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CIRCUIT INTERRUPTER

Leon R. Ludwig, Wilkinsburg, and Benjamin P. Baker, Turtle Creek, Pa., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

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10 Claims. (Cl. 200-144)

1

This invention relates to circuit interrupters in general, and more particularly to arc extinguishing structures and mounting arrangements therefor.

In U. S. patent application filed April 30, 1945, Serial No. 591,047, by Leon R. Ludwig and Benjamin P. Baker and assigned to the assignee of the instant application, there is shown and described a circuit interrupter of improved mounting construction embodying a supporting means disposed at ground potential which supports a high voltage terminal bushing intermediate the ends thereof. It is an object of our invention to further improve the mounting construction disclosed and claimed in this application.

A more specific object is to provide an improved circuit interrupter having improved mounting constructional features in which conducting means are supported by support means and have an arc extinguishing unit secured to one end thereof. Preferably, terminal means are associated with the arc extinguishing unit and are positioned closely adjacent thereto.

Another object is to provide an improved circuit interrupter of the type comprising a single terminal bushing supported by support means and having an arc extinguishing unit secured to one end thereof. Preferably, movable contact means are actuated toward and away from the same end of the bushing and are actuated by operating means at least in part supported by the supporting means.

Further objects and advantages will readily become apparent upon a reading of the following specification taken in conjunction with the drawing in which:

Figure 1 is a side elevational view of a circuit interrupter embodying our invention;

Fig. 2 is an elevational view partially in section of the interrupter shown in Fig. 1 with the supporting framework omitted and the view enlarged to more clearly show the enclosure therefor, the contacts being shown in the fully open circuit position of the interrupter; and

Fig. 3 is a view similar to Fig. 2 but showing a modified type of arc extinguishing unit and in which the contacts are shown in the closed circuit position.

Referring to the drawing and more particularly to Fig. 1 thereof, the reference numeral 1 generally designates supporting means disposed at ground potential and comprising a plurality of vertically extending channel members 2 braced by diagonally extending supports 3. The supporting means 1 is supported on a base 4. The sup-

2

porting means 1 rigidly supports in place a circuit interrupter 5 having an upper line terminal 6 and a lower line terminal 7. The conductors 8, 9 connect the circuit interrupter 5 into the electrical circuit to be protected.

Fig. 2, which shows more clearly the internal construction of the interrupter 5, shows an arc extinguishing unit 10 threadedly secured and clamped into place at 11 to the lower end of the high voltage bushing 12, the latter being supported by the supporting means. Conducting means 13 for the interrupter extend through the high voltage bushing 12 and serve to carry the electrical circuit through the supporting means 1 to the upper line terminal 6 of the interrupter.

The arc extinguishing unit 10 forms no part of our invention and in this instance is shown as being of the type in which a pressure-generating break is established prior to the formation of an interrupting break. The contact structure for the arc extinguishing unit 10 comprises a stationary pressure-generating contact 14 which is co-operable with an intermediate contact 15, the latter being spring-biased downwardly by a compression spring 16 and cooperating with a movable contact 17 to establish an interrupting arc. Oil under pressure created at the pressure-generating break is forced to flow by suitable passage means into the interrupting break to consequently effect the extinction of the interrupting arc drawn between the intermediate contact 15 and the lower movable contact 17. The passage arrangement is preferably of the type set forth in U. S. patent application, filed November 11, 1942, Serial No. 465,244, now U. S. Patent 2,406,469, issued August 27, 1946, by Leon R. Ludwig, Winthrop M. Leeds and Benjamin P. Baker and assigned to the assignee of the instant application. However, the passage arrangement as set forth in the aforesaid patent could be varied in any desired manner, the particular arc extinguishing unit 10 forming no part of our invention, as will more fully be apparent hereinafter.

