

C. KLINK.
SAFETY SWITCH MECHANISM.
APPLICATION FILED SEPT. 10, 1918.

1,324,903.

Patented Dec. 16, 1919.

2 SHEETS—SHEET 1.

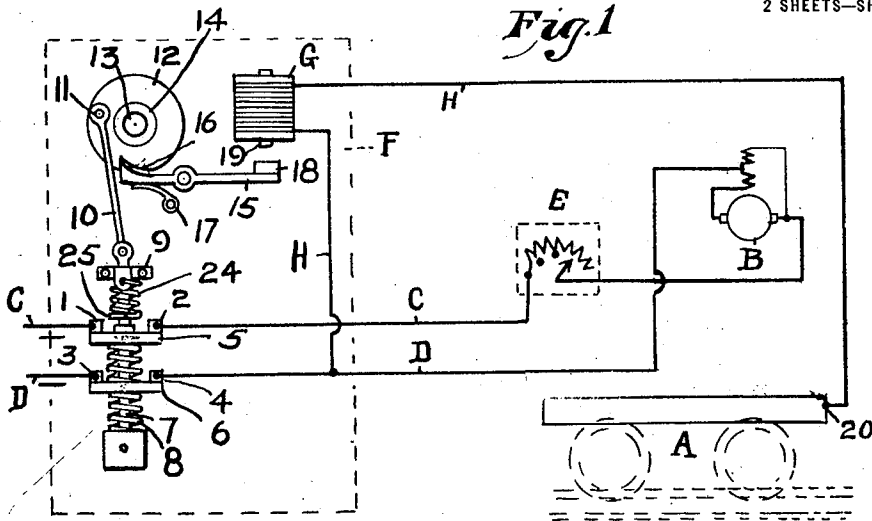
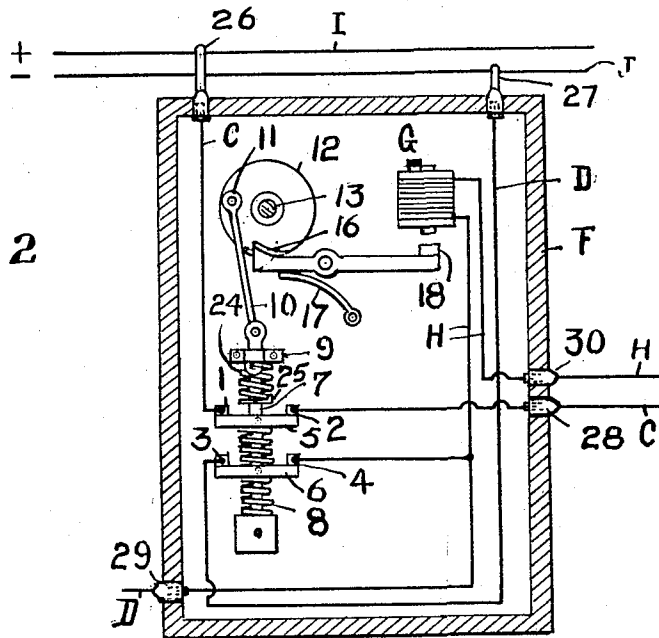


Fig. 2



WITNESS
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Charles Klink,
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Fig. 3

