July 5, 1966 R. L. RUEFFER 3,259,726

TELESCOPING TYPE CIRCUIT BREAKER HAVING ISOLATOR CONTACT WITH ARC SNUFFING MEANS

Filed March 2, 1964 3 Sheets-Sheet 1

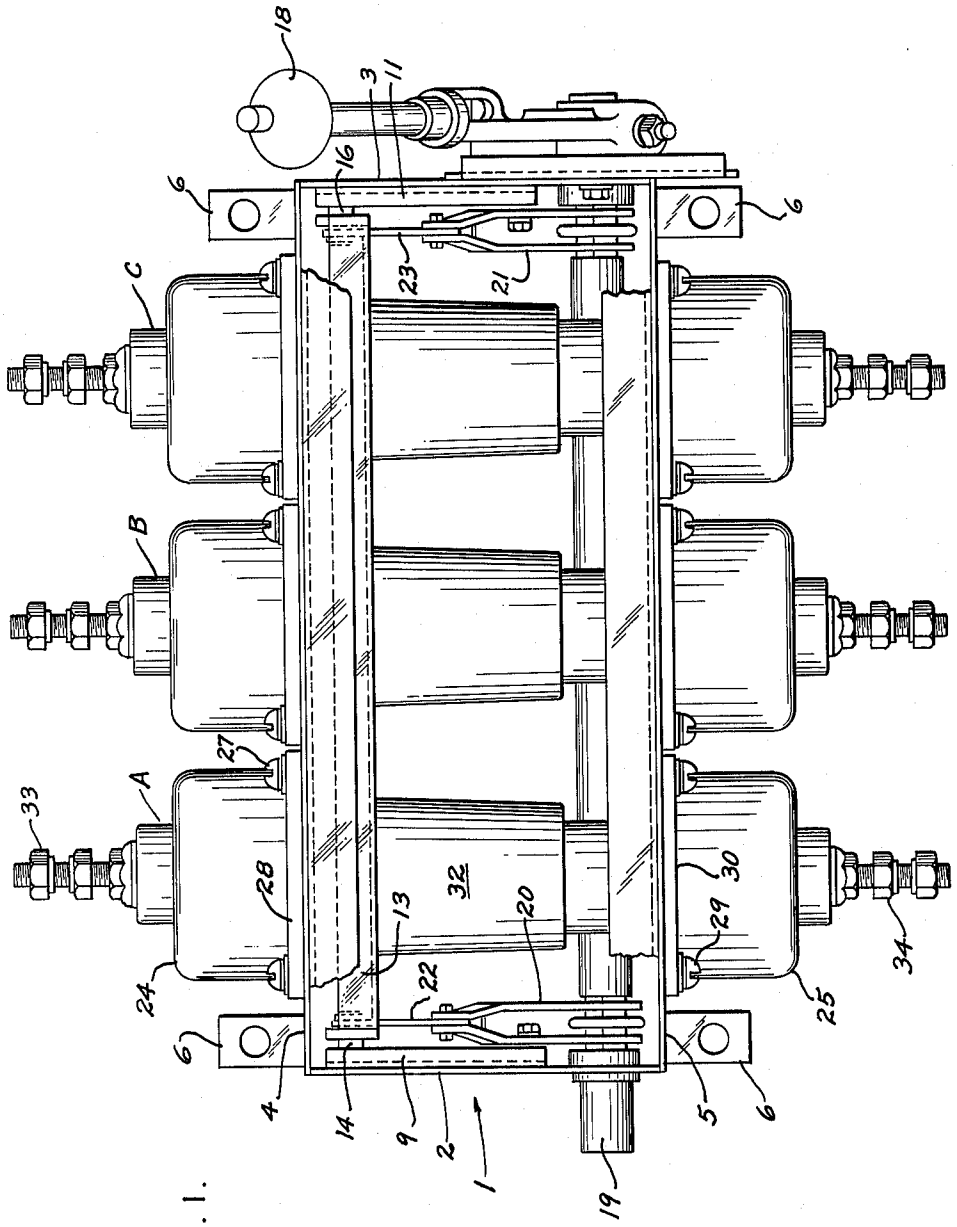

FIG. 1.

