

Nov. 21, 1950

R. A. GUND
SAFETY SWITCH

2,530,461

Filed Aug. 31, 1948

2 Sheets-Sheet 1

FIG. 1

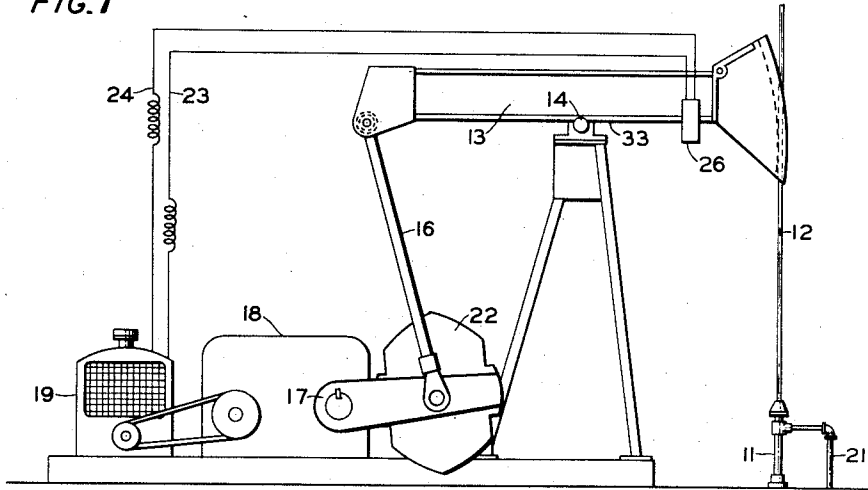
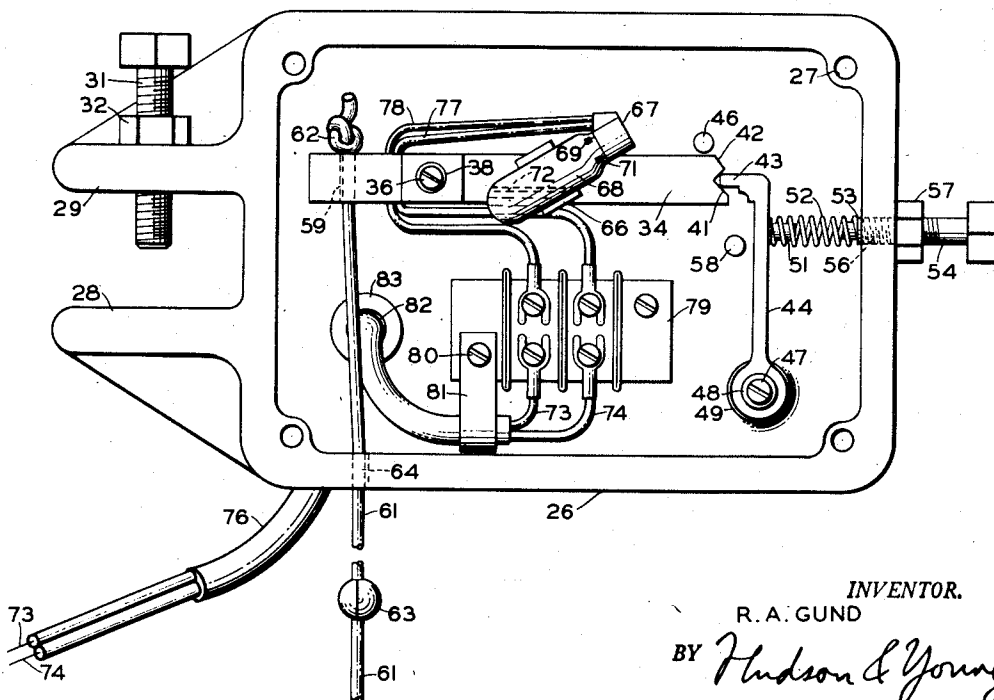