Surrounding the arc extinguishing unit 10 and the lower end of the high voltage terminal bushing 12 is an insulating cylinder 18, in turn surrounded by a cylinder 19, the latter being composed of porcelain or other suitable weatherproof material. The lower end of the porcelain casing 19 rests upon a terminal housing 20 in which are disposed a plurality of spring washers 21. The spring washers 21 cooperate with bolts 22 to maintain the porcelain casing 19 in compression and to maintain the insulating cylinder 18 in tension.

The terminal housing 20 also supports a contact guide 23 with contact bearing portions 23a to guide the reciprocating longitudinal movement of the lower movable contact 17, the latter being actuated by an insulating operating rod 24 making pivotal engagement thereto at 25. The upper end of the operating rod 24 makes pivotal engagement at 26 to a crank lever 27, the latter being rotated by an operating shaft 28.

From the foregoing, it will be apparent that rotation of the shaft 28 will cause rotation of the crank and longitudinal movement of the operating rod 24, which extends substantially longitudinally of the terminal bushing 12. To effect closure of the contact structure, it is necessary to rotate the shaft 28 in a clockwise direction. This effects upward movement of the operating rod 24 and correspondingly upward movement of the movable contact 17, which after picking up the intermediate contact 15, causes engagement between the stationary contact 14 and the intermediate contact 15. Thus, the electrical circuit through the interrupter extends downwardly through the high voltage terminal bushing 12, through the stationary contact 14, intermediate contact 15, movable contact 17, through contact bearing portions 23a associated with the contact guide 23, metallic cap 23b, casting 23c to the lower terminal 7 of the interrupter.

In the interrupter shown in Fig. 3, the construction is generally similar to the construction hereinbefore described in connection with Fig. 2. However, a hook-shaped movable contact member 30 pivotally mounted at 31 to a bracket 32 is actuated by the operating rod 24 and makes engagement with stationary contact structure 33. The lower terminal 29 of the interrupter is electrically connected to the bracket 32. The arc extinguishing unit 34 is of modified construction, the details of which are fully shown and claimed in U. S. Patent 2,039,054, which issued April 28, 1936, to Samuel H. Boden and Stanley T. Schofield and which is assigned to the assignee of the instant application.

Preferably, the arc extinguishing action which takes place in the operation of such an arc extinguishing unit causes the single arc drawn between the contacts 30, 33 to be moved toward the left, as viewed in Fig. 3, into suitable constrictions and permits it to intimately engage fresh oil which fills the cylinder 18. The plate structure is completely set forth in the aforesaid patent; consequently, since the arc extinguishing unit 34 specifically forms no part of our invention, merely a brief description of the arc extinguishing action is thought necessary. Following the leftward movement of the arc into the pockets and constrictions afforded by the plate structure as caused by U-shaped plates formed of magnetic material, rapid arc extinction soon takes place. Continued downward movement of the movable contact 30, as caused by downward movement of the insulating rod 24, effects an isolating gap into the circuit.

From the foregoing description, it will be apparent that we have provided an improved circuit interrupter of the single bushing type in which only a single arc extinguishing unit is necessary, and in which the isolating gap in the interrupter is caused by continued movement of the movable contact. The simplicity of the construction lends itself readily to economic manufacture. Since the arc extinguishing units 10, 34 are rigidly secured to the lower ends of the high voltage terminal bushings 12, there is hence pro-

vided rigid support for the several parts of the interrupter. By causing the operation of the interrupter to be effected by rotation of the shaft 28, the arrangement is particularly suitable for two or more interrupters 5 controlling the several phases of a transmission line.

The entire breaker may be mounted with the bushing terminal end up or down. It is, thus, possible to have the interrupter above or below the interrupting oil gap for either position of the breaker mounting.

Current transformers 35, surrounding the terminal bushing 12, are supported by the framework 1 and are preferably used to initiate relay operation to effect opening of the interrupter during the existence of overload conditions in the circuit controlled by the interrupter. The general breaker arrangement not only results in a much cheaper breaker and one which can be serviced more easily but permits of greater switch yard flexibility. Also features of the construction are readily applicable to circuit interrupters of the compressed air type or even of the air-break type. Merely for purposes of illustration have we illustrated a preferred embodiment of our invention as one of the liquid-break type.