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Filed March 2, 1964 3 Sheets-Sheet 2

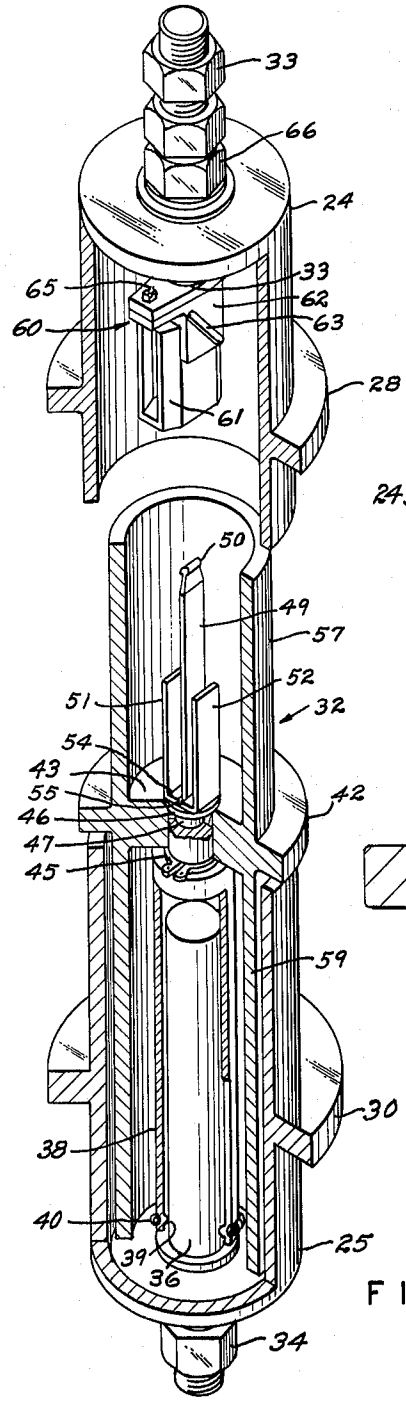

FIG. 2.

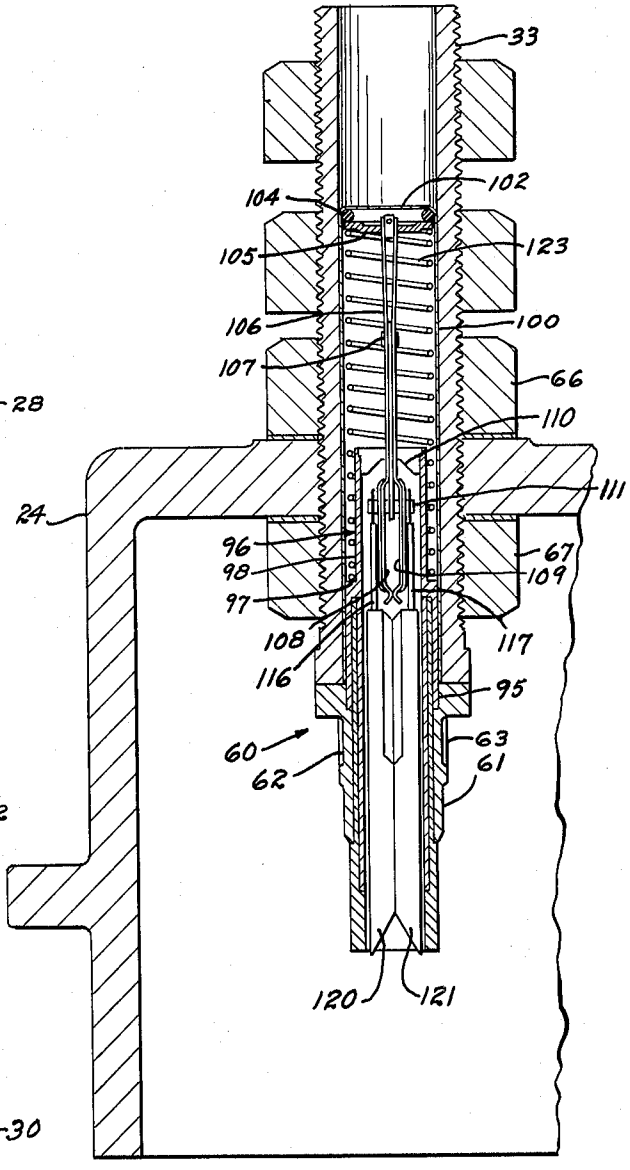

FIG. 3.

