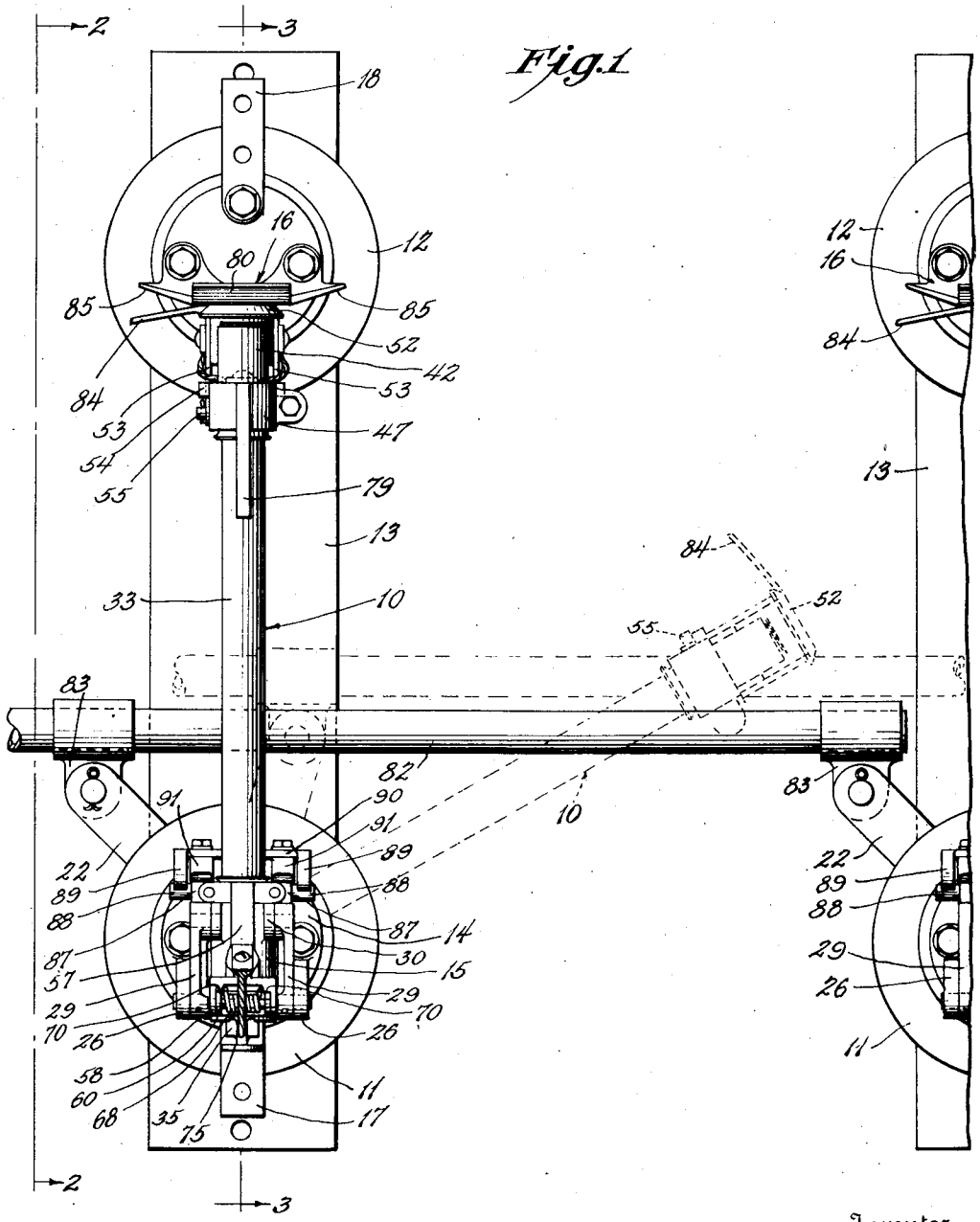
May 16, 1939. T. F. JOHNSON 2,158,722

FUSE SWITCH

Filed Aug. 1, 1938 4 Sheets-Sheet 1

Fig. 1



