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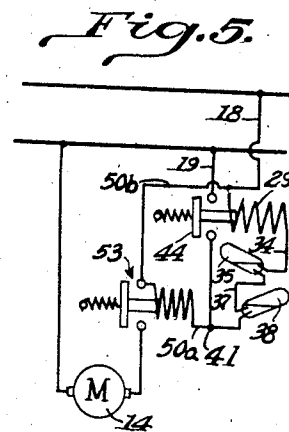
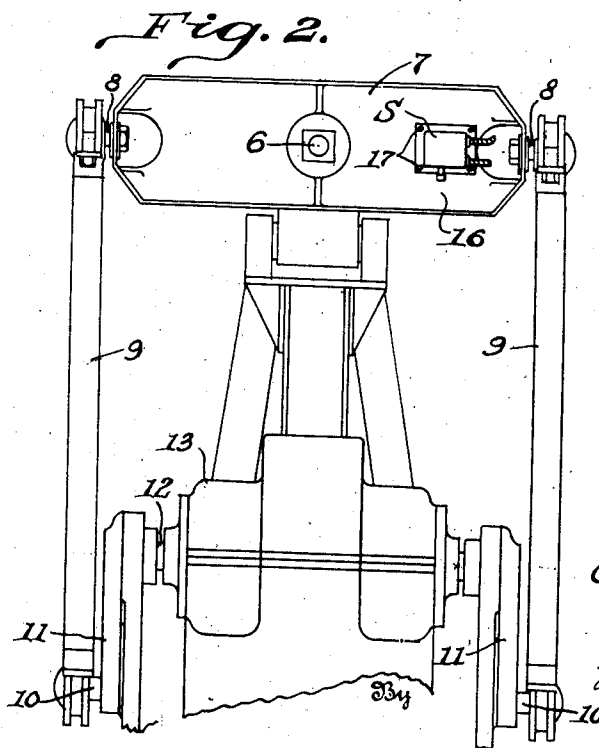
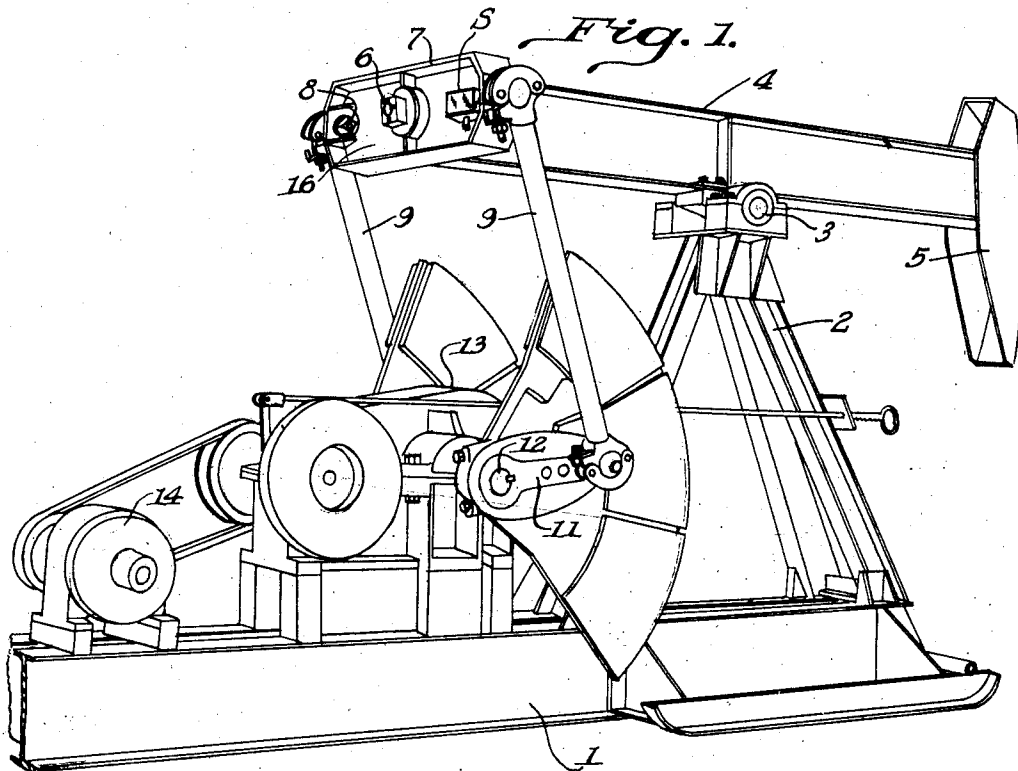
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EMERGENCY CUT-OUT SWITCH FOR WELL PUMPING MECHANISM