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TELESCOPING TYPE CIRCUIT BREAKER HAVING ISOLATOR CONTACT WITH ARC SNUFFING MEANS

Filed March 2, 1964 3 Sheets-Sheet 3

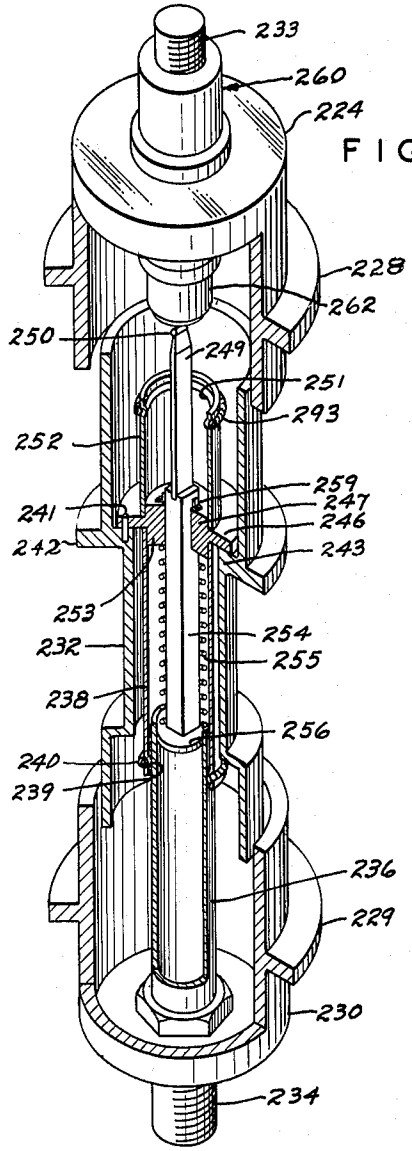

FIG. 4.

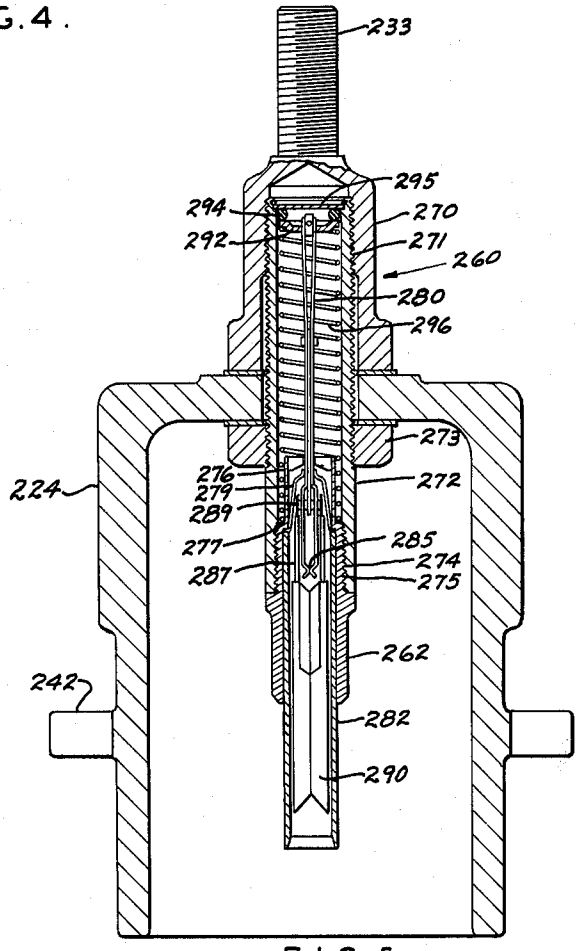

FIG. 5.

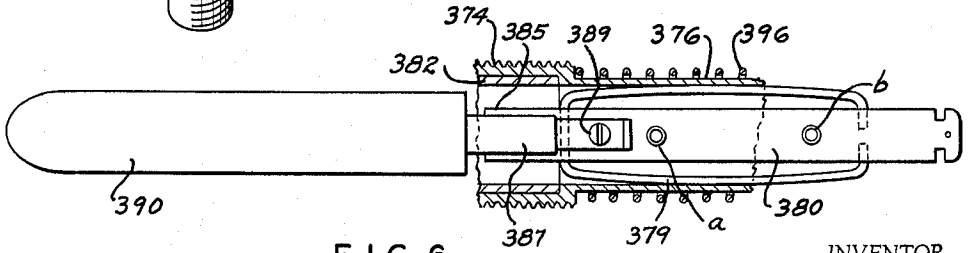

FIG. 6.

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United States Patent Office 3,259,726 Patented July 5, 1966

3,259,726

TELESCOPING TYPE CIRCUIT BREAKER HAVING ISOLATOR CONTACT WITH ARC SNUFFING MEANS

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Filed Mar. 2, 1964, Ser. No. 348,749
6 Claims. (Cl. 200—151)

This invention relates to a telescoping type of disconnect unit for an electric circuit isolator such as shown in my prior United States application for patent, Serial No. 318,637, filed October 24, 1963, and entitled "Electric Circuit Isolator." The disconnect unit constructed in accordance with the teachings of this disclosure may be substituted for the units **140**, **141** and **142** shown in my prior application for patent.