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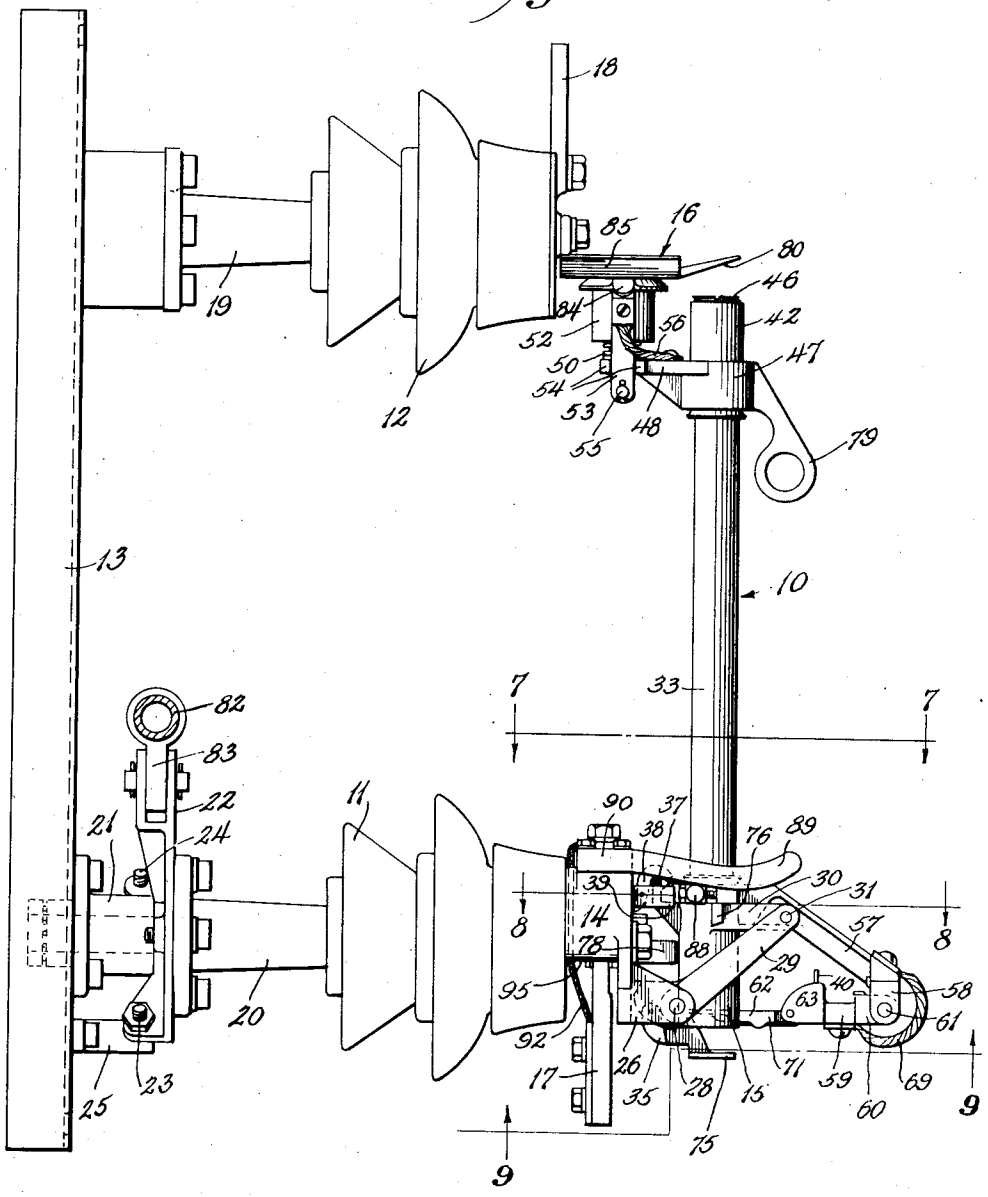
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FUSE SWITCH