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EMERGENCY CUT-OUT SWITCH FOR WELL
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This invention relates to well pumping and drilling mechanism, and has particular reference to a well pumping and drilling unit of the power driven geared type wherein an oscillatory walking beam is actuated by a power shaft having cranks on the opposite ends thereof, the ends of said cranks being connected by a pair of pitmans with a transversely extending equalizing member centrally pivoted to one end of the walking beam.

It is an object of the present invention to provide apparatus for automatically discontinuing the operation of the driving motor or engine of such well pumping or drilling mechanism in the event a wrist pin or pitman should break or become disconnected or otherwise rendered inoperative in carrying out their intended functions.

In well pumping mechanism of the character under consideration, twin pitmans are connected at the upper ends thereof to an equalizing cross beam. If a wrist pin should break or if the wrist pin nut should become loose so that the wrist pin could come out of the crank opening, the opposite pitman would continue to operate the walking beam if the power were not immediately shut off. Such a disconnected pitman is apt to do considerable damage to a machine, and the pitman which remains attached to the crank is likely to twist the walking beam and otherwise damage associated structure.

In accordance with the present invention, the equalizing cross beam, or other corresponding portion of the walking beam to which the upper ends of the twin pitmans are united, is provided with a switch mechanism which is used for governing the operation of the control circuit of an engine or motor employed for driving the walking beam, the said switch mechanism during normal operation of the walking beam serving to provide for the closure of said control circuit but is so formed that in the event of undue oscillation on the part of the equalizing cross beam, or of distortion of the walking beam proper, the said switch mechanism will operate automatically to open the control circuit and thereby immediately arrest the operation of the prime mover, such as an internal combustion engine or an electric motor, used in imparting power to the apparatus.

It is a further object of the invention to provide a switch mechanism with a manually operated resetting control so that when said switch mechanism is operated to open the control cir-

cuit of the prime mover, it will be impossible to close the same except by the employment of a deliberate manual operation.

Other objects reside in the provision of a switch mechanism of the character indicated which may be readily applied to well pumping apparatus of the character indicated, and one which will be small and compact, will not in any way interfere with the ordinary operation of the pumping apparatus, susceptible to convenient adjustment, and reliable and positive in operation.

For a further understanding of the invention, reference is to be had to the following description and the accompanying drawings, wherein:

Fig. 1 is a perspective view of a twin pitman well pumping and drilling unit and disclosing the switch mechanism comprising the present invention in its operative position thereon;

Fig. 2 is an end elevation of the unit;

Fig. 3 is a vertical sectional view taken through the switch mechanism;

Fig. 4 is a transverse sectional view on the line IV—IV of Fig. 3;

Fig. 5 is a wiring diagram employed by the switch mechanism;

Fig. 6 is a vertical sectional view on the plane indicated by the line VI—VI of Fig. 4;

Fig. 7 is a vertical sectional view through a mercury switch used in the mechanism, the plane of the section being indicated by the line VII—VII of Fig. 3.