As explained in this prior application, an electric circuit isolator is a disconnect often used for installations, such as public buildings or other commercial users of large amounts of electric power. These installations usually carry a heavy current which may be one or more hundreds of amps at anywhere from several hundred to several thousand volts.

A circuit isolator must effectively isolate a service circuit for safety reasons and, in using my prior machine, it is preferable to disconnect all of the power from, or to, a service circuit before opening the circuit isolator which, when open, isolates this particular service circuit to which it is connected even though other service circuits may be re-energized.

With the substitution of my improved units disclosed herein, it is unnecessary to disconnect the power supply before opening the isolator because these improved units include arc suppressing devices so that the isolator may be opened under load in perfect safety and without the risk of damage due to arcing.

Accordingly, it is one of the objects of this invention to provide an improved disconnect unit of the telescoping type which has the added advantage of safe operation under heavy electric load.

It is still another object of the invention to provide an improved disconnect unit of the telescoping type which has self-aligning contact structure including the added advantage of safe operation by eliminating arcing danger.

This improved unit has separable contacts to open an electric circuit and an insulator housing in which the contacts are totally enclosed when connected. The insulator housing opens when the contacts open so as to indicate the open relation of the contacts visually. The housing, when open, still conceals the contacts making them inaccessible to touch.

One of these contacts includes an arc suppressing device operated sequentially on opening to suppress any arc which might be struck due to contact separation. The incorporation in the device of the arc suppressor in no way changes or detracts from the self-aligning features built into the unit as described in detail in my prior patent application or eliminates other features contributing to reliability and simplicity in its operation or design.

Other objects and advantages of this invention will appear from the following detailed description which is in such clear, concise and exact terms, as will enable any person skilled in the art to make and use the same when taken in conjunction with the accompanying drawings, forming a part thereof, and in which:

FIG. 1 is an environmental view illustrating a circuit isolator constructed in accordance with this invention;

FIG. 2 is a perspective view with parts broken away and in section illustrating an embodiment of one unit of this invention such as shown in FIG. 1;

FIG. 3 is a fragmentary sectional view of the upper contact and arc suppressor shown in FIG. 2;

FIG. 4 is a perspective view with parts broken away and in section illustrating another embodiment of this invention such as used in FIG. 1;

FIG. 5 is a fragmentary sectional view of the upper contact and load interrupter shown in FIG. 4; and

FIG. 6 is a side view of the internal mechanism within an arc suppressor showing a modified form of brush.

One mechanism in which a unit, or units, constructed in accordance with this invention may be mounted for operation is depicted in FIG. 1, which mechanism is described in detail in my prior patent application herein identified. This description will be restricted to only so much of this prior structure as required for an understanding of the improvement in the unit itself.

The open box-like frame **1**, shown in FIG. 1, is closed at its opposite ends **2** and **3** and at its top **4** and bottom **5**. Mounting bracket **6** provides for attachment of frame **1** to a support. The inner sides of ends **2** and **3** carry vertical guides **9** and **11**, respectively. A subframe **13** within the box-like frame **1** has protruding guide pins **14** and **16** in the guides **9** and **11** so that subframe **13** is confined to vertical movement between the closed sides **4** and **5**. Handle **18** rocks a crank shaft **19** and cranks **20** and **21**. Links **22** and **23** connect between the cranks and pins **14** and **16** and raise and lower the subframe **13** as handle **18** moves.

There are three units, such as A—B—C, in the illustrated mechanism. Each unit is the same and all have fixed insulated parts, such as **24** and **25**, received in aligned holes in the top and bottom walls **4** and **5**, which parts are held therein by screws **27** in apertured flanges **28** and screws **29** in apertured flanges **30**. All of these units A—B—C have intermediate movable insulator sections **32** straddled by spaced side members in subframe **13** and attached to the subframe by screws in flanges on the movable sections **32**. The parts **24**, **25** and **32** are hollow insulators and the intermediate sections **32** telescope with fixed parts **24** and **25** as will be later described. Projecting through the fixed parts **24** and **25** are threaded electric terminals **33** and **34**, respectively. Power feeders are connected to one set of terminals, such as **34**, and a service circuit is connected to the other set of terminals **33**. Operation of handle **18** upwardly to the position shown in FIG. 1 connects the service circuit to power. When the handle **18** is moved downward to its lowest position, the units open the connection between the feeders and the service circuit to isolate the service circuit from its power supply.