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Fig. 2



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FUSE SWITCH

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Fig. 3

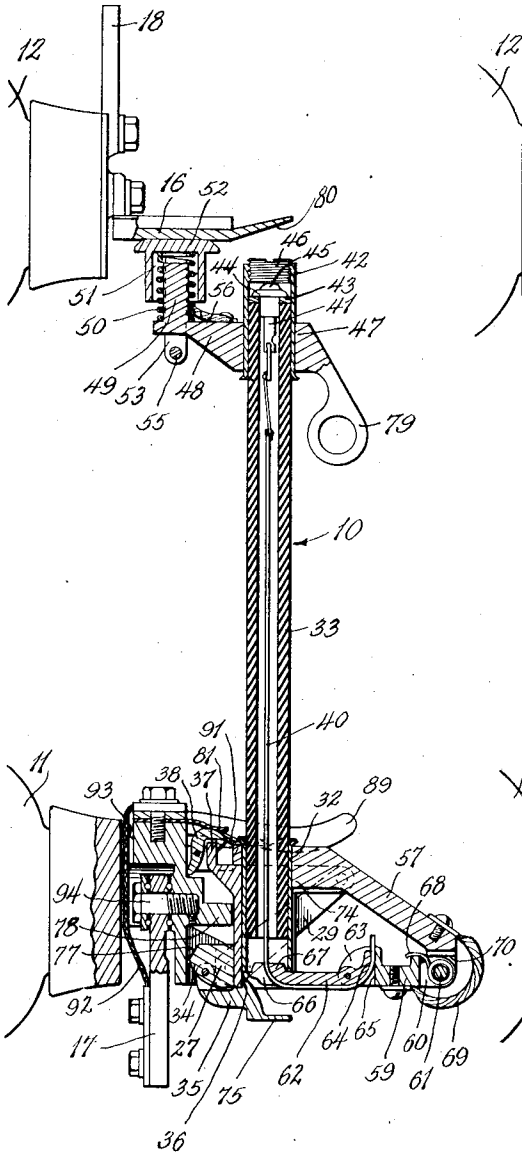
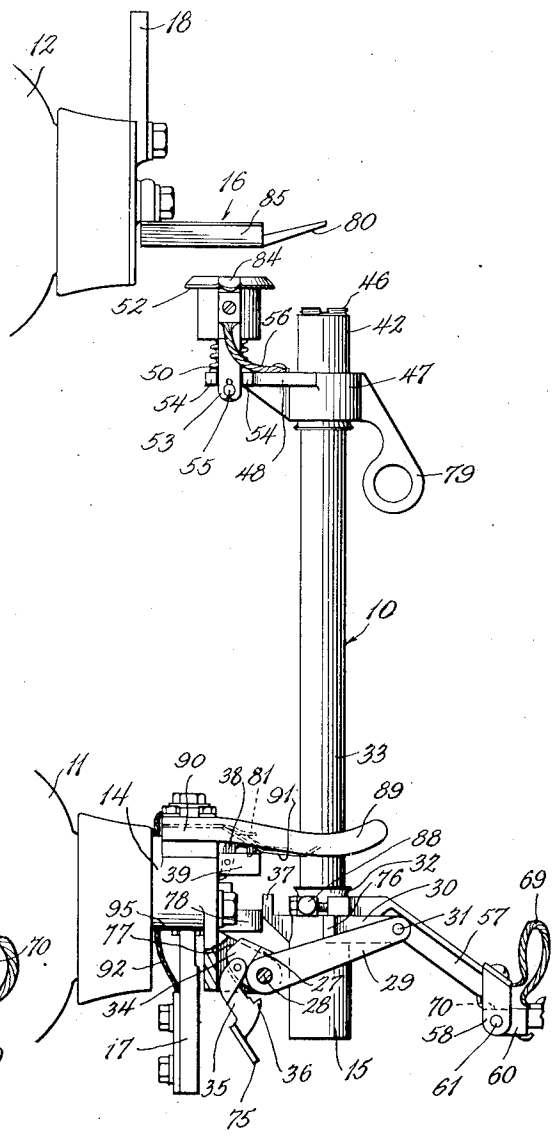


Fig. 4



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May 16, 1939. T. F. JOHNSON 2,158,722

