Aug. 14, 1951 J. H. WILSON 2,564,457

SAFETY DEVICE FOR DRILLING RIGS

Filed June 25, 1948 3 Sheets-Sheet 1

Fig. 1

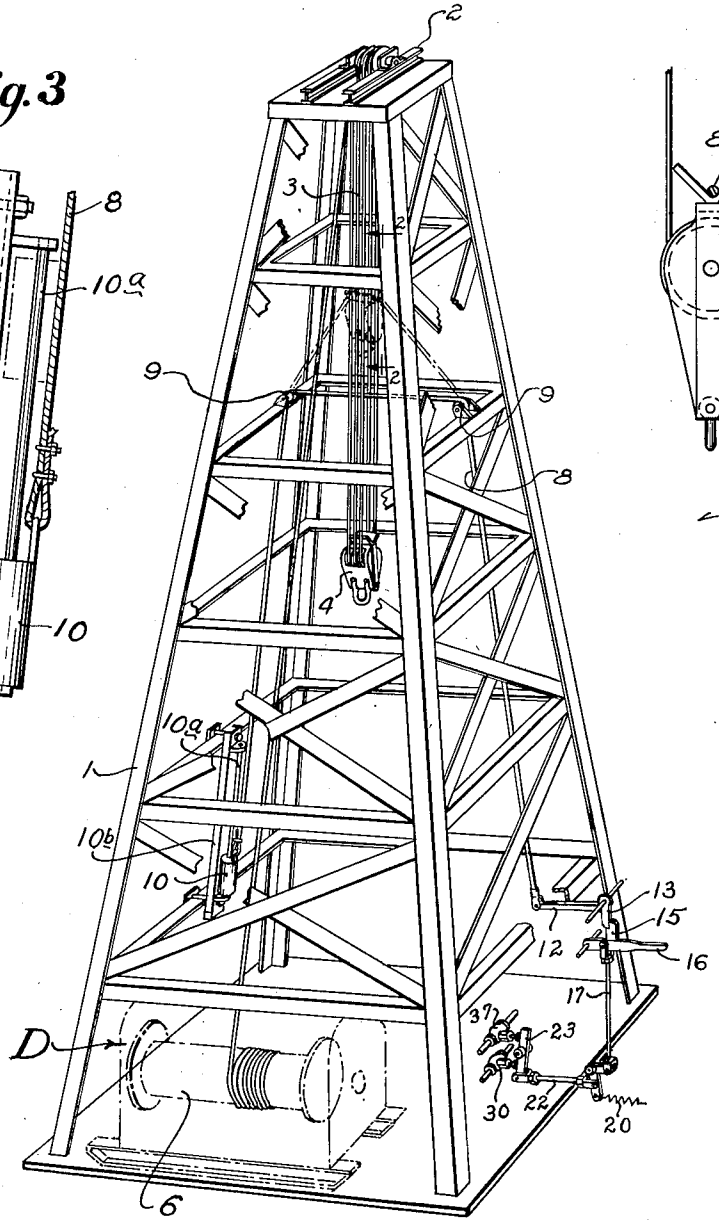
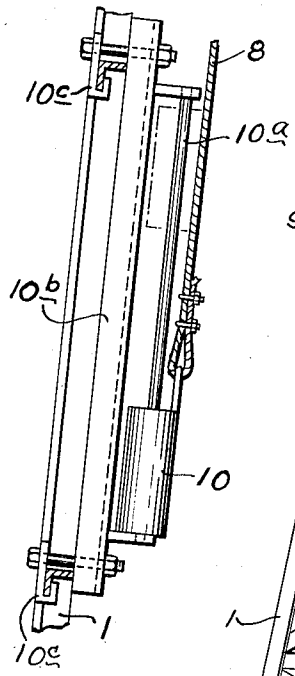