Although we have shown and described specific structures, it is to be clearly understood that the same were merely for the purpose of illustration and that changes and modifications may readily be made therein by those skilled in the art without departing from the spirit and scope of the appended claims.

We claim as our invention:

1. In a circuit interrupter, supporting means at ground potential, a casing secured to said grounded supporting means and having a major part of the side walls thereof of insulating material, only a single terminal bushing for the interrupter, the terminal bushing including an elongated conductor having insulation disposed thereabout, the terminal bushing extending through and being supported intermediate the ends thereof by the grounded supporting means, the terminal bushing projecting into one end of the casing and having the interior end thereof terminating adjacent the mid-portion of the casing, an arc extinguishing unit secured to the interior end of the terminal bushing, line terminal means for the interrupter disposed adjacent the other end of the casing, movable contact structure disposed within the casing and separable to establish an arc within the arc extinguishing unit, and actuating means for the movable contact structure carried by the grounded supporting means.

2. In a circuit interrupter, supporting means at ground potential, a casing having a major part of the side walls thereof of insulating material, only a single terminal bushing for the interrupter, the terminal bushing including an elongated conductor having insulation disposed thereabout, the terminal bushing being supported intermediate the ends thereof by the grounded supporting means, the terminal bushing projecting into one end of the casing, and having the interior end thereof terminating adjacent the mid-portion of the casing, an arc extinguishing unit secured to the interior end of the terminal bushing, line terminal means for the interrupter disposed adjacent the other end of the casing, movable contact structure including a movable contact disposed within the casing and separable to establish an arc within the arc extinguishing unit, rotatable actuating means for the movable

5

contact structure carried by the grounded supporting means, and an insulating operating rod extending substantially longitudinally of the terminal bushing within the casing and interconnecting the rotatable actuating means and the movable contact to effect the operation of the same.

3. In a circuit interrupter, supporting means at ground potential, a casing having a major part of the side walls thereof of insulating material, only a single terminal bushing for the interrupter, the terminal bushing including an elongated conductor having insulation disposed thereabout, the terminal bushing extending through and being supported intermediate the ends thereof by the grounded supporting means, the terminal bushing projecting into one end of the casing and having the interior end thereof terminating adjacent the mid-portion of the casing, an arc extinguishing unit secured to the interior end of the terminal bushing, line terminal means for the interrupter disposed adjacent the other end of the casing, movable contact structure disposed within the casing and separable to establish an arc within the arc extinguishing unit, and an elongated operating rod of insulating material extending substantially longitudinally of the terminal bushing in the space between the terminal bushing and the insulating part of the casing for interconnecting the actuating means and the movable contact structure.

4. In a circuit interrupter, grounded supporting means, a casing at least the side wall portions of which are composed of insulating material and secured to the grounded supporting means at one end thereof, only a single terminal bushing for the interrupter, the terminal bushing including a conductor surrounded by insulating material and extending through the grounded supporting means, the grounded supporting means supporting the terminal bushing adjacent the mid-portion thereof, the terminal bushing projecting into said one end of the casing substantially parallel to the side wall portions thereof, the interior end of the terminal bushing terminating adjacent the mid-portion of the casing, an arc extinguishing unit secured to the interior end of the terminal bushing, line terminal means for the interrupter disposed adjacent the other end of the casing, movable contact structure disposed within the casing and including a movable contact for establishing an arc within the arc extinguishing unit, and actuating means for the movable contact structure supported by the grounded supporting means and operable to move the movable contact away from the interior end of the terminal bushing during the opening operation.

