

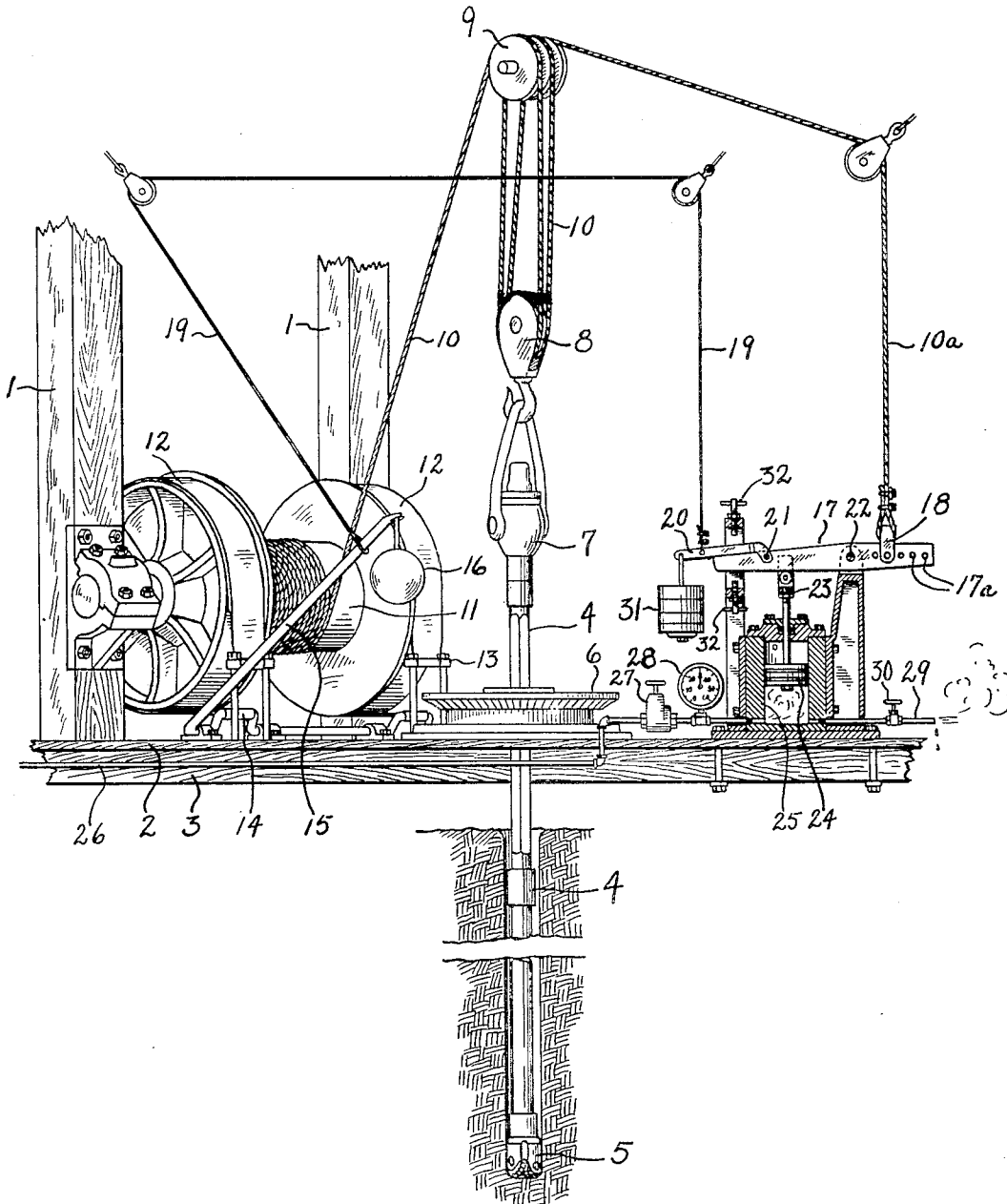
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WEIGHT REGULATOR AND INDICATOR

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WEIGHT REGULATOR AND INDICATOR

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This invention relates generally to deep well drilling apparatus and specifically to apparatus for indicating and regulating the pressure imparted to drill bits.

