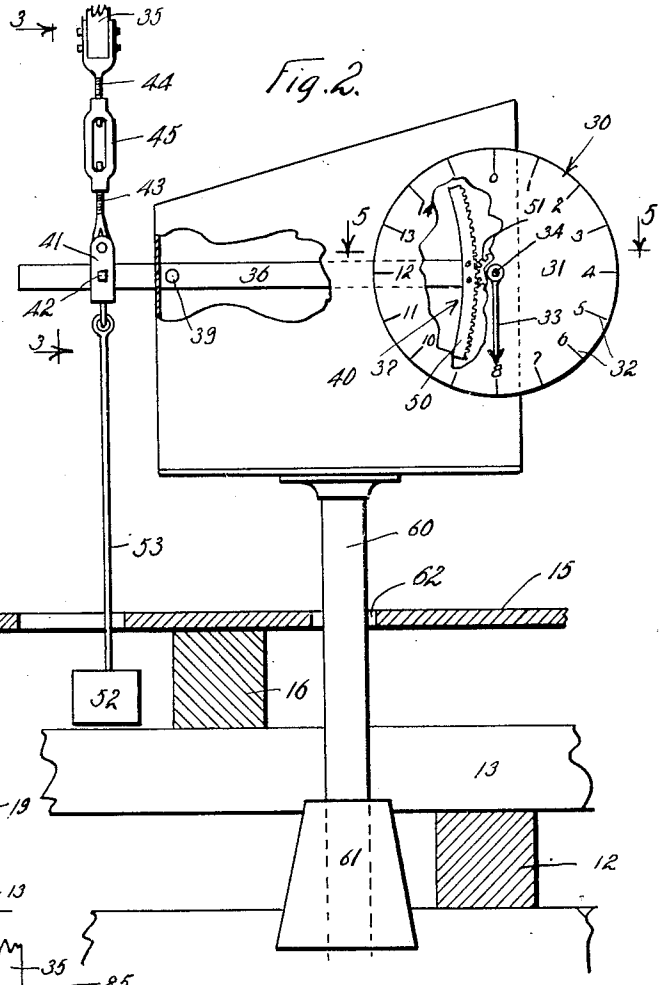


Fig. 3.

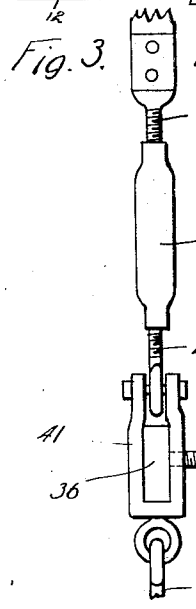


Fig. 4.

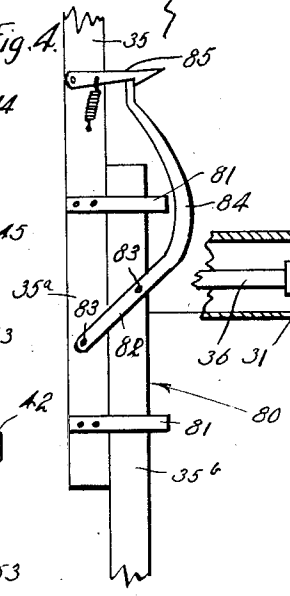
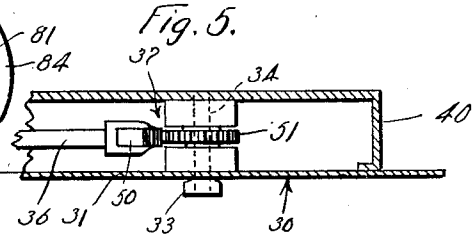


Fig. 5.



Inventor
John E. Reed
by W. W. Maxwell
his Attorney

Patented May 15, 1928. 1,670,124

UNITED STATES PATENT OFFICE.

JOHN E. REED, OF BREA, CALIFORNIA.

WELL-DRILLING APPARATUS.

Application filed February 12, 1924. Serial No. 692,206.

This invention relates to well drilling apparatus, and has particular reference to apparatus for indicating various conditions of a well drilling rig.

This application is a continuation of and substitution for my application entitled Scales for weighing drill pipe, filed October 21, 1922, Serial Number 595,933.

It is an object of this invention to provide a simple, accurate and reliable means for indicating various conditions of a rig.