The description so far has been limited to the mechanism described in my prior application for patent above identified. This invention is primarily concerned with the construction for the units A—B—C which are described hereinafter in detail.

FIG. 2 illustrates a construction for a unit, such as A—B—C shown in FIG. 1. One of the fixed parts **25** is a cup-shaped insulator surrounded by a flange, such as **30**, for supporting the cup-shaped insulator **25** within an aperture in the side **5** of the box-like structure **1**. The closed end of the cup-shaped insulator **25** is apertured and this aperture has secured therein the terminal **34** which projects from the outside of the insulator and has formed thereon an electrode **36** projecting axially of of the cup-shaped insulator **25**. Slidable on the electrode **36** is tubular contact **38**. On the lower internal wall of the sleeve contact **38** is an annular bead **39** slidably gripping the external surface of the electrode **36**. The lower end of the sleeve contact **38** is split to provide

a plurality of spring fingers which are held in engagement with the electrode **36** by a surrounding garter spring **40**.

Intermediate telescoping section **32** is surrounded by an external flange **42** forming the support for the intermediate telescoping sleeve **32** in the subframe **13**. As heretofore pointed out, the flange **42** may be secured to the subframe **13** by screws, or clamps, so as to move with the subframe from the open position of the isolator parts as depicted in FIG. 2. Internally of the telescoping intermediate insulator part **32** is a supporting flange **43**. Contact sleeve **38** projects through the flange **43** and is loosely received therein. A spring ring **45** seated in a groove surrounding the contact sleeve **38** loosely abuts the lower side of the flange **43**. The upper side of the flange **43** projects beneath head **46** of a plug part **47** brazed or otherwise suitably secured in the upper end of the sleeve contact **38**. Integral with the head **46** is a blade type of electrode **49** provided with a spear end **50**. The blade type contacts **51** and **52**, shown on opposite sides of the electrode **49**, have a bight portion **54** slotted at **55** for the electrode **49**. The bight portion **54** is brazed or otherwise suitably secured to the head **46**.

The intermediate telescoping sleeve insulator **32** has an upwardly projecting skirt part **57** concealing the electrode **49** and the blade contacts **51** and **52**. The skirt **57** also has an external size so as to telescope within the cup-shaped fixed part **24** on closing of the contacts within the isolator unit. When the contacts are open, this is visibly indicated by separation of the skirt **57** from the cup-shaped part **24**. Protruding downwardly from the flange **42** is a lower skirt **59** which is dimensioned to telescope within the cup-shaped part **25**.

The upper insulator part **24** is inverted cup-shaped and surrounded by a flange **28** by which it is supported in an aperture in top wall **4**. The closed end of the cup **24** is apertured to receive the terminal **33**. This terminal **33** is hollow as will be pointed out hereinafter and contains an arc suppressing device **60** which includes a socket **61** of insulating material into which electrode **49** moves when the isolator unit is closed. Externally of the insulator socket **61** are a pair of flat fixed contacts such as **62** with diagonal ribs **63** (one of which is shown in FIG. 2). Blades **51** and **52** move into face to face contact with the ribs **63** to form the electric load carrying circuit when the isolator is closed. The arc suppressing device **60** has apertured flanges which mate with similar apertured flanges at the lower end of the terminal **33** where it projects within the cup-shaped insulator **24**. Bolts, such as **65**, secure the flanges together and the arc suppressing device within the terminal **33**. Terminal **33** is externally threaded and clamped in place within the cup **24** by nuts, such as **66** and **67**, all as shown in FIG. 3.

Turning now to FIG. 3, the metal ferrule part **62** of the arc break device which carries the flanges and contact surfaces **63** has a rabbeted portion **95** holding a tubular extension **96**. The tubular extension **96** is of metal and is stepped externally at **97** to form a reduced tubular diameter extension **98**. Metal casing **100** which surrounds the tubular extension **96** has a press fit in the rabbeted portion **95** and has a cap **102** closing its upper end. An O-ring of rubber-like material **104** forms a cushion support on the cap **102** for a disk **105**. Anchored in the the disk is a plunger **106** formed of a plurality of flat strips of copper or conductor material, all of which are secured together intermediate their ends by a rivet **107**. Two of the strips forming the plunger **106** and indicated as **108** and **109** form a socket-like contact electrically connected with plunger **106**. A pair of spring pressed brushes **110** bear against opposite edges of the flat plunger **106** and also against the cylindrical casing **96** so as to form an electrical connection between the plunger and the metal casing. The screw **111** supports a pair of spring fingers **116** and **117** which are

anchored at their lower ends in opposite snuffer elements **120** and **121**. A coil spring **123** is compressed between the shoulder **97** and disk **105** and tends to hold the contacts **108** and **109** in the position shown in FIG. 3.