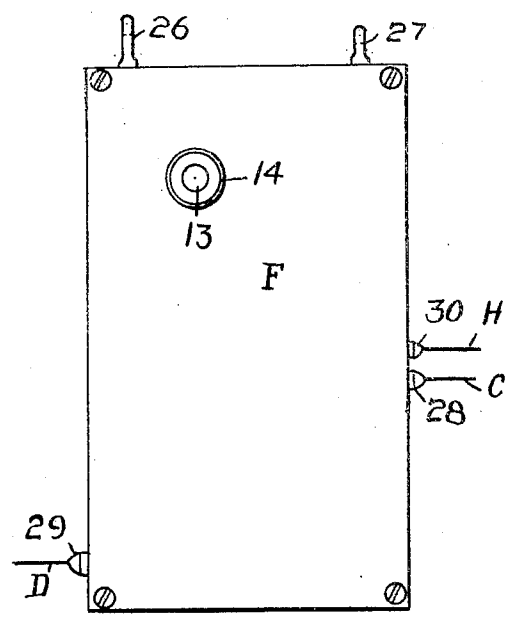


Fig. 4



Fig. 5

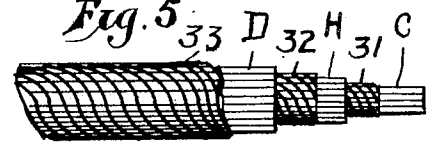
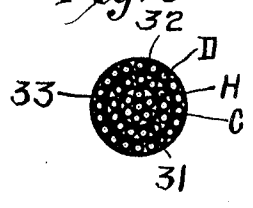


Fig. 6



WITNESS
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UNITED STATES PATENT OFFICE.

CHARLES KLINK, OF NORTH FAYETTE TOWNSHIP, ALLEGHENY COUNTY, PENNSYLVANIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-THIRD TO LYMAN G. YOST AND ONE-THIRD TO WILLIAM S. LOCKHART, BOTH OF McDONALD, PENNSYLVANIA.

SAFETY-SWITCH MECHANISM.

1,324,903.

Specification of Letters Patent.

Patented Dec. 16, 1919.

Application filed September 10, 1918. Serial No. 253,419.

To all whom it may concern:

Be it known that I, CHARLES KLINK, a citizen of the United States, and residing in the township of North Fayette, in the county of Allegheny and State of Pennsylvania, have invented or discovered new and useful Improvements in Safety-Switch Mechanism, of which the following is a specification.

My invention consists in a new and improved safety switch mechanism for direct current electrically driven machinery. While highly useful for all forms of such machinery, the present invention is especially designed for use in connection with mine machinery, such as coal cutters, pumps, fans, &c.

In the use of electrically driven mining machinery, accidents frequently occur from the machines becoming charged, and the object of the present invention is the provision of automatic means for interrupting the current supply in such emergencies.

A novel form of circuit breaking apparatus is shown; also a gas-tight box to contain the same and including means for connecting up the feed wires of the machine with the source of current.

Other novel features of construction and arrangement of elements will appear from the following description.

In the accompanying drawings, which are merely intended to illustrate a practical embodiment of the principles of my invention without limiting the scope of the latter to the construction shown, Figure 1 is a diagrammatic view illustrating an electrically driven machine fitted with my invention; Fig. 2 is an enlarged vertical section through the gas-tight box within which I prefer to install the switch mechanism; Fig. 3 is a face view of the box showing the detachable lid thereof; Fig. 4 shows the cable in which are included the three wires to be described; Fig. 5 is an enlarged view showing the cable cut away to show its construction, and Fig. 6 is a cross section of the cable.

The following is a detailed description of the drawings.

A represents a mining machine, such as a coal cutter, the cutting elements being omitted for the sake of clearness. B is the D. C. motor mounted thereon and driving

the machine. C is the positive lead wire conducting current to the motor, and D is the negative lead wire. E is the usual starting box interposed in the wire C.

The lead C is connected to the positive terminal of the motor B and the lead D to the negative terminal of the same in the usual manner. The lead C is interrupted and provided with opposed terminal blocks 1 and 2, and the lead D is similarly interrupted and provided with terminal blocks 3 and 4, the blocks 1 and 3, and the blocks 2 and 4 being, respectively, alined. 5 is a metal switch bar adapted to electrically connect the blocks 1 and 2, and 6 is a similar switch adapted to connect the blocks 3 and 4. 7 is a rod upon which said switches are slidingly mounted, the helical springs 8 being coiled about said rod to hold the butterfly normally in resilient contact with the blocks. The rod 7 is slidingly supported, as by means of one or more bearings 9 secured to a support, such as the wall of the gas-tight box F, shown in Figs. 2 and 3 and to be more fully described.