FIG. 2



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FIG. 3

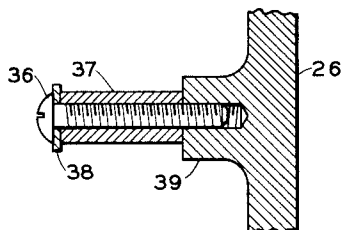


FIG. 4

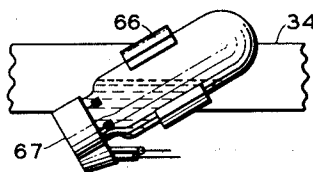


FIG. 5

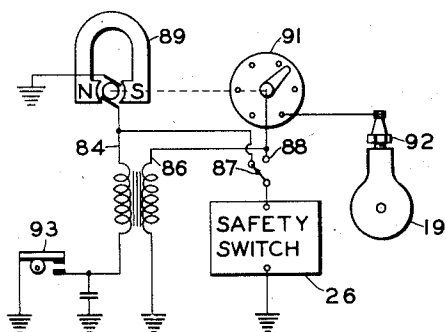


FIG. 6

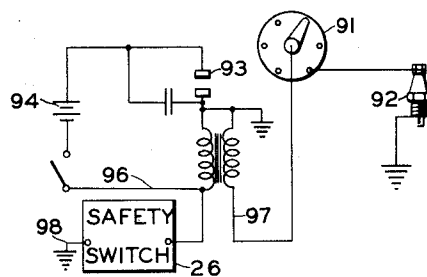


FIG. 7

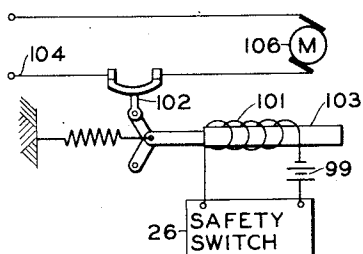
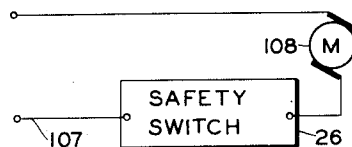


FIG. 8



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SAFETY SWITCH

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5 Claims. (Cl. 200—52)

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This invention relates to a safety switch. In one specific aspect it relates to a safety switch for a walking beam. Another aspect of the invention is that it relates to switches actuated by acceleration of the switch housing of a predetermined magnitude and operating by inertia of part of the switch.

There are numerous applications where it is desirable to have a safety switch mounted on a moving piece of machinery so that machinery may be stopped in case it runs wild.

In the art of pumping oil wells by means of a pump at the bottom of the well actuated by a string of sucker rods, the sucker rods being moved up and down by a walking beam, it is very important to stop the actuation of the walking beam when anything goes wrong, especially if the string of sucker rods breaks. In many instances, the well is located at a remote point and is only visited by an operator once a day. Therefore, if anything goes wrong a considerable amount of destruction can occur before the return of the operator. Also as the pumping device is in balance when a long string of sucker rods and a heavy column of oil being pumped is supported, obviously the device will be entirely off balance when the rod string breaks and no oil is being pumped. The walking beam unit will tear itself to pieces under such conditions if allowed to continue to run.

One object of the present invention, therefore, is to provide a system including a switch for stopping the walking beam when the rod line breaks.

Another object is to provide a rugged, simple, and efficient switch for such an installation.

Further object is to provide such a switch which may be readily attached to a portion of the walking beam or other similar reciprocating or oscillating element of a machine.

Another object is to provide a switch which is actuated by a predetermined acceleration of its housing and which may be reset by the operator in a single operation.

Numerous other objects and advantages will be apparent to those skilled in the art upon reading the accompanying specification, claims and drawings.

In the drawings

Figure 1 is an elevational view of a walking beam oil well pump embodying the present invention.

Figure 2 is an elevational view with the cover removed of a switch embodying the present invention and adapted to be used in the structure shown in Figure 1 and in similar situations.

Figure 3 is a cross-sectional view of a fragmentary portion of Figure 2 showing details of construction.

Figure 4 is an elevational view of a portion of Figure 2 showing how the mercury switch may be reversed in its position so as to furnish a contact-breaking switch instead of a contact-making switch.

Figure 5 is a wiring diagram showing how the primary or secondary of a magneto ignition system may be grounded by a safety switch of the type shown in Figure 2.

Figure 6 is a wiring diagram similar to Figure 5 showing how a battery ignition system may be grounded by the switch of Figure 2.

Figure 7 is a wiring diagram showing how the safety switch of Figure 2 may be employed to actuate a circuit breaker when the prime mover of the walking beam is an electric motor.

Figure 8 is a wiring diagram showing how the safety switch of Figure 4 may be employed to directly interrupt the source of electric power when the prime mover of the walking beam is an electric motor.

In Figure 1 an oil well 11 is being pumped by a pump (not shown) in the bottom of the well actuated by a string of sucker rods 12. The sucker rods 12 are moved up and down by a walking beam 13 pivoted on a supporting structure 14 and actuated by a pitman 15 driven by a crank 17 operated by gears in gear box 18 driven by internal combustion engine 19.