The flat electrode **49** passes between the snuffer elements **120** and **121** as the contacts are closed in the isolator. The spear end **50** protrudes beyond the snuffer element into the arc suppressor **60** and is gripped between the contacts **108** and **109** of the socket type contact therein. This forms an electric connection between the electrode **49**, sockets **108**, **109**, plunger **106**, brushes **110** and metal sleeve **95** to the ferrule **62**. The ferrule in turn is an integral part of the flange connection secured by the bolts **65** to terminal **33**. Contact ribs **63** also on the ferrule **62** are electrically connected to the terminal **33**.

If the contacts of the unit are opened as shown in FIG. 2 and handle **18** is moved to the closed position, the intermediate section **32** moves upwardly from the position shown in FIG. 2 along with the subframe **13**. Sleeve **32** carries tubular contact **38** and blade contacts **51**, **52** as well as electrode **49**. Electric contact is maintained between the sleeve type contact **38** and the electrode **36** as the intermediate section **32** moves upwardly. As the handle **18** continues to move, blades **51** and **52** make contact with the ribs **63** thereby completing the circuit through the isolator. Still further movement of the handle **18** forces the spear end **50** into the socket formed by the contacts **108** and **109**, thus, at the same time, completing a circuit through the arc suppressing device. Blade contacts **51** and **52** and sleeve contact **38** with the electrode **36** form the load carrying electric connection from terminal **33** to terminal **34**, after the handle has moved to its full up position.

To isolate the service circuit, handle **18** is moved downwardly. Initial downward movement of the handle separates blade contacts **51** and **52** from the ribs **63** so that the load is now carried to the terminal **33** through the flat electrode **49** and its connection between electric contacts **108** and **109**. As the movement of the handle **18** continues downwardly, the grip of the contacts **108** and **109** on the spear end **50** is maintained so as to draw plunger **106** downwardly compressing the spring **123**. This downward movement not only moves the contacts **108** and **109**, but also carries along with it the snuffers **120** and **121** until the washer, or disk, **105** contacts the end of sleeve **96**. At this point, the snuffers have been withdrawn from the arc suppressor as they follow the electrode **49**. Contacts **108** and **109** release their grip on the spear end **50** after they have reached their limit of downward travel. On release, spring **123** expands retracting the contacts and the snuffers from the electrode **49**. The circuit is broken through the unit from the terminal **33** to the terminal **34** and at the same time the snuffers retract within the arc suppressor coming together as shown in FIG. 3. Any arc which has formed between the end of the electrode **50** and the contacts **108** and **109** is immediately extinguished by the snuffers which form a barrier to arc travel between the contacts **108** and **109** and the end of electrode **49**. The snuffers may be made of a resin material which will give off a gas when subject to the heat of an arc to aid the snuffers in breaking the arc.

The embodiment of the invention, shown in FIGS. 4 and 5, operates basically in the same manner as that previously described and has corresponding parts which will be indicated by the same reference character with 200 added.

With reference to FIG. 4, the cup-shaped insulator of a fixed part **230** is apertured at its closed end and, the threaded end of terminal **234** is secured in this aperture by suitable nuts. The terminal **234** has an electrode part **236** which projects axially within the cup-shaped insulator **230**. Flange **229** around the cup-shaped insulator **230** forms the means to support the fixed part **230** in an opening in the bottom wall **5** of the frame **1**.

The movable insulator part 232 has one end in telescoping relation with respect to the cup-shaped insulator part 230 and its opposite end constructed and arranged to telescope within the cup-shaped insulator part 224. Flange 242 around the insulator is a support for the movable insulator part 232 in the subframe 13. Internal shoulder 243 on insulator 232 is arranged to support the external annular flange 246 on the metal bushing 247. There is an annular depending skirt 253 on the bushing 247. A contact sleeve 238 is secured on the skirt 253 by brazing and telescopes with the electrode 236. Contact is made through an annular rib 239 within the contact sleeve 238 and the end of this sleeve is split to form spring fingers, all as described in my prior patent application above identified. Garter spring 240 is seated in an annular groove around the sleeve contact 238.