In deep well drilling, it is essential that certain pressures be applied to drill bits to insure efficient cutting of certain formations. The application of greater pressures must be prevented to avoid damage to the drilling apparatus.

The pressure on a drill bit is afforded by a heavy drill stem which comprises a plurality of pipe sections to the lowermost of which the drill bit is attached. The weight of a lengthy drill stem imparts a pressure to the bit much greater than can advantageously or even safely be used, under usual conditions, and it is now customary for the driller to repeatedly ascertain the weight of the stem by means of weight indicators and then manually so adjust the stem supporting mechanism that only the excessive part of the stem weight is thereby supported. The inconvenience and expense incident to this procedure are well known to drillers.

This invention has for its principal object the provision in well drilling apparatus of efficient means to automatically regulate the pressure upon drill bits.

Another of its objects is to provide a new and improved weight indicator.

The drawing is a fragmentary, partly sectional, and somewhat diagrammatical perspective view of a well drilling apparatus including the preferred embodiment of the invention.

The usual derrick frame is shown fragmentarily at 1; the floor, at 2; the sills, at 3. Through the floor 2 the drill stem 4 extends, the bit 5 being attached to the lower end thereof. The stem is rotated by the rotary 6 and supported by the swivel 7 which is hooked to the traveling block 8, the pulleys of said block being connected to the crown block pulleys 9 by the cable 10. It will be under-

stood that the crown block pulleys are shown at 9 for convenience in illustration, these pulleys ordinarily being supported by a crown block disposed in the upper end of the derrick frame. The cable 10, wound upon the drum 11, passes from said drum over the crown block pulleys 9 and the pulleys of the traveling block 8 in the usual manner. The outer end of said cable is indicated at 10^a and is commonly called the dead line. It is now the custom to attach the dead line to a rigid part of the derrick, usually the sill 3.

Rotation of the hoisting drum 11 is controlled by a brake which includes the bands 12 each of which has one end immovably connected to the derrick at 13, and the other end to one of the cranks 14 of the operating lever 15.

The apparatus above described is well known in the art. As the bit penetrates the formation, and the drill stem is permitted to descend, it is necessary for the driller to observe a weight indicator (not shown) and adjust the brake as often as necessary to permit the bit to carry only the proper part of the weight of the stem. Entertaining a well-founded aversion to standing continuously upon the derrick platform with an eye on an indicator and a hand on a brake lever, drillers have endeavored to automatically control the brake by placing a suitable weight on the brake lever. But the variable friction between the brake bands and the rims, and the vibration of the operating parts render this arrangement impractical.

This invention provides automatic and adjustable means adapted to be actuated by the weight of the drill stem and to actuate the brake lever, whereby the drill bit may be made to support only a predetermined part of the weight of the stem.

Its preferred embodiment includes the rocking beam 17 to which the dead line 10^a of the cable is attached by the member 18. The beam is thus operatively connected to the

drill stem. The beam is operatively connected to the brake lever 15 by the line 19 to which the link 20, pivoted to the beam at 21, is attached.

So the weight of the drill stem exerts a constant upward pull on the dead line 10^a, and if this pull is not resisted, the beam 17 will be rotated in an anti-clockwise direction to exert a downward pull on the line 19 and thereby pull up the brake lever 15 to release the cable 10. The upward pull on the dead line 10^a may be resisted, and the weight of the stem or any part thereof, therefore supported, by means which will now be described.

A piston rod 23, bearing against the beam on the opposite side of the fulcrum 22, extends upwardly from the piston 24, which is reciprocable in the cylinder 25, and is energized by steam supplied through the pipe 26 from the usual boiler (not shown) forming a part of the drilling equipment. The pressure of the steam in the usual boiler is much greater than is needed in the cylinder 25. An adjustable reduction valve 27 in the pipe 26 automatically regulates the pressure of steam in the cylinder 25, said pressure being indicated by a pressure gage 28. Drainage of condensed vapors is permitted by the pipe 29 having a needle valve 30 therein.

