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PORTABLE MINE JUNCTION BOX

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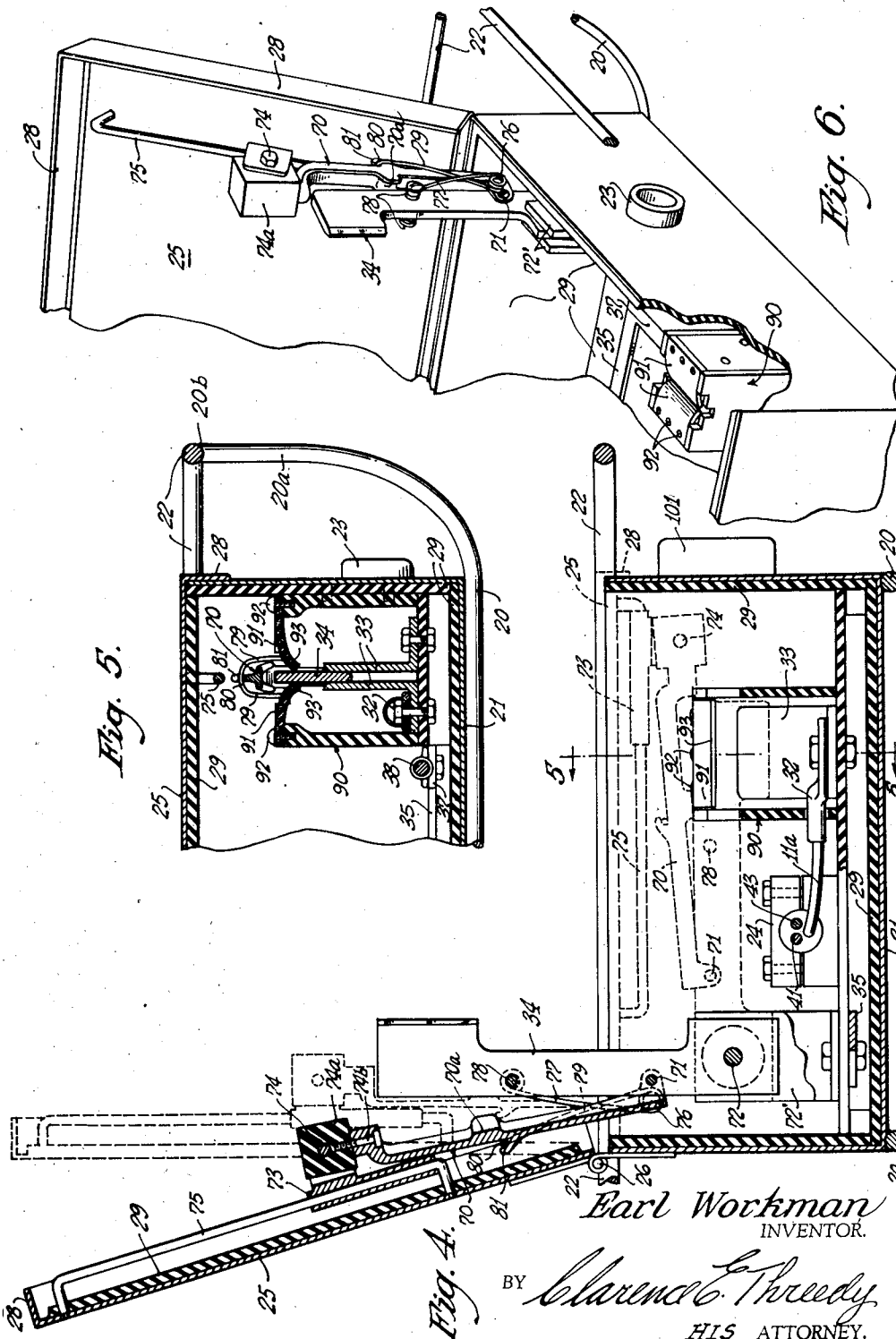


Fig. 4.