The rod 7 is normally held in proper position to electrically complete the leads C and D by means of a link 10 connecting one end of the rod with a wrist pin 11 set eccentrically on the face of the disk 12. The disk is rigidly mounted on a shaft 13 which is suitably journaled in a fixed support, as the back wall and front lid of the box F. One end, preferably the front end of said shaft protrudes from the box and is provided with a knob 14 by means of which the shaft may be turned by hand.

The disk is normally held from rotation from the position shown in Figs. 1 and 2 by means of a latch 15 which engages a notch 16 in the perimeter of the disk and is resiliently held in such engagement by a leaf spring 17. The latch is pivoted intermediate of its ends, and its other, and preferably longer, end is provided with an armature 18 alined with the core 19 of an electromagnet G, whose winding forms part of the by-circuit H which connects at one end to the negative lead D between the make and break mechanism and the motor, and at its other end to ground on the machine frame at 20.

It is evident that as long as the latch engages the perimeter of the disk, the switch

bars will be held in contact with the terminal blocks in the lead wires, but when the electro-magnet becomes energized, the long end of the latch will be drawn toward the magnet, thus releasing the latch from the disk.

Automatic means for moving the rod 7 to break the leads when the latch is disengaged are provided. Thus, if the rod 7 is vertically alined and its upper end linked to the disk, so that a downward movement of the rod will break the leads, a weight 23 may be attached to the lower end of the rod, so that the rod will slide downwardly when the latch is released and the disk is free to turn. In such case, the lower helical spring 8 may be interposed between the weight and the lower switch bar, while the upper spring 8 may be interposed between the switch bars. Since the apparatus may not always be placed so that gravity may be used to shift the rod 7 when released, as a substitute for the weight, or as auxiliary thereto, I may provide a relatively heavy helical spring 24 coiled about the rod 7 between the upper bearing 9 and a collar 25 pinned to the rod between the bearing and the upper switch bar. This spring is compressed while the latch is engaged with the disk, but upon the disengagement of the latch, the spring expands and throws the rod 7. When it is desired to again complete the leads C and D, after the electro-magnet has become de-energized, the knob 14 is turned, rotating the disk clockwise until the latch again engages the notch in the perimeter of the disk, thus reestablishing the contact between the switch bars and the terminal blocks.

The operation of my invention is as follows.

Assuming that a ground has occurred between the motor and the machine frame or between some portion of the charged lead wire and said frame, a circuit is at once completed through the by-wire H to the negative lead D, energizing the electro-magnet, releasing the latch and causing the switch bars to be thrown out of contact with the terminal blocks, thus breaking both leads and cutting the supply of current to the motor. Again, should a leak occur between the positive and negative leads on the motor side of the switch, the lead D, being charged, will charge the by-wire H, thus energizing the magnet and operating the safety switch. In case the negative lead burns off or becomes open between the safety switch and the negative main, then a circuit is completed through the positive lead, the starting box, the armature and fields of the motor, and the by-wire H and electro-magnet G to the ground 20, thus operating the switch.

There is a decided advantage in interrupting both lead wires, since were only the

positive lead interrupted, a leak between the two leads on the far side of the safety switch would result in the machine remaining charged owing to the current thus shunted into the negative lead.

As long as the circuit through the electro-magnet remains charged, the latch 15 will be held out of engagement with the disk 12, so that the disk cannot be locked in position to reestablish the circuit through the leads. Therefore the ground or leak must be repaired before the supply current can again be supplied to the motor.

For the sake of illustration I have shown an electro-magnet interposed in the by-wire H to operate the latch 15, but it will be understood that any character of electro-magnetic device may be substituted which, when the wire H is energized, will act to release the latch from the disk.