FUSE SWITCH

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Fig. 5

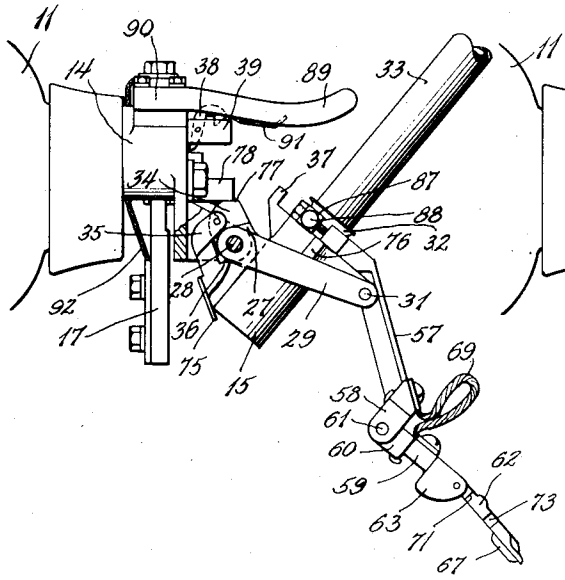


Fig. 6

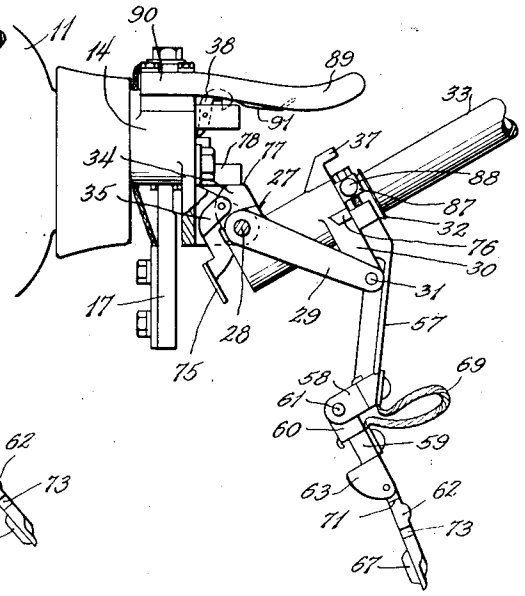


Fig. 7

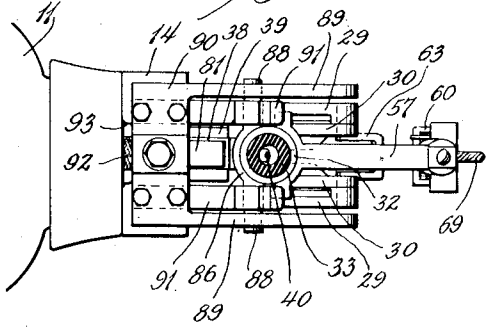


Fig. 8

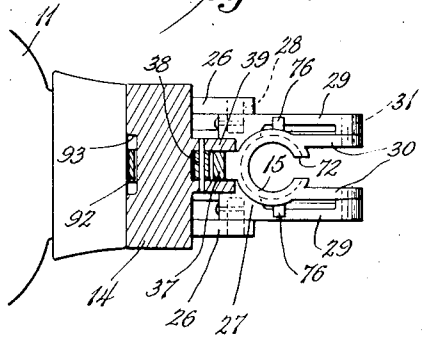
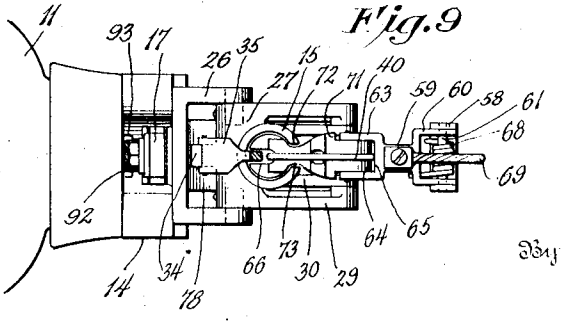


Fig. 9



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Patented May 16, 1939 2,158,722

UNITED STATES PATENT OFFICE

2,158,722

FUSE SWITCH

Tomlinson F. Johnson, Atlanta, Ga.

Application August 1, 1938, Serial No. 222,528

15 Claims. (Cl. 200—114)

This invention relates to fuse switches and, among other objects, aims to provide a plurality or gang of fuse assemblies having removable fuse units connected to be manually operated simultaneously to open or close a multiphase circuit and being further arranged to permit any one or all of the fuse units to function as automatic drop-out fuses when an overload occurs in the circuit.

Other objects and advantages of the invention will appear in the specification, when considered in connection with the accompanying drawings.

This application embodies certain improvements on the inventions disclosed in Patents No. 2,059,796 and 2,074,913.

In the drawings:

Fig. 1 is a fragmentary front elevation of a gang fuse switch assembly;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1 and showing a complete assembly in side elevation;

Fig. 3 is a sectional view partly in elevation taken on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary side elevation similar to Fig. 2 but showing the parts in their initial position when a fuse blows;

Figs. 5 and 6 are fragmentary side elevations similar to Fig. 4 but showing the parts in subsequent positions;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 2;

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 2 but omitting the fuse tube and its connected parts; and

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 2.

In the installation of multiphase transmission lines, it has been the custom to include in the equipment a gang operated switch by means of which the circuit could be opened or closed as desired. In addition, to protect the circuit from overloads, a set of fuses was provided, one for each phase so arranged as to blow out when the particular fuse was subjected to an overload. This method, however, not only is expensive in the cost of the switch assembly and fuses but also in the structure on which they are mounted. Also, such structures require more space. The present invention contemplates the use of a plurality of combined fuse-switch assemblies and a single mounting for each assembly.

Referring particularly to the drawings, one form of the invention is there shown as embodying a plurality of fuse assemblies mounted adjacent to each other and connected in such a manner as to permit them to be used as a gang operated switch, but to operate independently as drop-out fuses. Herein, each assembly is shown as comprising an expulsion type fuse unit 10 carried by a rotatable insulator 11 and a stationary insulator 12 both mounted on a vertical support 13 which is usually in the form of a structural channel. The automatic mechanism for each unit is carried by a metal bracket 14 bolted to the insulator 11 and the fuse unit is removably mounted in a socket 15 pivotally carried by this bracket so as to be swung into and out of engagement with a contact bracket 16 rigidly secured to the cap of the insulator 12.