Fig. 3



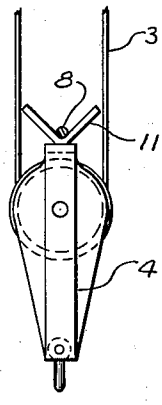


Fig. 2

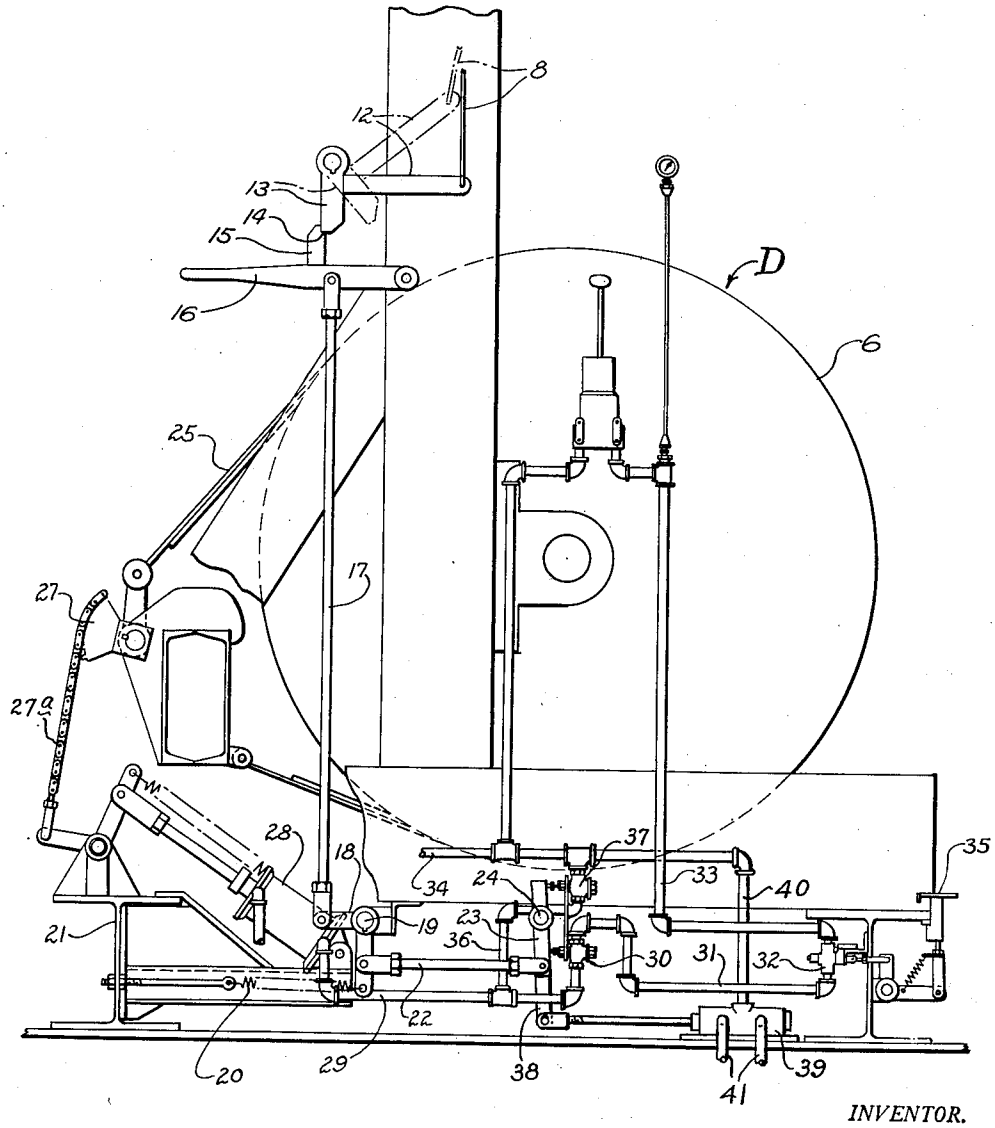
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Aug. 14, 1951 J. H. WILSON 2,564,457

SAFETY DEVICE FOR DRILLING RIGS

Filed June 25, 1948 3 Sheets-Sheet 2

Fig. 4



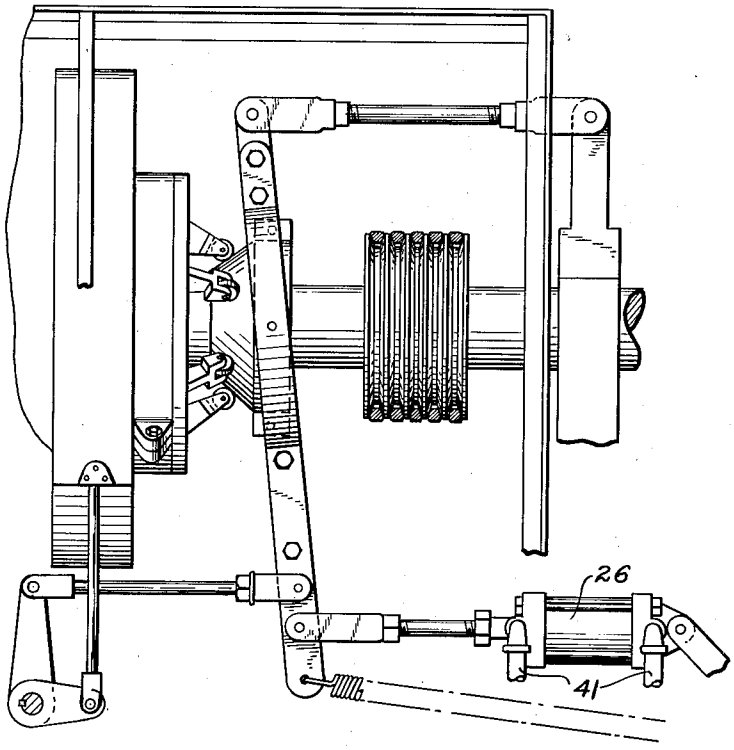
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Filed June 25, 1948 3 Sheets-Sheet 3