Referring more particularly to the drawings, the sub-frame of a geared well pumping and drilling mechanism is indicated at 1. Arising from the frame 1, which may be composed of structural steel members, is a Samson frame 2, carrying at the upper end thereof bearings 3 for the rocking support of a walking beam 4. The outer end of the walking beam is provided with the usual head 5 with which cables or other well drilling or pumping tools may be connected. At the opposite end of the walking beam, the latter is provided with a longitudinally extending stud 6, upon which is mounted for limited rocking movement a transversely extending equalizer 7. The opposite ends of the equalizer 7 are provided with pins 8 to which are pivotally connected the upper ends of a pair of twin pitmans 9, the lower ends of said pitmans being similarly connected with wrist pins 10 extending from the outer ends of a pair of crank arms 11, the latter being carried, in turn, by the outer ends of a gear driven shaft 12. The shaft is journaled for rotation in connection with a gear housing 13, bolted or other-

wise secured to the sub-frame 1 and motion is imparted to the gearing (not shown) contained within the housing by the provision of a suitable prime mover, which may be either an internal combustion engine or an electric motor, the latter having been shown at 14 in the drawings and as mounted directly on the frame 1.

The equalizer 7 is utilized to unite the spaced pitmans with the power receiving end of the walking beam and if desired, the said equalizer may rock about the axis of the stud 6 to compensate for inequalities of alignment which may exist between the crank arms 11 and the walking beam. In certain instances, however, the equalizer may be welded or otherwise attached to the power receiving end of the walking beam and any inequalities present may be absorbed by the normal flex inherent in the structural steel beam.

In apparatus of this character, it will be understood that if one of the pitmans should break or become disconnected with its operating members, injury to the machine and to the operators thereof may readily take place. In fact, such accidents are not uncommon and have caused considerable damage. As a safeguard against such a contingency, the present invention provides a switch mechanism, indicated generally by the letter S, which is so constructed and mounted that when a loose connection develops between the walking beam 4 and the cranks 11, with the machine in operation, the said switch mechanism will serve to substantially immediately arrest the operation of the motor 14 or other prime mover.

The switch mechanism S comprises a casing as indicated at 15, the said casing being preferably mounted on the vertical web 16 of the equalizer 7, and firmly secured in connection therewith by means of fastening bolts 17. Preferably, the casing is disposed contiguous to one of the ends of the equalizer where it will have the greatest amount of motion in the event of breakage of one of the pitmans.

Lead lines 18 and 19 enter the casing and are connected with any suitable source of electric current supply, such for instance as a battery or the power lines of a commercial circuit. The lead 18 is connected with a screw 20 which passes through an insulating panel 21 arranged within the casing, the panel being held in place by contacting lugs 22, projecting inwardly from the corners of the casing and held in contact with said lugs by screws 23. The screw 20 is connected by means of a conducting bar 24 with a terminal 25 also carried by the panel 21, and from the terminal 25, a lead line 26 extends to a strip conductor 27. From the conductor 27, a lead 28 extends to the field coil 29 of an electromagnet 30, the latter being stationarily mounted on a base plate 31 carried by the panel 21. The outgoing lead 32 of the coil 29 extends to a strip conductor 33 carried by the plate 31, which is also composed of a dielectric substance, and a wire 34 leads from the conductor 33 to a mercury switch 35 of the glass bulb type.

Such switches are of common construction but in the present instance comprise an enclosed glass bulb containing a limited amount of mercury which when the switch is in its normal position electrically unites a pair of spaced electrodes 36 carried by one end of the bulb. The wire 34 is connected with one of these electrodes and a wire as indicated at 37 is connected with the other thereof. The wire 37 extends to a

second mercury switch 38 which is of the same construction as the switch 35 but, as shown in Fig. 3, occupies a reverse angular position with respect to that normally assumed by the switch 35. Both the switches 35 and 38 are received within holders 39 which are pivotally united with the panel 21, so that the angularity of said switches may be controlled at will for the purpose of requiring more or less tilting of the switch mechanism S to control the opening of the circuit in which said switches are positioned.

From the switch 38, a wire 40 extends to a binding post 41 carried by the base plate 31, the binding post being connected with a stationary contact 42. Cooperative with this contact is a movable contact arm 43, which is connected with an armature 44, the latter being pivotally mounted as at 45 in connection with the base plate. When the field of the magnet 30 is excited, the armature is drawn toward the pole piece of the magnet against the resistance of a spring 46, so that the contacts 42 and 43 are brought into physical engagement to complete the circuit there-through. The movable contact arm is connected with a conductor 47 which extends to a binding post 48, the latter being joined by a conductor 49 to the lead 19 which connects the switch S with the power line to complete the circuit for the electromagnet 30. A conductor 50 leading from the binding post 41, connected with the stationary contact of the switch, is joined with a lead 50a of a motor controlling circuit, the return lead 50b of the last-named circuit being connected with the screw 25.