Some of the respective functions of the elements just described will appear in the following brief outline of a manner in which the apparatus may be used.

The drill stem may at first be entirely supported by the cable 10, and the reduction valve so adjusted that the pressure of steam in the cylinder 25 will move the piston 24 and its rod 23 upwardly to rotate the beam 17 in a clockwise direction to a substantially horizontal position, thereby overcoming the resistance offered by the weight of the drill stem communicated through the dead line 10^a.

The steam pressure required to thus effect the equilibrium of the beam 17 will actuate the pointer of the pressure gage 28, and said gage can be so calibrated that it will indicate the weight of the drill stem. Calibration of said gage may easily be effected. It will depend, of course, upon the number of lines between the traveling block 8 and the crown block 9, and the distance between the member 18 and the fulcrum 22, and between the fulcrum 22 and the piston rod 23. In the apparatus disclosed by the accompanying drawings, the upward pull on the dead line 10^a will be practically $\frac{1}{4}$ of the downward pull on the traveling block 8. The beam 17 may be provided with a plurality of openings 17^a adapted to receive the pin of the member 18, so that the member 18 may be moved outwardly from the fulcrum 22 when the number of lines between the traveling block and the crown block 9 are increased.

The brake may then manually be released

to permit descent of the stem until the bit 5 comes in contact with the bottom of the hole. The driller, after deciding upon the amount of pressure he wishes to put upon the bit, may then so adjust the reduction valve 27, that the steam pressure in cylinder 25 will be reduced a predetermined amount. When the steam is so reduced, the beam 17 will swing in an anti-clockwise direction, pulling the line 19 downwardly and releasing the brake by moving the lever upwardly. The pressure gage 28 will indicate the amount of weight then carried by the traveling block 8. The weight supported by the bit 5 will then be equal to the original weight indicated, minus the weight indicated after the reduction of the steam pressure.

When the desired part of the weight of the drill stem is supported by the drill bit 5, the upward pull on the dead line 10^a will be so reduced that the steam pressure within the cylinder 25 will move the piston 24 and rod 23 upwardly to swing the beam 17 into a substantially horizontal position, thereby permitting the line 19 to release the brake lever 15, so that the weight 16 will swing said lever downwardly and apply the brake.

By the means described, the traveling block 8 will automatically be made to support no more than the desired part of the weight of the drill stem, the remainder of the said weight being supported by the drill bit 5.

It will be understood that when the drill bit 5 penetrates the formation it will temporarily cease to support its part of the weight of the drill stem, whereupon said part will be added to the weight supported by the traveling block 8, the pull on the dead line 10^a will increase, the beam 17 will be rotated in an anti-clockwise direction, and the brake released to permit further descent of the drill stem. When the drill stem descends and the drill bit 5 comes into contact with the bottom of the hole, and supports its part of the weight of the drill stem, the upward pull of the dead line 10^a will again be reduced and the beam will swing in a clockwise direction to apply the brake and prevent an overload on the drill bit.

Should the brake bands become loose and permit objectionable release of the cable 10, the upward pull on the dead line 10^a will be reduced, the beam 17 rotated in a clockwise direction so that the line 19 will permit the weight 16 to swing the lever 15 downwardly. The brake bands will thereby be tightened automatically.

Should the brake bands become stuck, the upward pull on the dead line 10^a will be increased, whereupon the beam will rotate in an anti-clockwise direction and pull the line 19 downwardly to move the brake lever 15 upwardly. The brake bands will thereby be released automatically.

In view of the automatic tightening and

releasing of the brake bands referred to in the two paragraphs immediately preceding, vibration of the parts of the drilling equipment cannot impair the efficient operation of the apparatus.

Should the driller desire to manually apply the brake after it has been automatically released by the means above described, it would be necessary for him to disconnect the line 19 were it not for the lever 20 pivoted to the beam 17 at 21. This lever has a weight 31 which is greater than the weight 16 and is therefore normally in the position shown in the drawing. The driller may manually move the lever 15 downwardly thereby overcoming the resistance of the weight 31 and swinging the lever 20 upwardly on its pivot 21 to permit the necessary movement of the line 19.