Fig. 5.

Fig. 6.

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PORTABLE MINE JUNCTION BOX

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7 Claims. (Cl. 200—50)

The principal object of this invention is the provision of an improved safety junction box for use in mines to connect a feeder line with certain electrically operated mining tools and mechanisms through an extensible trunk line which is connected with the main power supply situated somewhere in the tunnel at a point remote from the junction box.

One of the more detailed objects is the provision of a junction box including a master switch coacting with a lid structure to open the connection with the feeding trunk whenever the lid is opened, whereby to obviate the danger of electrocution.

A further object is the provision of a mobile junction box provided with runners and guard rails facilitating the dragging or sliding of the box on the mine floor as the position of tools and associated apparatus is shifted.

A still further object is the provision of an improved snap-action mechanism controlled by the lid of the junction box to quickly open the master switch whenever the box lid is raised a predetermined amount from normally closed condition.

Yet another object is the provision of a shielded contact arrangement in a master switch of the knife switch variety, the arrangement being such that the stationary contact fingers are automatically shielded when the switch blade is withdrawn.

Still other objects relate to the arrangement of a plurality of control switches within the box and operating levers therefor accessible exteriorly of the box and shielded by a guard rail structure forming part of a runner or sled structure, together with the arrangement of said switches and fuses in the safety box, and signal means accessible exteriorly of the box and also guarded by the aforesaid guard rail.

Other objects, advantages and novel aspects of the invention reside in certain details of construction as well as the cooperative relationship of the component parts of the illustrative embodiment described hereinafter in view of the annexed drawings, in which:

Fig. 1 is a horizontal schematic section through a mine tunnel to illustrate the use of the junction box;

Fig. 2 is a perspective view of the junction box;

Fig. 3 is a horizontal section through the box with the switch mechanism shown largely in plan;

Fig. 4 is a vertical transverse section through the box with the lid open;

Fig. 5 is a vertical sectional fragment through

the master switch looking in the direction of lines 5—5 of Fig. 4, with the lid closed;

Fig. 6 is a perspective fragment of the box with the lid and master switch open.

By way of introduction to the environment in which the novel junction box is to be used, attention is called to Fig. 1 wherein is illustrated schematically a section of a mine in which the mining operations are being carried on with electrically energized tools supplied from a main junction box 10 situated somewhere in the main tunnel and connecting through a heavy flexible trunk cable 11 with a portable junction box 12, such as provided by the present invention. A plurality of tools, such as an electric drill 13, an electrically driven conveyor 14, and an electrically driven cutter 15 usually working in different rooms 16 and 17, are connected respectively by feeder cables 13a, 14a, and 15a with the portable junction box 12, the latter including certain control switches and fuses requisite to the customary operation of these instrumentalities, as will appear hereinafter.

As the mining operations shift from one vein or seam to another or from one room to another, it is obviously necessary to alter the position of the portable junction box 12, and the improved junction box, generally indicated at 12 in Fig. 2, is rendered mobile by the provision of a plurality of runners 20 secured, as by welding or other suitable means, to the bottom 21 of the box (Figs. 4 and 5 also) and each having opposite end portions 20a projecting beyond the ends of the box and curved upwardly to facilitate gliding action when encountering obstacles and surface irregularities, the free ends of these upturned portions being secured as at 20b, preferably by welding, to a side guard rail 22 surrounding the box (Fig. 3 particularly) at the level of the top of the main box portion.

As shown in Fig. 2 particularly, the main trunk cable 11 enters one end of the box through a tightly fitting bushing 23 and is firmly clamped at its inner end in a clamping block 24 (Figs. 3 and 4). The trunk cable 11 is reasonably flexible and ruggedly constructed so that in practice the junction box may be slid around on the mine floor by pulling on the cable 11, the runners 20a permitting practical mobility of the box for this purpose, and the guard rails 22 protecting the box and certain instrumentalities exposed thereon from injury during such manipulation.