The brackets 14 and 16 are of bronze or other suitable conducting material and have terminal arms 17 and 18, respectively, the arm 18 being integral with bracket 16 while arm 17 is pivoted on bracket 14, as will be hereinafter described. This insulator 12 is fixed on a post 19 which is bolted to the support 13 while the post 20 on which the insulator 11 is fixed is journaled in a bearing 21 secured to the support 13. A lever arm 22 (Figs. 1 and 2), secured to the base of the post 20 forms the means by which the insulator 11 may be rotated. The lever 22 carries adjustable stops 23 and 24 adapted to engage a fixed abutment 25 on the support to limit the rotatable movement of the insulator 11. As shown in Figs. 1 and 2, when in normal position, the unit 10 is substantially upright with the stop 23 engaging the abutment 25, but when the lever 22 is moved clockwise in Fig. 1, the fuse unit 10 swings into the dotted position with the stop 24 against the abutment 25.

The bracket 14 has forwardly extending ears 26 between which is pivoted the lower end of a U-shaped stirrup 27 on hinge pins 28. The stirrup has integral arms 29 adjacent to the ears and extending upwardly and forwardly therefrom. The cylindrical open ended socket 15 is arranged vertically between the arms 29 and has forwardly extending integral arms 30 pivotally connected to the upper ends of the arms 29 by pivot pins 31. See Fig. 6.

The socket 15 is adapted to receive a metal ferrule 32 on the lower end of the insulated tube 33 of the fuse unit, and when the parts are in normal position, the socket is arranged to hold the fuse unit in upright position with the socket substantially rigid both with respect to the stirrup 27 and to the bracket 14, at the same time being constructed and arranged to permit the fuse unit to drop downwardly and outwardly when the fuse blows. For this purpose, latch

means are provided releasably to secure the socket to the stirrup and to the bracket.

Herein, the lower end of the stirrup is shown as having a rearwardly extending integral ear 34 carrying a pivoted latch member 35 having a shoulder 36 adapted to engage the lower inside rear edge of the socket so that, when thus engaged, the socket and stirrup may swing as a unit about the pins 28. To releasably hold the socket with respect to the bracket 14, the upper end of the socket has a rearwardly and upwardly extending integral lug 37 adapted to be engaged by a pivoted spring tensioned latch 38 mounted between integral ears 39 on the bracket 14. The lug 37 is adapted to fit snugly between the ears to assist in reducing strain on the pins 28. When the socket is thus held, it cannot be moved forwardly unless the latch member 35 is tripped. This is done automatically when the fuse blows, as will be described.

Referring to Fig. 3, the fuse tube carries a tension fuse wire 40 having a fusible link soldered at its upper end to a member 41. Such fuses are of a well known type. The upper end of the fuse tube is open and has a metal ferrule 42 extending beyond it. A metal disk 43 is inserted in the open end of the ferrule against the end of the tube and carries the usual flanged washer or adapter 44 providing a seat for the rounded head 45 on the upper end of the fuse member 41. The end of the ferrule 42 is shown as being screw threaded and closed by a metal plug 46 adapted to be tightly screwed against the head 45 and make good electrical contact therewith. Thus, the fuse link is easily removable and replaceable.

To provide an electrical connection between the metal ferrule and the contact 16, a split collar 47 is clamped on the ferrule and has an integral, rearwardly extending bracket 48 carrying an upstanding guiding post 49 surrounded by a coiled spring 50. The lower end of the spring bears against the upper face of the bracket 48 while the upper end presses against the top of a socket 51 formed in a hollow contact head 52 to bias the head toward the contact 16. To retain the head 52 on the post 49 and to limit its upward movement relative to the bracket, it has depending arms 53 on opposite sides slidably mounted between lateral lugs 54 formed on the bracket 48 and the lower ends of the arms are connected by a removable pin 55 extending beneath the bracket. A flexible conductor 56 is secured to the contact member on opposite sides and to the bracket to provide good electrical connection between them.

When the fuse unit is in normal upright position as shown in Figs. 1, 2 and 3, the spring 50 exerts downward pressure on the tube 33 so that, when the latch 35 is tripped, the tube will initially be moved downwardly. Referring now to the automatic mechanism for tripping the latch, the fuse unit is arranged to expel its ruptured fuse element through the lower open end of the fuse socket and thereby effect release of the latch 35.

The fuse wire 40 projects through the lower open end of the lower ferrule 32 and is adapted to be connected to a spring tension member which, when released, operates the latch 35. The mechanism is substantially the same as that shown in the aforesaid Patent 2,059,796. As best shown in Fig. 3, a bracket member 57 is clamped on the ferrule 32 near its upper end and projects downwardly at an angle to the axis of the tube. The outer free end of the bracket member has spaced hinge ears 58 to which is connected a knee-jointed hammer comprising an arm 59 having spaced ears 60 mounted on a pin 61 projecting through the hinge ears 58 and a hammer member 62 pivotally mounted between ears 63 on the arm 59 and presenting a cam gripping surface 64 cooperating with a gripping face 65 between the ears 63. The hammer member is shown as being notched or bifurcated at 66 to receive the fuse wire 40 which is threaded through the notch and between the gripping surfaces 64 and 65, the hammer having a smooth central guiding groove to prevent displacement of and sharp bends in the wire. Also, the end of the hammer member has a bulb-shaped enlargement 67 adapted to guide it into the open end of the ferrule 32.