Normally, the armature 44 is disposed beyond the range of magnetic attraction of the coil 29 and to bring the contacts 42 and 43 into engagement, it is necessary to first operate a spring pressed plunger 51 which has an actuating knob 52 disposed exteriorly of the casing 15. The inner headed end 52 of the plunger is arranged in registration with the armature 44 and in order to first complete a circuit through the switch mechanism, it is necessary to actuate the plunger 51 to move the same inwardly of the casing into engagement with the armature and to thereby rock the latter about its axis of pivotal mounting to bring the contacts 42 and 43 into relative engagement. This results in completing the circuit through the coil of the magnet and since the armature will then be positioned in the field of said magnet, the latter operates to hold the spring pressed armature in its position of circuit closure. It will be understood that the leads 50a and 50b may extend directly to the motor 14, or may extend to an operating switch, as indicated at 53, for said motor. Again, the leads 50a and 50b may constitute a part of the ignition circuit of an internal combustion engine.

When the equalizing beam 7 occupies its normal horizontal position, the angularity of adjustment of the mercury switches 35 and 38 is such that both of these last-named switches will be closed, that is, the mercury contained therein will cover the spaced electrodes to provide for current travel therethrough. This, as shown more particularly in Fig. 5, provides for current flow through the coil of the magnet 30 from the source of current supply and as long as the magnet is energized, the armature 44 thereof will be retained in a position in which the contacts 42 and 43 will be in physical engagement. If, however, one of the pitmans should become disconnected from its operating frame or otherwise broken or injured, the operation of the remain-

ing pitman will cause oscillation of the equalizing beam 7. Oscillation in either direction of this equalizing beam, after a predetermined amount of movement, will cause the opening of one or the other of the mercury switches 35 and 38 so that current flow to the electromagnet will be interrupted.

This enables the spring 46, as well as the action of gravity, to oscillate the armature so that the contacts 42 and 43 will be separated and therefore interrupting the prime mover circuit involving the leads 50a and 50b. This results in automatic and substantially instantaneous stopping of the operation of the prime mover so that injury to the apparatus, or those working around the same, will be minimized.

The construction of the switch S is such that after the electromagnet has been deenergized, it is impossible for the switch to again close itself. This is due to the fact that the armature is actuated by the spring 46 to completely separate the contacts 42 and 43 and to remove the armature from the field of the magnet coil. Thus after normal operating conditions of the pumping mechanism have been restored and repairs made, it is necessary to manually operate the plunger 51 to reset the switch mechanism. By this arrangement, any oscillatory movement of the equalizing beam, after the switch mechanism has been actuated to stop the prime mover, would have no effect on the control circuit of the prime mover.

In view of the foregoing, it will be seen that the present invention provides a simple, automatic and efficient device for protecting twin pitmans pumping apparatus of the character set forth. The switch mechanism is of compact and simple form and when mounted on the equalizing beam, or other equivalent member, does not in any way interfere with the normal operation of said beam or the parts associated therewith. The switch may be installed on existing apparatus of this character as an attachment or, if desired, may be built into newly manufactured pumping equipment. The mercury switches 35 and 38 occupy fixed angular positions with respect to each other, although the angularity of said switches may be regulated by the partial rotation of said switches about the axes of the holders 39. The axes of said holders pass through the panel 21 and may be provided with nuts or the like to bind the holders in desired positions of adjustment. As the angularity of the mercury switches is increased, corresponding greater movement on the part of the equalizing beam will be necessitated to actuate the switches.