Fig. 5



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SAFETY DEVICE FOR DRILLING RIGS

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Application June 25, 1948, Serial No. 35,239

2 Claims. (Cl. 254—145)

1

This invention relates to improvements in safety devices for draw works and particularly to draw works adapted for use on well drilling rigs of the rotary type.

Well drilling apparatus of the rotary type ordinarily includes a rotary table for rotating the drill stem in the well. The drill stem is suspended by a traveling block supported by a number of leads of a cable which cable passes over the crown block at the top of the derrick, with one line passing downward to the drum of the draw works. Due to the height of the derrick on which the traveling block is used for withdrawing the drill stem and pipe from a well, it is necessary to raise the traveling block at high speed, so as to make rapid progress in the drilling operation. However, several dangers are ever present while the traveling block is being raised at high speed, either with or without pipe being connected thereto. Workmen necessarily have to be in the derrick while the traveling block is being raised, and if during this process, the traveling block hits the sheaves of the crown block, this frequently results in the breaking of the cable or in "pulling" the derrick in, with possible injury or loss of life to the workmen as result thereof, as well as much damage to the derrick and to the drilling rig, and if pipe is dropped into the well, the loss of the well may result.

The stopping of the traveling block short of the crown block, has, heretofore, been the responsibility of the operator or driller of the rotary rig. Sometimes the distance the traveling block travels before contacting the crown block is very short and necessitates the use of very careful judgment of distance with the traveling block passing up at very high speed, and the driller could not always exercise sufficiently precise judgment.

Such safety devices as have been proposed heretofore have not been adequate due to the high speed at which the traveling block travels upward, and due to the lack of flexibility and yieldability which is necessary for the successful operation of a device for stopping the travel of a traveling block within a given distance.

The primary object of this invention is to improve the construction of the drilling apparatus by providing a safety device with a yieldable line which will move in response to the movement of the traveling block and which will yield readily to action thereon by the traveling block and line without causing damage to the rig or other equipment, if the stopping of the draw works is not instantaneous.

2

Another object of the invention is to improve the control on the traveling block and draw works by the automatic actuation of the brake and clutch thereof, which parts are responsive to a resilient safety device mounted on the derrick to cause the traveling block to stop within a predetermined distance of travel.

These objects may be accomplished, according to the embodiment of the invention as illustrated in the accompanying drawings, by the provision of a cable passing transversely across the derrick above the traveling block and between the block lines that support the traveling block so that the transverse line will be engaged by the traveling block as it moves upward in the derrick above a predetermined point. The engagement of the transverse cable by the traveling block will actuate the control mechanism of the brake and clutch of the draw works to cause the latter to respond thereto.

The transverse cable that passes above the traveling block is connected with pneumatic controls that actuate the brake and disengage the clutch upon the engagement of the transverse line by the traveling block. Thus the draw works will be brought to a stop within the predetermined limits of travel of the traveling block so as to cause no undue shock on the rig. Any desired range of stop may be provided for, from instantaneous to the maximum travel accorded by the weight attached to the transverse cable.

This embodiment of the invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view of a derrick, showing the invention applied thereto;

Fig. 2 is a side elevational view of a traveling block and the lines associated therewith, with the safety cable shown in section;

Fig. 3 is a fragmentary view of a portion of a derrick, partly in section, showing the weight and weight guide member attached thereto;

Fig. 4 is a diagrammatic side elevation showing the controls actuated by the safety cable;

Fig. 5 is a side elevation of a master clutch.