Another object of this invention is to provide a simple, reliable and accurate means for indicating the load on a rig during operations, such as drilling, handling drill pipe, casing, or the like, fishing, etc.

Another object of this invention is to provide apparatus of the character herein described in the form of an attachment applicable to any ordinary well drilling rig.

The various objects and features of my present invention will be best and more fully understood from the following detailed description of a typical form application and carrying out of my invention, throughout which description reference is had to the accompanying drawings, in which:

Fig. 1 is a view showing an ordinary well drilling rig, including the present invention, some parts of the rig being broken away;

Fig. 2 is an enlarged detail sectional view taken in the rig, showing the parts provided by the present invention;

Fig. 3 is an enlarged detail view, taken as indicated by the line 3—3 on Fig. 2;

Fig. 4 is an enlarged view, showing the releasable joint in the connecting rod; and

Fig. 5 is an enlarged detail plan section, taken as indicated by the line 5—5 on Fig. 2.

For the purpose of facilitating a full and accurate understanding of my invention I have described a typical carrying out of my method and have illustrated in the drawings a simple form of my invention in combination with or as applied to a typical well drilling rig equipped to drill by the rotary method. It is to be distinctly understood, however, that the broader aspects of this invention do not contemplate that it be applied to or carried out in connection with a rig for drilling by any specific method or of any specific construction, so, therefore, the invention is not to be considered limited to the specific details and application herein set out.

The drilling rig that I have illustrated in the drawings includes an ordinary derrick of wooden construction. The derrick includes foundation posts 12, which support mud sills 13. The usual derrick floor 15 is mounted on floor sills 16, carried by the mud sills 13. The derrick structure above the floor includes the usual corner posts or cornices 16^a, spaced and braced by girths 17 and braces 18. The rig is equipped for drilling with the rotary method, and, therefore, includes a draw works 19, a rotary unit 20, and the various other apparatus incidental thereto. The rotary unit 20 is located on the derrick floor and includes a rotary table in alignment with the well and adapted to allow passage of casings, tools, etc., through it, and adapted to receive attachments whereby it will slidably carry and drive a drill stem or like tool, such as may be connected with a drill pipe, or the like. The rotary unit is driven from the draw works through the usual chain 21.

The drill pipe, casing, and various other parts and tools employed in drilling are usually handled by a cable 22. In accordance with standard practice the cable 22 is carried by a crown block 23, located at the top of the derrick, and supports a travelling block 24, to which the drill pipe, casing, tools, etc., are attached. One end of the cable extends downwardly from the crown block and is wrapped onto the drum of the draw works. The travelling block is moved up and down in the derrick to raise and lower the various objects that may be coneted to it by driving or releasing the drum of the draw works. With this arrangement the parts, for instance, casing, drilling tools, etc., that may be connected to the travelling block, are supported through the cable from the crown block or top of the derrick so that they put the derrick under compression. The compression strain put upon the derrick, in the manner just described, causes shortening or compression of the derrick, the exact amount of compression caused by any given load depending upon the construction of the derrick and the material out of which the derrick is built. The process provided by my invention will be fully understood from consideration of the following description of the apparatus and its application and manner of operation.

The present invention provides an indi-

cating device 30, and means connecting the indicating device with a part of the rig whereby movement of said part is indicated by the device. The indicating device may be of simple form, for instance, it may include a dial 31, having suitable graduations 32 on its face, and a hand 33 arranged to cooperate with the dial. In the drawings I have illustrated a circular dial 31 with the hand 33 carried on a centrally located shaft 34. In this particular case the dial is fixed on a stationary frame 40 and the hand movable with the shaft.

The means provided for connecting the rig or derrick with the indicating device may vary widely in form, arrangement and construction. It is, of course, desirable to connect the indicating device with a part of the rig which is moved a substantial amount when the rig is under the operating conditions that are to be indicated. When it is desired to indicate conditions, such as the load supported by the derrick, etc., it is desirable to connect with a part at the top or upper portion of the derrick as the top of the derrick has more movement than any other part when the derrick is put under compression strain through the rigging or block and tackle means including the cable, crown block, travelling block, etc. I will herein describe a form of my invention suitable for indicating the load upon the derrick applied through the block and tackle means, and, therefore, will describe a form of connecting means which connects the indicating device with the upper portion or top of the derrick.