The box is provided with a heavy cover 25 hinged as at 26 and provided with a usual form of drop handle 27, the cover further having lap

edges 28 (Figs. 4 and 6) which fit closely over the upper edge portions of the mouth or top of the main box portion with the object of providing as tight a fit as possible to exclude water and gases. The interior of the box and the underside of the lid are lined with a heavy insulating, water-repellant material 29 which may be rubber, this lining being carried to the top edges or rim of the box and as close as possible to the lap edges 28 of the cover to further seal off the interior from fluids.

The feeder cables 13a, 14a, and 15a are likewise flexible and ruggedly constructed and enter the opposite end of the box from the trunk cable through closely fitting bushings 30 for engagement in another clamping block 31 (Fig. 3) for connection with certain switching and fuse devices now to be described.

As seen in Fig. 3, the main trunk cable 11 includes a plurality of conductors one of which is a main conductor 11a, the opposite end of which is connected to the positive terminal of the supply source at the main junction box 10, the terminal of conductor 11a in the portable junction box connecting with a lug 32 (Figs. 4 and 5) on the stationary switch blades or fingers 33 forming one contact element of a knife switch, the movable or blade element 34 of which forms the other contact element and is connected by a bus-bar 35 (Figs. 3 and 6) with one terminal 36 of the cutter control switch for feeder cable 15a. A branch 37 of the bus-bar connects via conductor 38 with one of the terminals 39 of a conveyor control switch for feeder cable 14a and also with a terminal 40 for another control switch for the drill feeder cable 13a. Thus, when the master switch is closed, the positive terminal of the power supply is connected to each of the three control switches.

The trunk cable carries a safety ground conductor indicated by the dotted line 41 and connected with a bus-bar 42 from which individual ground connections 13b, 14b, and 15b extend respectively to the feeder cables 13a, 14a, and 15a. The return or negative conductor 43, indicated by the dash-dot line, extends from the trunk cable to a bus-bar 44 directly via the dash-dot conductor 15c into the cutter cable with a branch dash-dot connection 45 from the bus-bar 44 to one terminal 46 of the conveyor control switch and from the other terminal of this side of the switch through a fuse 47 and dash-dot conductor 14c into the conveyor cable 14a, it being observed that a conductor 48 connects through fuse 49 and the corresponding switch blade to contact 39 to connect the positive lead into the conveyor cable 14a. Similarly the terminal 40 of the drill switch is connected through one of the switch blades and a fuse (not shown) to terminal 50 and thence via conductor 13c with the drill feeder cable 13a. The negative lead from the bus-bar 44 connects with a drill switch terminal 51 and through the corresponding switch blade and a fuse (not seen) with terminal 52 and dash-dot conductor 13d into the drill feeder cable. The main positive bus-bar 35 connects through terminal 36 of the cutter switch, and a heavy fuse 54 to terminal 55 and thence via conductor 15d into the cutter cable.

The several switches are adapted for control from the exterior of the junction box, with the exception of the master switch, the cutter switch being operated by a lever 56 on the outside of the box and provided with a snap-action mechanism 57 and an operating bar 58 which rocks the

switch blade 59 into and out of engagement with contact 36.

Similarly, the conveyor switch is provided with an operating lever 60 on the outside of the box, a snap-action mechanism 61 connecting with an operating member 62 for rocking the switch blades 63 and 64 into and out of contacting engagement with the stationary contacts 39 and 46.

The drill switch includes an operating lever 65, a snap-action mechanism 66, and an operating arm 67 for moving the switch blades 68 and 69 into and out of engagement with contacts 40 and 51.

The master switch blade 34 is pivotally mounted as at 72 on a trunnion 72' and is operated by the lid of the box and a special snap-action mechanism including a tensioning lever 70 (Figs. 4 and 6) which is pivotally mounted as at 71 on the master switch blade 34 itself, at a point remotely or radially situated from the pivotal mounting 72 of this blade, this tensioning lever being further provided with a connection to the lid which includes a sleeve-like runner 73 (Fig. 4) pivotally connected as at 74 to the end of the lever and thus at a point which is radially away from the pivotal connection 71 of the lever to the master switch blade and also radially away from the pivotal axis 72 of the master switch blade.