The rocking of the beam 17 may be limited by suitable set screws 32.

The needle valve 30, hereinabove referred to, may obviously be so adjusted that the downward movement of the piston 24 within the cylinder 25 will be either rapid or slow. Downward movement of the piston compresses the steam, and its speed of descent will be dependent upon the amount of steam permitted to escape through pipe 29. The adjustment of valve 30 just referred to, will be found particularly useful when certain formations are encountered in which the bit "jumps", as the apparatus may be rendered slow-acting in its application of pressure to the bit.

Various mechanical equivalents of the apparatus will at once occur to those skilled in the art. For example, variable weights may be substituted for steam pressure. The use of steam pressure, however, is preferred for the reason that it is available in the drilling equipment now in common use. It provides great power, the accurate control of which may easily be effected to render the apparatus sensitive or slow-acting. It may be used in a cheaply constructed mechanism adapted to endure the rough treatment to which all apparatus is subjected on the drilling field.

Aside from its use as an automatic weight regulator the apparatus disclosed in the drawing will be useful as a weight indicator. Water may be introduced into the cylinder 25, and the valves 27 and 30 closed. The downward force exerted by the piston 25 will actuate the pressure gage 28, and the gage 28, properly adjusted, will accurately indicate the weight of the drill stem, casing or other element supported by the traveling block 8.

As hereinabove suggested, this invention is not limited to the preferred embodiment shown, and various changes therein may be made within the scope of the following claims.

I claim:

1. In an apparatus of the character described, the combination with a drum, a brake for said drum, and a load-supporting cable on said drum, of an automatic brake actuator to which said cable and brake are operatively connected.

2. In an apparatus of the character described, the combination with a drum, a brake for said drum, a crown block, a traveling block adapted to be attached to a load and a cable extending from said drum and through said blocks, of an automatic brake actuator attached to the dead line of said cable and operatively connected to said brake.

3. In an apparatus of the character described, the combination with a drum, a brake for said drum, and a load-supporting cable on said drum, of a pivoted beam, said cable being attached to said beam to rotate it in one direction, and means to rotate said beam in the opposite direction, said beam being operatively connected to said brake.

4. In an apparatus of the character described, the combination with a drum, a brake for said drum, and a load-supporting cable on said drum, of a pivoted beam, said cable being attached to said beam to rotate it in one direction, and variable means to rotate said beam in the opposite direction, said beam being operatively connected to said brake.

5. In an apparatus of the character described, the combination with a drum, a brake for said drum, a crown block, a traveling block adapted to be attached to a load, and a cable extending from said drum and through said blocks, of a pivoted beam, adjustable means to so attach said cable to said beam that said cable will rotate said beam in one direction, and means to rotate said beam in the opposite direction, said beam being operatively connected to said brake.

6. In an apparatus of the character described, the combination with a drum, a brake for said drum, and a load-supporting cable on said drum, of an automatic brake actuator to which said cable and brake are connected, and a device interposed between said actuator and said brake, said device being manually movable to permit the operation of said brake independently of said actuator.

7. In an apparatus of the character described, the combination with a drum, a brake for said drum, and a load-supporting cable on said drum, of a beam, said cable being attached to said beam to rotate it in one direction, means to rotate the beam in the other direction, a line to connect said beam to said brake, and a lever pivoted to said beam and connecting said beam and said line, said lever being manually movable to permit operation of said brake independently of said beam.

8. In an apparatus of the character described, the combination with a drum, a brake

for said drum, and a load-supporting cable
on said drum, of an automatic brake actuator
having a beam, said cable being connected to
said beam to rotate it in one direction, a cylin-
5 der, a piston in said cylinder and operatively
connected to said beam to rotate it in the
other direction, a fluid pipe communicating
with said cylinder, and a reduction valve in
said pipe.

10 In testimony whereof, I hereunto affix my
signature.

GUY E. BEHNKE.

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