The connecting means includes, in this case, a connecting rod 35, having one end connected with the top of the derrick, a pivotally mounted arm or beam 36, having one end connected with the other or lower end of the connecting rod, and a connection 37 between the other end of the beam and the indicating device whereby movement of the beam causes operation of the indicating device. The connecting rod 35 is securely and rigidly connected to the top of the derrick and is preferably formed of the same material as the derrick, or of a material or construction having the same coefficient of expansion as the derrick. The indicating device 30 is, as I will hereinafter describe, preferably located close to the derrick floor and preferably in the vicinity of the control levers of the draw works, so, therefore, the connecting rod extends downwardly from the top of the derrick to a point close to the derrick floor.

In the particular form of the invention illustrated in the drawings the beam 36 is carried on a pivot pin 39, located at a point between the ends of the beam. The pivot pin 39 is carried by the frame 40. The frame may be in the form of a housing which carries or encases certain parts of the mechanism. One end, which I will hereinafter term the outer end of the beam 36, is connected with the lower end of the connecting rod 35. The connection between the beam and rod is made adjustable so that the leverage between the rod and beam may be varied. The adjustability may, in practice, be carried out in various manners. In the form of the invention illustrated in the drawings this connection includes a block 41, slidably carried on the outer end of the beam and adapted to be set in the desired adjusted position by means of a set screw, or the like, 42. Screw threaded rods 43 and 44 are connected with the block and lower end of the connecting rod, respectively, and a turnbuckle 45 is provided to connect the rods. The threads on the rods are opposite so that rotation of the turnbuckle varies or adjusts the connection between the connecting rod and beam.

The connection 37, between the inner end of the beam 36 and the hand or movable part of the indicating device, may include a toothed segment 50, mounted on the beam to mesh and operate a gear 51 mounted on the shaft 34 that carries the hand 33. With this arrangement movement of the beam causes rotation of the gear and, therefore, operation of the shaft 34 and hand 33.

In accordance with my invention I provide means for keeping the apparatus thus far described free of slack or lost motion and under uniform strain. This means may include a counter-balance or weight 52 in connection with the beam. The weight may be connected to the outer end of the arm through the block 41 by means of a rod 53. It will be apparent that the weight keeps a uniform tension on the connecting rod and keeps lost motion out of the connection between the rod and beam.

The invention provides means whereby the indicating device may be disconnected or thrown out of operation. This means may be in the form of a releasable joint or connection 80 in the connecting rod. In the form of the invention shown in the drawings the connecting rod is constructed of two relatively movable sections, an upper section 35^a and a lower section 35^b. The sections 35^a and 35^b overlap near the lower end of the rod and are loosely guided by suitable straps 81. A link 82 is connected by swivel pins 83 to the overlapping parts of the sections 35^a and 35^b. The link is provided with an extension or handle 84 which, when in an in position, causes the link to hold the sections 35^a and 35^b together so that they will not move relative to each other. A spring latch 85 is provided to hold the handle in. When the handle is released the sections 35^a and 35^b can separate so that they are relatively movable and movement

of the upper section is not communicated to the lower section. This connection can be easily and quickly operated to release or connect the mechanism so that the indicating device is released or put into operation and does not in any way change or interfere with the adjustments hereinabove described. It is desirable to release the mechanism during some operations, for instance, when the rig is subjected to sudden and excessive strains such as might injure the indicating device.

It is desirable, of course, to locate the indicating device 30 at the lower part of the derrick, for instance, near the derrick floor, and in position near the control levers by which the rig is controlled. In accordance with my present invention the indicating device is mounted at and preferably in the derrick in a convenient position and independently of any part of the derrick. My present invention provides a support 60, for instance, in the form of a post, which carries the frame 40. The post may be mounted in a foundation 61, entirely independent of the derrick or other parts of the rig. If the indicating device is to be mounted in the rig, as I have illustrated in the drawings, the supporting post 60 may extend freely between the sills of the derrick and freely through a suitable opening 62 provided in the derrick floor. With this construction the indicating device is connected with the derrick only through the connecting means or operating connection hereinabove described, and, therefore, is not subjected to vibration and jarring from the rig and is in a fixed position and is not moved with or by the rig.