The bushing 247 is centrally apertured for slidably holding an electrode rod 254. A spring 255 surrounds the rod 254 and is compressed between a seat on the skirt 253 and a washer 256 held on the threaded end of the rod 254. The upper end of the rod 254 is slotted and the slot receives the end of a flat blade type electrode 249 securely anchored to the rod 254 within the slot. Since the blade 249 is wider than the diameter of the rod 254, it has protruding edges which act as stops to prevent further expansion of spring 255. The edges contact the upper surface of the bushing 247. Brushes 259 on the bushing 247 form an electric connection to the rod 254 and from the rod 254 to blade 249. A sleeve contact 252 is brazed to the bushing 247 and surrounds electrode blade 249. The internal annular rib 251 forms the electric contact surface when telescoped with the tubular contact 262 which is a stationary electrode and part of an assembly including terminal 233 in cup 224. The end of the tubular contact 252 may be slotted to form spring fingers as described in my prior application. Garter spring 293 is seated in the groove around the end of contact sleeve 252.

The flange 246 is suitably secured by pins 241 to internal shoulder 243 so that both sleeve contacts 238 and 252 move with movable insulator part 232. Pins 241, above-mentioned, may be received in slots within the flange 246 to provide for some floating movement of the bushing 247 with respect to the supporting shoulder 243. Flexibility of this kind is a distinct benefit during engagement of the contacts of the isolator. Regardless of how the flange 246 is secured on the shoulder 243, blade 249 is positively moved by the shoulder with the intermediate movable insulator part 232 in a direction to telescope within contact 262. On reverse movement of the insulator part 232, spring 255 is a yielding connection for moving the electrode 249. As will be pointed out hereinafter, the spring 255 is so selected that movement of the electrode 249 is not compelled until the spring 255 is compressed solid. This is due to the fact that the spear end 250 has a tendency to hang in the arc suppressor device 260 as hereinafter described.

Sleeve contacts 238 and 252 are electrically connected through bushing 247 and both are electrically connected with electrode 249 through brushes 259. When the sleeve contact 252 is telescoped with electrode 262 an electric circuit is completed from terminal 233 to terminal 234 through electrode 262, sleeve 252, bushing 247, sleeve contact 238 to electrode 236 and terminal 234.

Details of the second circuit from the blade electrode 249 through the arc suppressor 260 are more clearly shown in FIG. 5. Turning now to FIG. 5, it will be observed that terminal 233 has a threaded socket 270 as well as an externally threaded end. Arc suppressor 260 has a tubular casing 272 externally threaded to mate with threads 271 on the inside of socket 270. Nut 273 internally of the insulator cup 224 forms a rigid connection mounting the terminal 233 and the arc suppressing device 260 in the end of the insulator cup 224.

Internal threads 274 in the end of the casing of the arc suppressor 260 form a connection with external threads 275 on the end of electrode 262. There is a reduced tubular extension 276 on electrode 262 and an internal shoulder 277 at the junction between the part with threads 275, and the extension thereon 276.

Electrode 262 is electrically connected with a metal plunger 280 by brushes 279 which have a free end biased against one side of plunger 280 and the opposite end clamped between shoulder 277 and an end of an insulated tubular guide 282 which projects from within electrode 262. Plunger 280 is in turn electrically and mechanically connected with socket members 285 which are spring fingers gripping the spear end 250, or blade electrode 249. A pair of leaf springs 287 are secured at one end to opposite sides of the plunger 280 by connector 289 and carry a pair of snuffers 290 on their free ends. The snuffers are pressed against opposite sides of blades 249.

The plunger 280 has one end anchored in a disk 292 which is held against O-ring 294 forming a cushion between disk 292 and a plug 295 closing the casing 272. A spring 296 is compressed between the disk 292 and the threaded part 275 of electrode 262.

When the isolator unit is closed, the electric circuit is completed not only between the contacts 252 and 238 with electrodes 262 and 236 as described, but also through the arc suppressor 260 from blade 249 to socket 285, plunger 280, brushes 279, casing 272 and terminal 233. During the opening operation of the unit, movable insulator 232 travels in a direction from within cup insulator 224. The sleeve contact 252 separates from electrode 262, but there will be no arc since a parallel circuit through the arc suppressor from blade 249 to socket 285 is still operative. As the movement of movable insulator 232 continues, spring 255 is compressed because the spear end 250, or blade 249, is frictionally held in the socket 285. After a predetermined separation, but preferably while the end of insualtor 232 is still within the cup insulator 224, spring 2255 becomes solid and, thereafter, continued movement draws socket 285 and snuffers 290 toward the end of tube 282, compressing spring 296. When disk 292 contacts the end of extension 276, blade 249 is freed from socket 285. Spring 289 expands retracting socket 285 and withdrawing snuffers 290 which come together as they move into tube 282 and form a barrier to arc travel from the socket 285 to electrode 249. Both snuffers 290 and tube 282 may be formed of a resin which gives off a gas when an arc is formed. At the same time that spring 296 is retracting socket 285, spring 296 expands withdrawing the blade 249 away from the arc suppressor 260. These events all take place after the end of movable insulator 232 has withdrawn from cup 224 so that the action is observable to the operator. When the handle 18 reaches the end of its travel, electrode 249 has withdrawn into movable insulator 232.