What is claimed is:

1. In well pumping and drilling mechanism, in combination, a walking beam, a crank shaft, a pair of pitmans for transmitting motion from said crank shaft to said walking beam, a prime mover for driving said crank shaft, said prime mover having a control circuit, and switch means automatically responsive to transverse distortion of said walking beam caused by the loosening or breaking of one of said pitmans to interrupt the control circuit of said prime mover and arrest the operation of the latter.

2. In well pumping and drilling mechanism, in combination, a walking beam, a crank shaft, a pair of pitmans for transmitting motion from said crank shaft to said walking beam, a prime mover for driving said crank shaft, said prime mover having a control circuit, and switch means mounted in connection with said walking beam

and automatically responsive to transverse distortion of said walking beam caused by the loosening or breaking of one of said pitmans to interrupt the control circuit of said prime mover and arrest the operation of the latter.

3. In well pumping and drilling mechanism, in combination, a walking beam pivotally mounted for oscillation in a vertical plane, an equalizing member connected to one end of said walking beam, said equalizing member being disposed in a plane transverse to that of the walking beam, a pair of cranks carried by a journaled shaft, spaced pitmans uniting said cranks with the ends of said equalizing member, a motor including a control circuit, motion transmitting means between said motor and said crank shaft, and a switch mechanism carried by said equalizer and automatically operative upon predetermined movement of said equalizer from its normal operating position to effect the opening of the control circuit for said motor to arrest the operation of said motor and the application of power to said crank shaft.

4. In well pumping and drilling mechanism, in combination, a walking beam pivotally mounted for oscillation in a vertical plane, a transversely extending equalizing member pivotally mounted for oscillation on one end of said beam in a plane perpendicular to the plane of oscillation of said beam, a shaft having a pair of cranks, spaced pitmans having their lower ends secured to said cranks and their upper ends secured to the ends of said equalizing member, a motor including a control circuit, motion transmitting means between said motor and said crank shaft for effecting the rotation of the latter, and a normally closed switch mechanism carried by said equalizing member for governing the operation of the control circuit of said motor, said switch being automatically operative to interrupt said control circuit when said equalizing member oscillates through predetermined degrees of movement from its normal position.

5. In well pumping and drilling mechanism, in combination, a pivotally mounted walking beam, a motor including a control circuit, motion transmitting means between said motor and said walking beam, and switch mechanism carried by said walking beam and automatically responsive to predetermined transverse distortion of said beam to interrupt said motor circuit and automatically discontinue the application of power to said walking beam.

6. In well pumping and drilling mechanism, a pivotally mounted walking beam, a motor including a control circuit, motion transmitting means between said motor and said walking beam, switch mechanism carried by said walking beam and disposed in a plane transverse to that of the plane of oscillation of the walking beam, said switch mechanism including a pair of angularly disposed mercury tubes positioned to normally close said control circuit, and means for adjusting and maintaining the relative adjustment of said mercury tubes, said tubes being automatically operative upon predetermined transverse distortion of said beam to interrupt said control circuit and thereby automatically discontinue the application of power to said walking beam.

7. In well pumping and drilling mechanism, a pivotally mounted walking beam, a transversely extending equalizing member carried by said beam contiguous to one end thereof, means for rocking the walking beam about its pivotal

mounting, said means having connection with the opposite ends of said transverse member, and mercury switch means carried by said equalizing member, said switch means being operated by
5 tilting movement of said equalizing member in a plane angular to that of the longitudinal axis of said beam.

8. In well pumping and drilling mechanism, a pivotally mounted walking beam, a motor including a control circuit, a transversely extending
10 equalizing member pivotally carried by said beam contiguous to one end thereof, means for transmitting motion from said motor to said beam through said equalizing member, and switch
15 means carried by said equalizing member and

operated by movement of the member on its pivot to interrupt said control circuit and discontinue the operation of said motor.

9. In well pumping and drilling mechanism, a pivotally mounted walking beam, a motor, a
5 transversely extending equalizing member carried by said beam contiguous to one end thereof, means for transmitting motion from said motor to said beam through said equalizing member,
and switch means stationarily carried by said
10 equalizing member and operated by tilting movement of the member in a plane extending transversely of the beam to effect the stopping of said
motor.

CLIFFORD R. ATHY. 15