As such internal combustion engine driven walking beam pumping units are old, no description of the component parts will be made, except to state that during normal operation the sucker rod 12 and the column of oil in well 11 being moved by sucker rod 12 into flow line 21 has considerable weight and this weight is balanced on pivot 14 by a counterweight 22.

The internal combustion engine 19 has an ignition system and an electrical circuit comprising wires 23 and 24, and a switch (shown in Figure 2) completes this circuit inside housing 26.

The details of the preferred form of the switch inside of housing 26 are shown in Figure 2.

The housing 26 may be provided with a cover (not shown) which may be secured by any suitable means such as screws in holes 27. Housing 26 is also preferably provided with a bifurcated portion comprising lugs 28 and 29 which are adapted to engage a portion of the walking beam or other reciprocating or oscillating member by means of a set screw 31 which may be provided with a lock nut 32. As will be apparent in Figure

1, the walking beam 13 is generally provided with some element such as flange 33 which may be engaged by the bifurcated portions 28 and 29. Wires 23 and 24 of Figure 1 are integral with, or are connected to, wires 73 and 74 respectively of Figure 2.

A combined weight, switch actuating, and reset member 34 is pivoted to the housing by and rotates around the axis of screw 36.

As shown in Figure 3 screw 36 may be provided with an anti-friction sleeve 37 and a washer 38 for preventing displacement of member 34. Housing 23 may also be provided with a boss, or raised portion, 39, spacing member 34 out of frictional engagement with the wall of housing 26. The construction of Figure 3 is preferable in that better or more uniform results are obtained especially in instances where the switch has not operated over a long period of time. One of these switches when mounted on a walking beam might not be called on to operate for as much as a year, but when the time to operate comes it is very important that satisfactory operation occurs as otherwise valuable machinery, and perhaps even a valuable oil well, may be completely ruined.

Member, or arm, 34 comprises a weighted portion as obviously that portion of arm 34 which lies to the right of the axis of screw 36 is much heavier than that portion lying to the left of said axis. Arm 34 has a notch 41 formed in the free end thereof and is preferably also formed with a bevel 42. The functions of notch 41 and bevel 42 will be discussed below under the operation of the device, but it will be noted that notch 41 is receiving the end 43 of a latch member 44. Further upward movement of any substantial nature by the notch end of arm 34 is prevented by an outstanding pin or boss 46 which is mounted on or is an integral part of housing 26.

Latch 44 is pivoted for rotation around the axis of screw 47. Screw 47 is preferably constructed in the same manner as screw 36 as shown in Figure 3, washer 48 corresponds to washer 38, boss 49 corresponds to boss 39, and preferably an anti-friction sleeve (not shown) corresponding to sleeve 37 is also provided. The corresponding parts have the same functions.

Latch 44 is provided with a suitable spring engaging means 51 shown in the drawing as a boss formed integral with latch 44. Latch 44 in a position shown in Figure 2 is being urged into engagement with notch 41 by a biasing means preferably comprising a helical compression spring 52. The other end of spring 52 is mounted on an adjustable spring mounting 53 preferably formed in the end of a set screw 54. Set screw 54 is threaded through housing 26 and engages threads 56 in said housing so that by rotating set screw 54 spring support 53 may be moved to the right or left thereby varying the compressive force of spring 52 as will be explained when discussing the operation of the device. A lock nut 57 is preferably provided to fasten set screw 54 in adjusted position. When latch 44 is not engaging notch 41 any substantial counterclockwise rotation of latch 44 is prevented by pin or boss 58 secured to or formed in housing 26 in a manner similar to pin or boss 46.

The portion of arm 34 to the left of pivot 36 is the reset portion of the arm and is provided with a means for moving arm 34 back into the position shown in Figure 2. This means cooperating with said reset portion for moving said member 34 into engagement with said stop 46 prefer-

ably comprises a hole 59 receiving lanyard or reset pull cord 61. Cord 61 may be provided with any simple knot or other engaging means 62 and noted to indicate the position of cord 61 and thereby the position of arm 34. Cord 61 may be provided with a position indicating marker 63 preferably consisting of a split lead sleeve clamped around the cord. However, a painted mark on the cord or other means may be employed. Marker 63 is positioned so that when arm 34 is in its tilted position (not shown) marker 63 will be near housing 26. Cord 61 may pass through a hole 64 in housing 26.