Turning now to FIG. 6, therein shown is a sub-assembly of parts for an arc suppressor such as heretofore described and as shown specifically in FIG. 5. Corresponding parts in FIG. 6 are indicated by the same reference characters used in FIG. 5 with 100 added.

As in FIG. 5, the snuffers 390 are mounted on leaf springs 387 and fastened to the plunger 380 by connector 389. The electric socket, or gripper contact, 385 is formed at one end of the plunger 380 and the opposite end of the plunger is notched to hold a disk, such as 292 shown in FIG. 5 on the end of the plunger 280. As also shown in FIG. 5, the plunger 380 of FIG. 6 comprises two strips of metal side by side held together by rivets A and B. In this modification, the electric connection is made between the plunger 380 and the casing 372 by a brush in the form of a wire bail 379 frictionally clamped between the strips of the plunger 380 at points on opposite sides of the rivets A and B. The ends of the bail 379 are left open to permit expansion and

traction. Each leg of the bail **379** makes sliding contact with the inner surface of the casing **372** on the outside of the spring **396** so as to electrically connect the plunger **380** and the socket **385** with the casing **372**. The brush **379** can be made of a suitable metal which is springy, such as Phosphor bronze. As will be apparent from a comparison of FIGS. 5 and 6, the bail **379** is a full-floating electric brush and replaces the pair of fixed brushes **279** in FIG. 5.

Changes in and modifications of the structure described may be made without departing from the spirit of my invention or sacrificing its advantages.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In an electric circuit isolator having a first fixed contact member; a second fixed contact member;

means mounting said contact members in substantial alignment and spaced a substantial distance apart; and a bridging member mounted for rectilinear movement between said contact members to make and break a circuit therebetween, said bridging member being continuously electrically connected to said first fixed contact member but movable relative thereto, and being selectively electrically connected to and disconnected from said second fixed contact member, the improvement which comprises: said bridging member having:

(a) a main contact selectively engageable with said second fixed contact member,

(b) a spear contact permanently electrically and mechanically connected to said main contact and continuously electrically connected with said first fixed contact member,

said second fixed contact member having electrically connected thereto, a gripper contact member, said gripper contact member:

(c) being spring mounted for limited rectilinear movement toward and away from said first fixed contact member,

(d) being constantly spring biased in a direction away from said first fixed contact member,

(e) having means for receiving and resiliently gripping said spear contact when said main contact and said second fixed contact are engaged; and

(f) having an arc snuffer mounted thereon, movable therewith and projecting therefrom for a substantial distance toward said first fixed contact, said arc snuffer providing a channel for traverse by said spear contact to and from said means (e),

the gripping force exerted by said means (e) upon said spear contact being so coordinated with the spring bias on said gripper contact member that during circuit interruption the gripper contact member moves with said spear contact until said main contact has separated from said second fixed contact.

2. The improvement of claim **1** wherein the gripper contact member is disposed within an electrically conductive tube electrically and mechanically connected with said second fixed contact member, the axis of said tube being parallel with said rectilinear movement, and a spring-biased brush for maintaining said gripper contact member in electrical connection with said tube.

3. The improvement of claim **2** wherein the spring-biased brush is a hair-pin spring movable with said gripper contact member, the legs of said hair-pin spring being biased into electrical contact with the interior of said tube at substantially diametrically opposite points.

4. The improvement of claim **1** wherein said arc snuffer is composed of a plurality of elements formed of gas-emitting material, and said elements are connected to said gripper contact member by spring fingers.

5. The improvement of claim **1** wherein said gripper contact member is mounted upon a plunger disposed within a tubular casing fixed relative to said second fixed contact and whose axis is substantially parallel with said rectilinear movement, said plunger being anchored to disk whose outside diameter corresponds substantially with the inside diameter of said tubular casing, said disk being free to move axially of said tubular casing and being constantly biased away from said first fixed contact.

6. The improvement of claim **1** wherein said first fixed member is disposed within a cup-shaped insulator whose open end is addressed toward said second fixed contact member, said second fixed contact member is disposed within a cup-shaped insulator whose open end is addressed toward said first fixed contact member, and said bridging member is disposed within an insulating sleeve having telescoping relationship with both of said cup-shaped insulators.

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