The apparatus which I have hereinabove described may be applied into a rig as a unitary and integral part thereof, or may be applied to a rig as an attachment. Further, the apparatus of my invention is obviously applicable to rigs of various types and forms of construction, for instance, to rigs having steel derricks as well as to those having wooden derricks.

From the foregoing description it is believed that the method and operation of the apparatus will be clearly and fully understood, and that it will be obvious how the apparatus is useful under numerous conditions and for indicating a wide variety of conditions of a rig. It will describe, for example, how the apparatus is useful in a typical and simple case. The apparatus is applied to the rig and the block 41 adjusted on the outer end of the beam so that the indicating hand 31 is actuated a definite amount by a certain load being put upon the derrick. For example, the apparatus may be adjusted as to leverage between the rod and beam so that the hand of the indicating device is moved one unit for each stand of drill pipe supported by the derrick. The turnbuckle 45 provides an adjustment between the hand and operating means whereby the hand can be adjusted to any desired part of the dial without changing the leverage of the apparatus. Stands of drill pipe connected to the travelling block in the usual manner will, as above pointed out, put the derrick under compression strain, and, therefore, cause downward movement of the top of the derrick. This movement is communicated, by means of the connecting rod 35, to the beam 36, which transmits it to the connection 37, which in turn communicates it to the hand 33. It will be apparent, therefore, that the hand will indicate the load upon the derrick, and if the apparatus is properly adjusted the indicating device will indicate directly the number of stands of drill pipe or other units carried by the derrick. With the indicating device thus indicating the load on the derrick the driller may determine at any time how many stands of drill pipe there are in the hole. Further, when drilling, and during other operations, the driller can determine from the indicating device the pressures or conditions under which the tools are operating. For instance, if there are ten stands of drill pipe in the hole the indicating device will indicate a certain amount, say, for instance, ten, and as the bit or cutting tool bears on the bottom of the hole the indicating device will retract, the amount of retraction depending upon the amount the bit is allowed to bear on the bottom of the hole. It is convenient, for instance, during drilling, for the driller to adjust the indicating device by means of the turnbuckle, so that the hand is at a given point, say, zero, when the load of the operating tools is on the derrick. With the indicating device thus set the pressure with which the bit is lowered against the bottom of the hole may be read directly from the zero mark on the dial.

Having described only a typical preferred form of my invention I do not wish to limit myself to the specific details hereinabove set forth but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims:

Having described my invention, I claim:

1. Apparatus for use in a well drilling rig including a derrick comprising an indicator to be located at the lower part of the derrick, and a connecting rod for operatively connecting the indicator with the upper part of the derrick, the connecting rod having a coefficient of expansion substantially the same as that of the derrick.

2. Apparatus for use in a well drilling rig including a derrick comprising an indicator to be located at the lower part of the derrick, a connecting rod for operatively

connecting the indicator with the upper part of the derrick, and means for maintaining the rod under tension.

3. Apparatus for use in a well drilling rig including a derrick comprising an indicator to be located at the lower part of the derrick, a connecting rod for operatively connecting the indicator with the upper part of the derrick, and a weight connected with the lower end of the rod.

4. Apparatus for use in a well drilling rig including a derrick comprising an indicator to be located at the lower part of the derrick, a connecting rod to be connected with the upper part of the derrick, connecting means for the rod and indicator, and a weight connected with the lower end of the rod through the connecting means.

5. Apparatus for use in a well drilling rig including a derrick comprising an indicator to be located at the lower part of the derrick, means for adjustably operatively connecting the indicator with the upper part of the derrick, and means for adjusting the indicator with relation to the upper part of the derrick independently of the adjustable operative connection.

6. Apparatus for use in a well drilling rig comprising an indicator, means for operatively connecting the indicator with a part of the rig, means whereby said connecting means can be adjusted to vary the operative relation between the indicator and said part of the rig, and means for adjusting the indicator with relation to said part of the rig.

7. Apparatus for use in a well drilling rig including a derrick comprising an indicator to be located at the lower part of the derrick, means for operatively connecting the indicator with the upper part of the derrick, and screw means for adjusting said connecting means to vary the operative relation between the upper part of the derrick and the indicator.

8. Apparatus for use in a well drilling rig including a derrick comprising an indicator to be located at the lower part of the derrick, means for operatively connecting the indicator with the upper part of the derrick, and means whereby the leverage of said connecting means can be adjusted.