The runner 73 slides on a bar 75 secured to the inside of the lid 25, the arrangement being such that the opposite swinging movements of the lid will cause runner 73 to slide back and forth on rod 75 with a consequent pivotal movement of the master switch blade 34 into and out of engagement with the companion or stationary contact structure formed by the contact elements 33. These elements 33 are a pair of upstanding fingers, spaced from each other and adapted to receive the blade 34 to make a positive contact.

Means for effecting snap action of the master switch blade, particularly when it is moved to open-circuit position, includes the provision of a special spring (Figs. 4 and 6) coiled as at 76 near the pivotal connection 71 of the tensioning lever on the master switch blade, this spring having arms 77 which have an end portion connected by the screw means 78 to the master switch blade itself at a point along the latter away from both of the pivots 71 and 72, the tensioning spring having intermediate arms 79 with an intermediate portion 80 looped around a lug 81 on the tensioning lever.

The operation of the snap mechanism is such that when the master switch blade assembly is in closed circuit condition, as indicated in dotted lines in Fig. 4, the runner 73 will be at one end of the rod 75. When the lid is raised, the tensioning lever 70 is pivoted upwardly as the runner 73 shifts (toward the left, Fig. 4) on rod 75, although at this time there is no direct pull on the master switch blade, this movement of the tensioning lever, however, placing the spring arms 77 and 79 under increasing tension until a point is reached in the opening movement of the lid where the spring will have sufficient tension to throw the master switch arm upwardly and quickly out of engagement with the companion contacts or fingers 33.

In order to insulate the lid structure from the switch, the pivotal connection 74 of the rider or sleeve 73 is made to an insulated block 74a secured as by the screw means 74b to the upper end of the tensioning lever. When the lid of the box is closed, an ear portion 70a on the tensioning lever bears directly against the adjoining

edge of the master switch blade and forces the latter down into engagement with the contacts 33.

The operator is shielded from engagement with the positive lead, when the box is open, by a special shielding of the switch blades 33, this shielding including the provision of an insulated housing, generally indicated at 90 (Figs. 3, 5 and 6) surrounding the contacts 33 and provided with a pair of flexible insulated flaps 91 secured to the top of the housing as by screws 92 and each having a downwardly curved end portion 93 opposite a similar edge portion of the other adapted to meet in substantially closing engagement when the master switch blade is withdrawn from contacts 33, the master switch blade engaging and passing between the meeting edges of this flap in its downward movement into engagement with contact fingers 33 when the lid is closed.

Means for signaling from the main distributing station 10 to the junction box and vice versa, includes the provision of signal means in the form of a bell 100 enclosed in a casing 101 on the outside of the box and operated through connections with signal conductors (not shown) also carried in the main trunk cable 11 to be actuated by an attendant at the main power distributing station 10. In order to signal from the junction box to the main station, there is provided a push button 102 enclosed in a waterproof housing 103 on another outside wall of the box, this push button being connected also by conductors carried in the main trunk cable 11 with signal means at the station 10 for signaling in the reverse direction.

From the foregoing description, it will appear that I have provided a portable junction box and one which is also mobile in that it is capable of sliding movement on runners provided for this purpose. The operator is protected by the provision of a master switch which is operated by the lid of a box to break the main power circuit when the lid is opened, the master switch being further provided with enclosed terminals within the box which prevent accidental engagement therewith when the box is opened. The invention further provides a plurality of control switches with operating levers disposed exteriorly of the box and protected substantially by a guide rail attached cooperably with the runners. These and other features hereinbefore set forth in detail provide a rugged junction box of great utility and ease of operation and manipulation, and one which provides maximum safeguards for the operator.