In coal mine practice the naked feed wires are usually strung along under the roof of the entries past the rooms in which the coal is being mined, and the terminals of the machine lead wires are provided with contact hooks which are thrown over the feed wires or mains to connect up the machine. In the case of gaseous mines, it is necessary to avoid open sparking as much as possible.

Thus, I have shown in Fig. 2 my safety switch mechanism mounted and inclosed in a gastight metal box F, the outer ends of the leads C and D extending through gas-tight fittings in the top of the box and provided with terminal hooks 26 and 27 which may be thrown over the positive and negative feed wires or mains I and J, respectively, thus forming a convenient method of connecting up the machine and suspending the safety switch mechanism out of the way.

The lead wires C and D are led out of the box F to the motor B through gas-tight socket and plug connections 28 and 29, respectively, in the walls of the box, and the by-wire H is led out through a similar connection 30. By making these connections of different sizes, a plug will fit into its proper socket only, so that a careless operator cannot make a mistake in connecting up the machine. In case he should throw the hook 26 over the negative main and the hook 27 over the positive main, the by-wire H would at once be energized and the safety switch operated, and the leads would remain broken until the hooks were engaged with the proper mains. The operation of the safety switch mechanism of course involves a certain amount of sparking but the inclosure of this mechanism in a gas-tight box will prevent such sparking causing mine explosions.

Between the safety switch and the motor I prefer to combine the three wires C, D and H into a cable, as shown in Figs. 4, 5

and 6, the positive lead C in the form of a plurality of wire strands forming the central core protected by an insulating covering 31 about which are placed the wire strands 5 which make up the by-wire H. 32 is an insulating covering for the strands of the by-wire H, and the strands of the negative lead D surround the same and are covered by the outer insulation or covering 33 of the cable.

10 The purpose of placing the conductors C, D and H in the relation shown is that an injury to the cable, such as might be caused by a mule stepping on it or a mine car running over it, with the result that the conductors D and H came into contact, would 15 cause no interference with the operation of the machine, but if the injury was serious enough to bring the conductor H into contact with the conductor C or to form a leak between said conductors, then the by-wire 20 would be energized and the safety switch operated, as the conductor H would in all likelihood become energized from the lead C before or as soon as would the conductor 25 D, and the safety switch would be operated before any accident could happen. As a matter of convenience, I have shown the safety switch mechanism combined with the gas-tight connection box used to connect the 30 machine lead wires with the mains, but it will be understood that the safety switch mechanism may be mounted on the machine frame, or upon the reel which is frequently interposed between the machine and the feed 35 wires to take up slack in the lead cable while the machine is in use.

It is evident from the foregoing that the improved safety switch mechanism is positive in its action, and will immediately cut 40 off all current from the machine in case of accident, leak or ground. It is simple and inexpensive, occupies but little space, and contains no parts likely to rapidly wear out or become broken, and it can be repaired 45 without trouble.

What I desire to claim is—

1. In combination with a machine, a direct current motor operating the machine, a source of electrical current, a return wire 50 circuit consisting of a positive lead wire and a negative lead wire connecting the motor with said source, a safety switch mechanism comprising a switch member interposed in said positive lead wire, a by-wire connecting 55 said negative lead wire to ground on the machine, an electro-magnetic device interposed in said by-wire, and means whereby when said electro-magnetic device is energized the electrical connection in said positive lead wire through said switch member 60 is broken, for the purposes described.

2. In combination with a machine, a direct current motor operating the machine, a source of electrical current, a return wire 65 circuit consisting of a positive lead wire and

a negative lead wire connecting the motor with said source, a safety switch mechanism comprising a pair of switch members interposed in said positive and negative lead 70 wires respectively, a by-wire connecting said negative lead wire to ground on the machine, an electro-magnetic device interposed in said by-wire, and means whereby when said electro-magnetic device is energized the 75 electrical connection in said lead wires through said switch members is broken, for the purposes described.