The invention is shown as applied to a rotary drilling rig which comprises a derrick 1 and a conventional draw works generally designated at D. The derrick 1 has mounted at the top thereof, in the usual manner, a conventional crown block 2 for supporting line 3 which extends downward from the crown block 2 in multiple loops, in which the traveling block 4 is suspended for supporting the drill stem or pipe during the raising and lowering operation thereof while drilling a well. The drill stem is rotated by the

conventional rotary table (not shown), which rotary table is usually driven by the draw works D mounted on the floor at the base of the derrick 1. The draw works D includes a drum 6 upon which a cable is wound to raise and lower the traveling block 4, as shown in Figs. 1 and 4. The line 3 is attached to the drum 6 which is generally known as the "fast line," and which is adapted to raise and lower the traveling block in response to the rotation of the drum 6.

Extending transversely through the derrick 1 is a safety cable or flexible device 8 passing over pulleys 9 on opposite sides of the derrick and supporting a weight 10 on one end thereof. The weight 10 is guided on a rod 10*a* spaced from but secured to frame 10*b*, which frame is clamped to the derrick by means of clamps 10*c*. By having the weight 10 so positioned and guided by the rod 10*a*, the transverse cable 8 is relieved of the weight 10 until such time as the safety device is brought into action. The frame 10*b* restrains the weight 10 against falling, in event the cable 8 becomes broken. This safety cable 8 extends through the loops in the line 3 and is disposed directly over a V-yoke 11 secured to the top of the traveling block 4, as shown in Fig. 2. Thus the line 8 is in a position to be engaged by the yoke 11, as the traveling block moves upward in the derrick 1 and to be moved thereby from the full-line position in Fig. 1 to the dotted-line position therein, the yoke 11 insuring engagement of the safety line 8 by the traveling block and causing it to move in response thereto. Normally the movement of the cable 8 would be much less than that shown in the drawings, which is somewhat exaggerated for the purpose of illustration.

The cable 8 may be formed of any suitable material, although a wire line is the most satisfactory for the purpose. However, it may be of non-metallic material, if desired, and will function satisfactorily to control the operation of the draw works as hereinafter described.

The line 8 extends along the derrick substantially to the bottom thereof, where its lower end is attached to an arm 12 mounted on a lever 13 and cooperating with the latter to form substantially a bell crank. The lower end of the lever 13 engages a notch 14 formed in one side of a lug 15 secured to an operating lever 16.

A connecting rod 17 extends downwardly from the lever 16 in the form illustrated in Fig. 4, and is connected at its lower end to an arm of the bell crank lever generally indicated at 18, which bell crank lever is pivotally mounted at 19. The other arm of the bell crank lever 18 has a spring 20 connected to its extreme lower end, and normally tending to swing the bell crank lever 18 in a clockwise direction, as viewed in Fig. 4. The opposite end of the spring 20 is anchored to a part of the frame 21 of the draw works.

Also connected with the depending arm of the bell crank lever 18 is a connecting rod 22 which extends therefrom to one end of a lever 23 pivotally mounted on a shaft 24, this lever being fixed to the shaft and movable about the axis thereof.

The draw works, generally designated in the drawing as D, include a pneumatic power brake, generally indicated at 25, which brake is applied to retard the movement of or to stop the drum. The entire draw works is controlled by a master clutch which is regulated by the pneumatic control device generally designated at 26. These elements are adapted to be controlled by the engagement of the safety line 8.

The brake 25 is illustrated as controlled by a segment 27 of a gear which is connected with a pneumatic power device 28, by a chain 27*a*. Air is supplied to the pneumatic power device 28 through a line 29 extending to a valve 30, thence through a line 31 which has a valve 32 therein. The opposite side of the valve 32 is connected through a line 33 with a main air source of supply under pressure, as indicated at 34. The valve 32 is adapted to be manually controlled by the control device generally indicated at 35.

Also connected with the source of air supply 34, is a branch line 36 which contains a control valve 37 therein and which branch line 36 leads to the line 29 and may connect therethrough to the pneumatic power device 28. The valve 37 is adapted to be closed alternately with the valve 30, for which purpose the lever 23 engages the valve stem of the valve 37 at one side of its pivotal axis, while it engages the valve stem of the valve 30 at the opposite side of the axis thereof, so that the lever 23 will cause an opening of one valve simultaneously with the closing of the other.

Also mounted on the shaft 24 is a control arm 38 connected with a control valve 39 which has an air line 40 connected with one side thereof and leading from the main source of air supply, as indicated at 34. The valve 39 is connected also through lines 41 with the air cylinder that regulates the master clutch, which is indicated at 26 in Fig. 5. The valve 39 is adapted to supply air to the master cylinder 26 for regulating the position of the master clutch.