9. Apparatus for use in a well drilling rig comprising an indicator, and means for operatively connecting a movable part of the rig with the indicator including, a pivotally mounted beam operatively connected with the indicator and a connecting rod connected with the beam and adapted to be connected to said part of the rig.

10. Apparatus for use in a well drilling rig comprising an indicator, means for operatively connecting the indicator with a movable part of the rig including, a pivoted beam operatively connected with the indicator and a connecting rod connected with the beam and adapted to be connected with said part of the rig, and means for adjusting the relationing between the indicator and said part of the rig.

11. Apparatus for use in a well drilling rig comprising an indicator, means for operatively connecting the indicator with a movable part of the rig including, a pivoted beam operatively connected with the indicator and a connecting rod connected with the beam and adapted to be connected with said part of the rig, and means for adjusting the connecting means to vary the operative relation between said part of the rig and the indicator said adjusting means including means for varying the leverage between the connecting rod and beam.

12. Apparatus for use in a well drilling rig comprising an indicator, means for operatively connecting the indicator with a movable part of the rig including, a pivoted beam operatively connected with the indicator and a connecting rod connected with the beam and adapted to be connected with said part of the rig, and means for adjusting the indicator with relation to said part of the rig, said adjusting means including means for adjusting the distance between said part of the rig and the point of connection between the beam and connecting rod.

13. Apparatus for use in a well drilling rig comprising an indicator, a connecting rod adapted to be connected with a movable part of the rig, a beam operatively connected with the indicator, and an adjustable operative connection between the rod and beam.

14. Apparatus for use in a well drilling rig including an indicator, a pivoted beam operatively connected with the indicator, a connecting rod connecting a movable part of the rig with the beam, and means for maintaining the rod under tension.

15. Apparatus for use in a well drilling rig including a derrick comprising an indicator to be located at the lower part of the derrick, a pivoted beam, a gear connection between the beam and indicator, a connecting rod attachable to the top of the derrick to extend downwardly to the lower part thereof, an adjustable connection between the beam and connecting rod, and a weight connected with the lower end of the rod through said adjustable connection.

16. In combination a well drilling rig, an indicator, a mounting for the indicator independent of the rig and supporting the indicator within the rig, and an operative connection between the indicator and a part of the rig, the mounting including a post having a foundation independent of the rig and having no connection with the rig.

17. In combination a well drilling rig including a derrick having a floor with an

opening in it, a post having a foundation independent of the rig and extending freely into the rig through the opening in the derrick floor, an indicator mounted on the post within the derrick, and an operative connection between the indicator and a part of the rig.

18. Apparatus of the character described comprising a beam fulcrumed between its ends, an indicator, means connecting the beam and indicator whereby the indicator is actuated by rocking of the beam, a part adjustably mounted on the beam, a connecting rod adjustably connected with said part and a weight connected with said part.

19. Apparatus of the character described comprising a dial, a hand movable to cooperate with the dial, a beam fulcrumed between its ends, gear means operatively connecting the beam with the hand, means for counter-balancing the beam, and a connection adapted to connect the beam with a well rigging substantially as described.

20. Apparatus of the character described comprising a frame, a beam fulcrumed on the frame, a dial supported by the frame, a rotatable shaft at the dial, a hand fixed on the shaft to cooperate with the dial, a pinion fixed on the shaft, a gear segment carried by the beam to cooperate with the pinion, a block adjustable longitudinally on the beam, a weight suspended from the block, and a connecting rod adjustably connected with the block.

21. Apparatus for use in a well drilling rig including a derrick comprising, an indicator to be located at the lower part of the derrick, means for releasably operatively connecting the indicator with the upper part of the derrick, and means for adjusting the relationing of the upper part of the derrick to the indicator.

22. Apparatus for use in a well drilling rig including a derrick comprising an indicator to be located at the lower part of the derrick, means for operatively connecting the indicator with the upper part of the derrick, a releasable connection in said connecting means, and means for adjusting the leverage of said connecting means with relation to the indicator.

23. Apparatus for use in a well drilling rig including an indicator, a pivoted beam operatively connected with the indicator, a connecting rod connecting a movable part of the rig with the beam, a releasable connection in the connecting rod, and means for maintaining the rod under tension.

In witness that I claim the foregoing I have hereunto subscribed my name this 30th day of Jan., 1924.

JOHN E. REED.