3. In combination with a machine, a direct current motor operating the machine, a source of electrical current, a return wire 80 circuit consisting of a positive lead wire and a negative lead wire connecting the motor to said source, a safety switch mechanism comprising a pair of switch members interposed in said positive and negative lead 85 wires respectively, a by-wire connecting a point in said negative lead wire between the machine and said switch member to ground on the machine, an electro-magnetic device interposed in said by-wire, and means 90 whereby when said electro-magnetic device is energized the electrical connection in said lead wires through said switch members is broken, for the purposes described.

4. In combination with a machine, a direct current motor operating the machine 95 and a two wire supply circuit for the motor, a gas-tight box through which said circuit passes, a safety switch mechanism in said box, and means whereby when a ground occurs said safety switch mechanism is actuated to interrupt said circuit, for the 100 purposes described.

5. In combination with a machine, a direct current motor operating the machine 105 and a two wire supply circuit for the motor, a gas-tight box through which said circuit passes, a switch member interposed in said circuit within said box, a by-wire leading from the negative lead wire within said box 110 to ground on the machine, an electro-magnetic device in said box interposed in said by-wire, and means whereby when said electro-magnetic device is energized the electrical connection through said switch 115 member is interrupted for the purposes described.

6. In combination with a machine, a direct-current motor operating the machine 120 and a two-wire supply circuit for the motor, a gas-tight box provided with positive and negative wires, means for connecting up said last named wires with the motor circuit, terminals for said positive and negative 125 wires protruding from said box for connection with a source of supply, a safety switch in said box leading from the negative wire, means for connecting said by-wire to ground on the machine, an electro-magnetic device in said box interposed in said by- 130

wire, and means whereby when said electro-magnetic device is energized said safety switch is thrown open, for the purposes described.

5 7. In combination with a machine, a direct-current motor operating said machine, and a two wire supply circuit for said motor, a gas-tight box provided with positive and negative wires, means for connecting
10 said wires with a source of current, gas-tight terminals for said wires protruding from the walls of said box, a safety switch interposed in said wires within said box, a by-wire leading from the motor side of said
15 negative wire to a terminal in the wall of said box, an electro-magnetic device interposed in said by-wire, means whereby when said electro-magnetic device is energized said switch is thrown, positive and negative
20 lead wires connected with the motor and provided with members adapted to engage the positive and negative terminals of said box and a wire connected to ground on the machine and provided with a member
25 adapted to engage said by-wire terminal.

8. In combination with a machine, a direct-current motor operating said machine and a two wire supply circuit for said motor, a gas-tight box provided with positive
30 and negative wires, means for connecting said wires to a source of current, gas-tight terminals for said wires protruding from the walls of said box, a safety switch interposed in said wires within said box, a by-

wire leading from the motor side of said 35 negative wire to a terminal in the wall of said box, all said terminals being of different sizes, an electro-magnetic device interposed in said by-wire, means whereby when said electro-magnetic device is energized said 40 switch is thrown, positive and negative lead wires connected to the motor and provided with members adapted to engage said positive and negative box terminals, and a wire connected to ground on the machine and 45 provided with a member adapted to engage said by-wire terminal.

9. In combination with a machine, a direct-current motor operating said machine and a two wire supply circuit for said motor, a safety switch mechanism interposed 50 in said circuit, a by-wire running from the motor side of the negative wire to ground on the machine, an electro-magnetic device interposed in said by-wire adjacent to said 55 switch, means whereby when said electro-magnetic device is energized said switch is thrown, and a cable composed of said circuit wires and said by-wire, the positive wire being innermost in said cable and the negative 60 wire being outermost while the by-wire is interposed between the same, for the purpose described.

Signed at McDonald, Washington Co., Pennsylvania, this 5th day of September, 65 1918.

CHARLES KLINK.