In the operation of the control system, it will be evident that the upward movement of the traveling block 4 and loops 3, which support the traveling block, will cause the yoke 11 to engage the safety cable 8 and move it upward from its normally stretched position in bridging relation between the pulleys 9, and tend to deflect this safety cable 8 out of its normal position. The safety cable 8 has a weight 10 positioned on the opposite end to that connected to the draw works control lever 12. This weight is adapted to be lifted when the traveling block 4 engages transverse safety cable 8, which permits the traveling block to move upward several feet, while allowing the brakes to be applied gradually so as to prevent undue shock, which would be the result if the traveling block were stopped instantaneously upon contacting the cable 8. This pulling action applied to the cable 8 will lift the outer end of the arm 12, shown in Fig. 4, and cause an upward swinging movement of the lever 13, which forms a safety catch, disengaging the latter from the notch 14. When thus released, the lever 16 may move upward in response to the tension of the spring 20 acting on the depending arm 18 that is connected therewith through the bell crank 18 and the connecting rod 17. Normally, these parts are held in the positions shown in Fig. 4 when the latch 13 engages the lug 15 on the lever 16.

This releasing movement of the lever 16, as described, will move the connecting rod 22 toward the left in Fig. 4, which, thereby, will swing the lever 23 in a clockwise direction. The effect of this will be to close the control valve 30 and to open the valve 37. This will admit air from the supply line 34 through the branch line 36 to the power device 28 in a direction tending to actuate

the latter to apply the brake 25, thus causing the stopping action of the drum 6.

Simultaneously with the application of the brake to the drum 6, the rotation of the shaft 24 will swing the arm 38 to move the valve 39 for opening the latter to permit the air to the power device 26 in a direction to release the clutch of the draw works, thereby stopping the application of power thereto and allowing full effect of the brake 25 to be applied to stop the motion of the draw works and of the drum.

These parts will respond readily and quickly to the movement of the safety cable 8, because of the use of air power devices that are controlled thereby. Thus instant response to the actuation of the safety device is to be had in controlling the action of the draw works. Therefore, it will be controlled effectively without danger of injury or damage to the equipment or to the workmen.

While the invention has been illustrated and described in one embodiment, it is recognized that variations and changes may be made therein without departing from the invention except as specified in the claims.

I claim:

1. In a well drilling apparatus, a derrick, a draw works having a hoist for raising and lowering a traveling block, a clutch and a brake for controlling the operation of said hoist, a valve for controlling said clutch and brake, and a lever pivotally secured near the lower end of the derrick for actuating said valve, sheaves at the upper end of said derrick, a traveling block suspended within said derrick, a line suitably connecting said hoist, said sheaves, and said block for raising and lowering the block, a transverse cable positioned across said derrick at a point spaced downwardly from the top thereof and in the path of movement of said block, a guide member positioned on the upper end of said traveling block to guide the transverse cable thereinto upon upward movement of said traveling block beyond a predetermined safety point, one end of said cable being attached to a vertically movable weight, a frame receiving said weight and confining it to its vertical path of movement, means for removably and selectively securing said weight-carrying frame to said derrick, the other end of said cable extending down a side of the derrick, and means operatively connecting said other end of the cable with said lever, whereby the movement of said traveling block may be arrested within the length of the yieldability of said transverse cable.

2. In a well drilling apparatus a derrick having girts, a traveling block, a draw works having a hoist for raising and lowering the traveling block, which hoist includes winding means, power means, a clutch for connecting and disconnecting said power means and said winding means, a brake for said winding means, fluid pressure means for operating said clutch and said brake, valves controlling the application of said fluid pressure means to said clutch and brake, and a pivotally mounted lever operatively connected with said valves to apply the brake and release the clutch when moved in a given direction, sheaves at the upper end of said derrick, said traveling block being suspended within said derrick, a line suitably connecting said winding means, said sheaves, and said block for raising and lowering the block, a transverse cable positioned across said derrick and spaced downwardly from the top thereof and in the path of movement of said block, a guide member positioned on the upper end of said traveling block to guide said transverse cable thereinto upon upward movement of said traveling block beyond a predetermined safety point, one end of said cable being attached to a movable weight positioned on a frame that may be selectively secured to a pair of derrick girts within the length of said derrick, means for removably securing said weight-carrying frame to said girts, the other end of said transverse cable extending down a side of said derrick, and means for operatively connecting said other end of the cable with said lever to swing the latter in said given direction so as to arrest the movement of said traveling block within the length of the yieldability of said transverse cable.

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