The various advantages and objects of the invention may be accomplished by modifications of the particular embodiment specifically described herein, and it is intended that the appended claims shall include all equivalent arrangements fairly coming within their call.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. A movable junction box comprising, in combination, a box member provided with a lid, runners on said box member whereby the same may be slid on a supporting surface, switch means in said box member, lever means for operating said switch means and disposed exteriorly of the box member, means supportably engaged with said runners providing a guard rail for said lever means, said box member being adapted for con-

nection with a flexible cable including electrical connections with said switch means.

2. A movable junction box comprising, in combination, a box member provided with a lid, runners on said box member whereby the same may be slid on a supporting surface, switch means in said box member, lever means for operating said switch means and disposed exteriorly of the box member, means supportably engaged with said runners providing a guard rail for said lever means, said box member being adapted for connection with a flexible cable, a master switch in said box operable to connect and disconnect said switch means with a power lead in said cable, and mechanism coacting with said lid for opening said master switch when the lid is open and closing said master switch when the lid is closed.

3. The combination with a movable junction box, of runners thereon, each having opposite end portions extending beyond one of the opposite ends of the box, a guard rail extended around the box in spaced relation to the sides thereof and supportably engaged with said extending portions of the runners, said box being adapted to contain electrical instrumentalities, and operating means for said instrumentalities situated on exterior portions of the box opposite said guard rail in a position to be substantially protected by the latter against accidental operation by engagement with obstructions encountered in movements of the box.

4. In a junction box having a lid and a master switch including a pivoted contact and a stationary contact together with snap action mechanism coacting with the lid and the pivoted contact to quickly disengage said pivoted contact from said stationary contact in snap action when the lid is moved a certain amount from closed condition, said mechanism including a tensioning lever, means pivotally connecting the latter to said pivoted contact, a slide bar on said lid and movable with the latter, sleeve means slideably arranged on said slide bar and means connecting said sleeve to said tensioning lever to impart movement to said pivoted contact as aforesaid.

5. In a junction box having a lid and a master switch including a pivoted contact and a stationary contact together with snap action mechanism coacting with the lid and the pivoted contact to quickly disengage said pivoted contact from said stationary contact in snap action when the lid is moved a certain amount from closed condition, said mechanism including a tensioning lever, and means pivotally connecting the latter to said pivoted contact, a slide bar on said lid and movable with the latter, sleeve means slideably arranged on said slide bar, means connecting said sleeve to said tensioning lever, and spring means interlocking said tensioning lever and said pivoted contact whereby to impart movement to the latter as aforesaid.

6. In a junction box having a lid and a master switch including a pivoted contact and a stationary contact having connection with a main power source, together with snap action mechanism coacting with the lid and the pivoted contact to quickly disengage said pivoted contact from said stationary contact in snap action when the lid is moved a certain amount from closed condition, said mechanism including a tensioning lever, means pivotally connecting the latter to said pivoted contact, a slide bar on said lid and movable with the latter, sleeve means slideably arranged on said slide bar, means connecting said sleeve to said tensioning lever to impart movement to said

pivoted contact as aforesaid, and guard means comprising a pair of pliable flap members disposed over said stationary contact with their free edges in abutting relation and yieldable to engagement by said blade when the latter is moved into and out of engagement with said stationary contact as aforesaid.

7. In a junction box having a lid and a master switch including a pivoted contact and a stationary contact, together with snap action mechanism coacting with the lid and the pivoted contact to quickly disengage said pivoted contact from said stationary contact in snap action when the lid is moved a certain amount from closed condition, said mechanism including a tension-

5 ing lever, means pivotally connecting the latter to said pivoted contact, a slide bar on said lid and movable with the latter, sleeve means slidably arranged on said slide bar, means connecting said sleeve to said tensioning lever, spring means interlocking said tensioning lever and said pivoted contact whereby to impart movement to the latter as aforesaid, and guard means comprising a pair of pliable flap members disposed over said stationary contact with their free edges in abutting relation and yieldable to engagement by said blade when the latter is moved into and out of engagement with said stationary contact as aforesaid.

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