On arm 34 there is mounted by any suitable means, such as spring clip 66, a gravity actuated switch 67. Switch 67 may be any gravity actuated switch but it is preferable to use a mercury switch of the type shown especially when operated near oil well 11 as the glass envelope 68 prevents sparks from contacts 69 and 71 from accidentally starting a fire in case the mercury 72 should produce an arc.

As shown in Figure 4, it is very easy to reverse the position of switch 67 in spring clip 66 so that tilting the arm 34 will open the circuit instead of closing the same.

In Figure 2 switch 67 is preferably connected to wires 73 and 74 in cable 76 by wires 77 and 78 connected respectively to contacts 69 and 71. Wires 77 and 78 have sufficient slack so that pivoting of arm 34 around pivot 36 is not impeded unduly. Wire 73 is connected to wire 78 and wire 74 is connected to wire 77 but any suitable means preferably a wire positioning and connecting junction board 79 secured by screws 80 to housing 26 may be used. A cleat or clamp 81 may be provided to hold the end of cable 76 against housing 26 and the inner edge of hole 82 in housing 26 may be lined with a rubber grommet 83 to prevent wear on the cable.

Figure 5 is a wiring diagram showing the use of primary 84 or the secondary 86 of a magneto ignition system for an internal combustion engine 19 which may be grounded by a safety switch 26 of the type shown in Figure 2 depending upon the position of switch 87. With switch 87 in the position shown primary 84 is grounded but if switch 87 contacts 88 then secondary 86 will be grounded. Part 89 is the magneto, 91 the commutator, 92 one of the spark plugs, and 93 the breaker contact mechanism. As such magneto ignition systems are known, no further description of the same is made.

Figure 6 is a wiring diagram similar to Figure 5 showing a battery ignition system powered by battery 94. The safety switch 26 is shown as a means for grounding primary circuit 96 but obviously it could be used to ground secondary circuit 97. Also by inverting the position of switch 67 from that shown in Figure 2 to that shown in Figure 4 and connecting safety switch 26 in series in wire 96 instead of grounding the same at 98 the safety switch can be used to interrupt the primary circuit and could be so used in Figure 5 in primary circuit 84. Also it could be used to interrupt secondary circuit 97 in Figure 6.

Figure 7 is a wiring diagram showing how the safety switch 26 may be employed with a battery 99 and a solenoid 101 to operate a circuit breaker 102 by means of an armature 103. Circuit breaker 102 interrupts the power circuit 104 of electric motor 106. Electric motor 106 is replacing the internal combustion engine 19 of Figure 1.

While electric motor controls shown in Figure

7 is preferred, it is possible to employ safety switch 26 directly in power line 107 of motor 108. In Figure 7 safety switch 26 has a normally open switch 67 in the position shown in Figure 2 whereas in Figure 8 safety switch 26 is of the normally closed type shown in Figure 4.

Operation

In Figure 1 during normal operation internal combustion engine 19 is running driving the gears in portion 18 and rotating crank 17 which oscillates walking beam 13 about pivot 14 by means of pitman 16. Rod line 12 slowly rises and falls in well 11 actuating the pump (not shown) to pump a column of oil from 11 into pipe 21. The weight of rods 12 and the oil is in part counterbalanced by counterweight 22. Because of the load on motor 19 the movement is somewhat deliberate and the acceleration of housing 26 mounted on flange 33 of walking beam 13 does not exceed a predetermined amount.

Motor 19 is preferably wired up as shown in Figure 5 and preferably magneto 89 is adapted to be grounded through the primary circuit 84 and safety switch 26 when arm 34 in Figure 2 rotates clockwise until mercury 72 contacts both contacts 69 and 71.

Rod 12 is subject to considerable strain and stress and sometimes breaks. This reduces the load on engine 19 and also counterweight 22 is no longer counterbalanced. As a result switch housing 26 is accelerated more than the predetermined amount necessary to actuate arm 34.

As shown in Figure 2 a sudden upward acceleration of housing 26 develops sufficient inertia in the right hand portion of arm 34 to cause the arm to rotate around pivot 36 in a clockwise direction and forces the end 43 of latch 44 out of notch 41. The amount of acceleration necessary to do this can be predetermined by adjusting the compression of spring 52 by set screw 54. When arm 34 has rotated until 43 is clear of notch 41 the force of gravity will then pull arm 34 down and move mercury 72 into contact with contacts 69 and 71 thereby closing switch 67 and connecting wires 73 and 74.

This movement pulls lanyard 61 in through hole 64 so that indicator 63 is adjacent housing 26. Counter-clockwise movement of latch 44 is limited by pin 58.