Mounted on the hinge pin 61 is a coil spring 68 normally urging the hammer to swing downwardly to engage the latch and knock it to its releasing position. To make good electrical contact between the bracket arm and the hammer member, a flexible wire 69 is shown as connecting them. In this instance, the spring-urged arm 59 of the hammer is limited in its swinging movement by means of a pair of stop shoulders 70 machined adjacent to the ears 60 to engage the top edges of the ears when the hammer is swung through approximately 180° as shown in Figs. 4, 5 and 6. Moreover, the swinging movement of the hammer member or arm 62 with respect to the arm 59 is limited by means of a pair of lateral stop shoulders 71 adapted to engage the edges of the ears 63. The arrangement is such that, when the hammer arm is swung into position so that the forked end of the hammer closes the lower end of the ferrule and the two arms are swung upwardly at their joint from the position shown in Figs. 2 and 3, the free end of the fuse wire may be inserted between the gripping faces 64 and 65. Then, when the arms are released, the spring tension will cause them to swing to the position shown in Figs. 2 and 3, not only to grip and hold the end of the fuse wire but also to place it under a slight tension.

Referring to Figs. 3, 8 and 9, the fuse socket is shown as having a longitudinal slot 72 in its front wall and the hammer arm 62 is provided with a narrow neck portion 73 insertable in said slot to permit the fuse unit to be pushed home in the socket. Also, the bracket 57 has an extension 74 adapted to engage and fit snugly into the upper end portion of the slot to prevent rotation of the fuse unit and keep the hammer in line with the latch 35. The reduced neck portion 73 on the hammer is somewhat narrower than the width of the slot 72 so that when the fuse tube is centered in the socket by the projection 74, the hammer is free to swing downwardly without binding in the slot.

As soon as a fuse link blows, the hammer is released and swings downwardly striking a trigger member 75 on the latch 35. The connecting portion between the latch 35 and the trigger 75 is narrower than the notch 66 of the hammer arm 62 to provide ample clearance for the swinging hammer. As soon as the shoulder 36 on the latch 35 clears the lower edge of the socket 15, the socket and the fuse tube will fall initially downwardly and slightly outwardly while maintaining their general upright positions, being accelerated by the compression of the spring 50. During this initial movement, the projecting lug 37 falls downwardly and is released from the latch 38, and the socket 15 and stirrup 27 swing on the

pivot pins 31 and 28 respectively until a pair of lateral lugs 76, formed on the socket 15 (Figs. 2, 4 and 8) engage the upper edges of the arms 29, when the parts will be in the position shown in Fig. 4. Then, the tube socket and stirrup swing clockwise as a unit about the pivot 28 until a beveled shoulder 77, formed on the upper rear edge of the extension 34 engages the underside of an integral stop 78, formed on the front of the bracket 14, which position is shown in Fig. 5. Then, the stirrup comes to rest and the tube and socket, being overbalanced, continue to swing clockwise about the pivots 31 and, while thus moving, the lower rear edge of the socket rides against the forward inclined portion of the latch 35 and swings it clockwise on its pivot until the rear wall of the socket is reseated in the stirrup when the shoulder 36 on the latch will automatically engage the adjacent edge of the socket. From the above position of the parts, as shown in Fig. 6, a lineman can instantly determine which fuse has been blown.

The blown unit can then be removed from its socket 15 by an ordinary switch hook engaging a hook eye 79 formed on the clamping bracket 48. A lineman may substitute a new unit or refuse the old one and replace it in its socket, after which the fuse tube, socket and stirrup are swung counter-clockwise as a unit on the pivots 28 from the position shown in Fig. 6 to that shown in Figs. 2 and 3. Just before reaching its final position, the beveled edge of the contact head 52 engages a cam extension 80 formed on the front of the contact 16, which causes the head 52 to compress the spring 50 and thereby provide a good electrical contact between the members 16 and 52. Also, the spring compression insures the initial downward movement of the tube when the latch 35 is tripped. As the fuse unit reaches its closed position (Figs. 1 and 3), the lug 37 engages the cam face of the latch 38 and raises it against its spring 81 until the socket 15 strikes against the stop 78. Then, the latch 38 will automatically engage the lug 37, thereby holding the fuse unit engaged with the bracket 14 until the tripping latch 35 is again tripped.