To reset the switch lanyard 61 is pulled and beveled surface 42 pushes end 43 into notch 41 while pin 46 prevents movement of 34 further than necessary, prevents end 43 from going below notch 41. The switch is then reset and will operate automatically on the next acceleration greater than a predetermined magnitude.

The operation of the switch shown in Figure 4 is the same as that shown in Figure 2 except that actuation of the switch breaks a contact instead of making a contact between contacts 69 and 71.

The operation of Figures 5, 6, 7 and 8 are believed obvious. Upon actuation of the safety switch 26 by excessive acceleration, magneto 89 in Figure 5 is grounded and internal combustion engine 19 stops due to failure of the ignition system. The same action takes place in Figure 6. In Figure 7 the closing of the circuit of safety switch 26 as in Figure 2 opens the power circuit 104 of motor 106. Similarly in Figure 8 the actuation of safety switch 26 as in Figure 4 interrupts power circuit 107 of motor 108.

In the specification the preferred form and em-

bodiment of the invention has been shown for the purposes of illustration and the scope of the invention is not limited thereby but is defined in the following claims.

5 Having described my invention, I claim:

1. A safety switch adapted to be carried by a walking beam comprising, in combination, a housing, a combined weight, switch actuating and reset member pivotally mounted on said housing, said member including a weighted portion at one side of said pivot having a notch formed in the free end thereof and a reset portion at the other side of said pivot, a stop limiting the pivotal movement of said member, means cooperating with said reset portion for moving said member into engagement with said stop, a latch biased into engagement with the notch in said weight portion for normally holding said member adjacent said stop, said member being disengageable from said latch upon acceleration of said housing of a predetermined magnitude due to the inertia of said weighted portion, and a switch carried by said member, the switch being actuated when the weight portion is displaced from said stop upon said predetermined acceleration.

2. A switch comprising, in combination, a housing, a unitary weight, switch actuating and reset member pivotally mounted on said housing, said member including a weighted portion at one side of said pivot having a notch formed in the free end thereof and a reset portion at the other side of said pivot, a stop limiting the pivotal movement of said member, a pull cord secured to said reset portion for rotating said member into engagement with said stop, a latch pivotally mounted on said housing, a spring biasing said latch into engagement with the notch in said weight portion for normally holding said member adjacent said stop, said member being disengageable from said latch upon acceleration of said housing of a predetermined magnitude due to the inertia of said weighted portion, and a switch carried by said member, the switch being actuated when the weight portion is displaced from said stop upon said predetermined acceleration.

3. A switch comprising, in combination, a housing, a unitary weight, switch actuating and reset member pivotally mounted on said housing, said member including a weighted portion at one side of said pivot and a reset portion at the other side of said pivot, the free end of one of said portions having a notch formed therein, a stop limiting the pivotal movement of said member, a pull cord secured to said reset portion for rotating said member into engagement with said stop, a latch pivotally mounted on said housing, a spring biasing said latch into engagement with the notch in said weight portion for normally holding said member adjacent said stop, said member being disengageable from said latch upon acceleration of said housing of a predetermined magnitude due to the inertia of said weighted portion, and a switch carried by said member, the switch being actuated when the weight portion is displaced from said stop upon said predetermined acceleration.

4. A switch comprising, in combination, a housing, a unitary weight, switch actuating and reset member pivotally mounted on said housing, said member including a weighted portion at one side of said pivot having a notch formed in the free end thereof and a reset portion at the other side of said pivot, a stop limiting the pivotal movement of said member, means cooperating with

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said reset portion for moving said member into engagement with said stop, a latch biased into engagement with the notch in said weight portion for normally holding said member adjacent said stop, said member being disengageable from said latch upon acceleration of said housing of a predetermined magnitude due to the inertia of said weighted portion, and a switch carried by said member, the switch being actuated when the weight portion is displaced from said stop upon said predetermined acceleration.

5. A switch comprising, in combination, a housing, a unitary weight, switch actuating and reset member pivotally mounted on said housing, said member including a weighted portion at one side of said pivot and a reset portion at the other side of said pivot, the free end of one of said portions having a notch formed therein, a stop limiting the pivotal movement of said member, means co-operating with said reset portion for moving said member into engagement with said stop, a latch

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biased into engagement with the notch in said weight portion for normally holding said member adjacent said stop, said member being disengageable from said latch upon acceleration of said housing of a predetermined magnitude due to the inertia of said weighted portion, and a switch carried by said member, the switch being actuated when the weight portion is displaced from said stop upon said predetermined acceleration.

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