When it is desired to manually open the circuit carrying the fuse units, it is only necessary to rotate the insulators 11, when the units will be swung laterally or in a direction at right angles to their drop-out movement. Herein, this movement is shown as being clockwise in Fig. 1. To operate two or more of the units in the circuit, the lever arms 22 of the assemblies are connected together at their free ends by a rod or pipe 82 having conventional hinge members 83 pivoted to the levers. The pipe 82 is adapted to be operated from the ground or a platform in the usual manner. By moving the rod 82 to the right, as viewed in Fig. 1, the fuse units will be swung clockwise simultaneously to the dotted position. When it is desired to close the circuit, the movement is reversed and as the contact heads 52 approach the contacts 16, combined guide and arcing horn extensions 84 engage cam faces 85 on the right hand sides of the contacts 16 to insure proper seating of the heads 52 against the contact 16. A second cam face 85 is provided on the left hand side of each contact in the event that it is desired to assemble the mechanism to permit the switch to open counter-clockwise instead of clockwise.

To relieve the pivots 28 of undue shearing strain when the device is operated as a switch and also to guide the fuse units into their closed positions, the clamping member 86 for the bracket 57 is provided with lateral contact extensions 87 terminating in trunnions 88 adapted to pass beneath forwardly extending cam arms 89 on a U-shaped member 90 shown as being secured to the top of the bracket 14. When a lineman standing below and in front of the units, closes a replaced fuse, there is a tendency to lift the unit out of its socket. This is prevented by the trunnions engaging beneath the arms 89 which extend well forwardly of the bracket 14.

To insure good electrical contact between the lower ferrule 32 and the terminal 17, a pair of spring contacts 91 are clamped between the member 90 and the top of the bracket 14, the arms extending forwardly and having bent ends to guide them over the extensions 87 with which they contact when the fuse units are swung to their closed positions. Incidentally, the spring 81 for the latch 38 is also clamped between the U-shaped member 90 and the top of the bracket. A braided conductor 92 is connected between the member 90 and the terminal 17, extending through a slot 93 formed in the rear face of the bracket 14.

To prevent bending, and ultimately breaking the line conductor to which the terminal 17 is connected, the upper end of the terminal is shown as being pivotally suspended on a bolt 94 arranged within a recess in the bracket 14 and on the axis of the insulator 11. Thus, when the insulator 11 is rotated, the terminal will remain in its vertical position, the bottom of the bracket 14 being cut away as at 95 to provide the necessary clearance.

From the foregoing description, it will be seen that the improved mechanism embodies, in a single unit, all of the elements of a drop-out fuse assembly and a gang operated air break switch. The functions of the combined fuse-switch are thus included in one piece of apparatus which can be manufactured at much less cost than the separate units. They are compact and easy to operate. There are no delicate parts that require frequent replacement and the mechanism is rugged and dependable in its operation.

Obviously, the present invention is not restricted to the particular embodiment thereof herein shown and described. Moreover, it is not indispensable that all the features of the invention be used conjointly, since they may be employed advantageously in various combinations and sub-combinations.

What is claimed is:

1. A combination gang switch and drop-out fuse assembly having fused switch units manually operable to open as an ordinary switch in one direction; and pivoted latch releasable supports for the units permitting them to drop out automatically in another direction when the fuses are blown.

2. A combination gang switch and drop-out fuse assembly having vertically mounted fused switch units; manually operable means connecting the units together for simultaneous movement as an ordinary gang switch; and releasable latch means associated with the units connected to permit the individual units to drop out when the respective fuses are blown.

3. A fused switch comprising, in combination, a support; a fixed contact and a movable contact on said support; a fuse unit removably carried by said movable contact and movable relative to it, said unit being normally held in en-

gagement with said fixed contact; releasable latch means normally holding said unit fixed relative to said movable contact; manually operable means connected to said movable contact to move said fuse unit in one direction and disengage it from said fixed contact; a fuse element associated with said unit; and means on said unit operable incident to the blowing of said fuse element automatically to release said latch means to permit said unit to move relative to said movable contact and drop out from said fixed contact.

4. In a gang operated switch, a plurality of fused switch units each comprising a vertical support; an insulator having a contact fixed on said support; a second insulator mounted for rotation about its own axis on the support and carrying said fuse unit; releasable latch means normally holding said unit fixed relative to said rotatable insulator; means connected simultaneously to operate all of said rotatable insulators to swing said fuse units in one direction relative to said contacts; and means automatically operable incident to the blowing of a fuse element to release the associated fuse units to permit them to swing and drop out in a different direction relative to the contacts.

5. In a fused switch assembly of the character described, a plurality of fixed contacts; a fused switch unit associated with each contact and mounted for movement about two axes; a fuse element carried by each unit; means connected simultaneously to move the units about one of their axes as an ordinary switch; and automatic means associated with the units to permit the units to move and drop out individually about the other of said axes when the fuse elements blow.

6. A fused switch comprising, in combination, a fixed insulated support having a contact member; a rotatable insulated support; hinge means on the rotatable support; a fuse unit pivotally supported by the hinge means and engaging said contact member; means associated with the unit connected to automatically cause said unit to swing in one direction out of engagement with said contact when the fuse blows; and manually operable means to rotate said insulated support and swing said unit in another direction out of engagement with the contact.

7. A fuse-switch comprising, in combination a fixed insulated support having a contact member; a rotatable insulated support; a fuse unit having a fuse element carried by said rotatable support and normally releasably held in engagement with said contact, said unit being biased to move in one direction away from its normal position; means connected automatically to release said unit to drop out when its fuse element blows; and manual means to move the unit in another direction away from its normal position.

8. In a fused switch assembly of the character described, a plurality of drop-out fuse units; a stationary contact for each unit; a movable support for each unit normally holding the unit in engagement with its contact; said units being biased to swing and drop out individually in one direction away from their contacts when said units blow; and manually operable means connecting said units simultaneously to move them in a direction at right angles to the first direction as an ordinary gang switch.

9. A drop-out fuse assembly comprising, in combination, a vertical support; an upper horizontal insulator having a contact fixed to said support; a lower horizontal insulator parallel with the upper insulator and mounted on said support; a bearing bracket on said lower insulator; a stirrup pivoted on said bracket and having arms; a socket pivoted between the arms; releasable latch means normally holding said socket in upright fixed relation to said bracket; a fuse unit removably held in said socket and having a movable terminal member at its upper end normally engaged with the contact on the upper insulator; a compression spring carried by said terminal biasing it to move said unit away from said contact; a fuse element carried by said unit; and latch operating means normally restrained by said fuse element and adapted to be released by said element when it blows to engage and release said latch means to permit said unit to drop out.

10. A fuse switch comprising, in combination, a vertical support; an upper horizontal insulator having a contact fixed to said support; a lower horizontal insulator parallel with the upper insulator and mounted on said support for rotation on its own axis; a bearing bracket on said lower insulator; a stirrup pivoted on said bracket and having arms; a socket pivoted between the arms; releasable latch means normally holding said socket in upright fixed relation to said bracket; a fuse unit removably held in said socket and having a resilient contact member at its upper end normally engaged with the contact on the upper insulator and biased to move said unit away from said contact; a fuse element carried by said unit; latch operating means normally restrained by said fuse element and adapted to be released by said element when it blows to engage and release said latch means to permit said unit to move and drop out in one direction away from the contact; and manually operable means connected to rotate the lower insulator to cause the unit to swing in another direction away from the contact as an ordinary switch.

11. In combination with a switch and fuse assembly of the character described, vertically arranged fused switch units connected to be opened and closed manually in one plane and arranged to swing and drop out automatically in another plane when the respective fuses blow; and stationary contact members for the respective fuse units having cam-shaped wings extending in the directions of the opening and closing movement and of the drop out movement to guide the units into closed position.

12. In combination with a switch and fuse assembly of the character described, a plurality of stationary contacts; a movable support below each stationary contact; vertically arranged fused switch units carried by said movable supports to engage said contacts; manually operable means connected simultaneously to move said units in one plane into and out of engagement with said contacts as a gang switch; and means connected automatically to permit said units to be disengaged independently from said contacts and move in another plane when the respective fuses blow.

13. In combination with a switch and fuse assembly of the character described, a plurality of stationary contacts; a movable support below each stationary contact; vertically arranged fused switch units carried by said movable supports to engage said contacts; manually operable means connected simultaneously to move said units in one plane into and out of engagement with said contacts as a gang switch; means connected automatically to permit said units to be disengaged independently from said contacts and move in another plane when the respective fuses blow;

conductor terminal connectors pivotally connected to the movable supports to prevent the conductors from moving with the unit; and means electrically connecting the fuse units to the respective terminal connectors.

14. In combination with a switch and fuse assembly of the character described, vertically arranged fused switch units connected to be opened and closed manually in one plane and arranged to swing and drop out automatically in another plane when the respective fuses blow; stationary contact members for the respective fuse units having cam-shaped wings extending in the directions of the opening and closing movement and of the drop out movement to guide the units into closed position; and spring urged contact heads carried by the fuse units and engageable with the stationary contacts.

15. A combination gang switch and drop-out fuse assembly having fused switch units manually operable to open as an ordinary switch in one direction; pivoted latch releasable supports for the units permitting them to drop out automatically in another direction when the fuses are blown said units being removably carried by said supports; and means to prevent said units from being lifted out of their respective supports until said units move to their drop-out positions.

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