5. In a circuit interrupter, grounded supporting means, a casing at least the side wall portions of which are composed of insulating material, the casing being secured to the grounded supporting means adjacent one end thereof, only a single terminal bushing for the interrupter, the terminal bushing including a conductor surrounded by insulating material, the grounded supporting means supporting the terminal bushing adjacent the mid-portion thereof, the terminal bushing extending through the grounded supporting means and projecting into said one end of the casing substantially parallel to the side wall portions thereof, the interior end of the terminal bushing terminating adjacent the mid-portion of the casing, an arc extinguishing unit secured

6

to the interior end of the terminal bushing, line terminal means for the interrupter disposed adjacent the other end of the casing, movable contact structure including a movable contact disposed within the casing and separable to establish an arc within the arc extinguishing unit, and actuating means for the movable contact structure supported by the grounded supporting means and including an elongated insulating operating rod extending substantially longitudinally of the terminal bushing interiorly of the casing and operable to move the movable contact away from the interior end of the terminal bushing during the opening operation.

6. In a circuit interrupter, grounded supporting means, a casing at least the side wall portions of which are composed of insulating material, the casing being secured to the grounded supporting means adjacent one end thereof, only a single terminal bushing for the interrupter, the terminal bushing including a conductor surrounded by insulating material, the grounded supporting means supporting the terminal bushing adjacent the mid-portion thereof, the terminal bushing extending through the grounded supporting means and projecting into said one end of the casing substantially parallel to the side wall portions thereof, the interior end of the terminal bushing terminating adjacent the mid-portion of the casing, an arc extinguishing unit secured to the interior end of the terminal bushing, line terminal means for the interrupter disposed adjacent the other end of the casing, movable contact structure including a linearly movable movable contact disposed within the arc extinguishing unit, and rotatable actuating means for the movable contact structure supported by the grounded supporting means and operable to cause movement of the linearly movable movable contact away from the interior end of the terminal bushing during the opening operation.

7. In a circuit interrupter, supporting means at ground potential, a casing secured to said grounded supporting means and having a major part of the side walls thereof of insulating material, only a single terminal bushing for the interrupter, the terminal bushing including an elongated conductor having insulation disposed thereabout, the terminal bushing extending through and being supported intermediate the ends thereof by the grounded supporting means and projecting into one end of the casing, an arc extinguishing unit secured to the interior end of the terminal bushing so that a clear space exists between the arc extinguishing unit and the other end of the casing, line terminal means disposed adjacent said other end of the casing, movable contact structure including a movable contact for establishing an arc within the arc extinguishing unit, the movable contact being movable into and out of the arc extinguishing unit, and actuating means for the movable contact structure supported by the grounded supporting means and operable to move the movable contact out of the arc extinguishing unit and away from the interior end of the terminal bushing to insert an isolating gap in the circuit between the tip of the movable contact and the arc extinguishing unit.

8. In a circuit interrupter, supporting means at ground potential, a casing secured to said grounded supporting means and having a major part of the side walls thereof of insulating material, only a single terminal bushing for the interrupter, the terminal bushing including an elongated

gated conductor having insulation disposed thereabout, the terminal bushing extending through and being supported intermediate the ends thereof by the grounded supporting means and projecting into one end of the casing, an arc extinguishing unit secured to the interior end of the terminal bushing and so disposed that a clear space exists between the arc extinguishing unit and the other end of the casing, line terminal means disposed adjacent said other end of the casing, movable contact structure including a movable contact for establishing an arc within the arc extinguishing unit, the movable contact being movable into and out of the arc extinguishing unit, and actuating means including an elongated insulating operating rod extending substantially longitudinally of the terminal bushing within the casing and supported by the grounded supporting means and operable to move the movable contact out of the arc extinguishing unit and away from the interior end of the terminal bushing to insert an isolating gap into the circuit between the tip of the movable contact and the arc extinguishing unit.

9. In a circuit interrupter, supporting means at ground potential, a casing secured to said grounded supporting means and having a major part of the side walls thereof of insulating material, only a single terminal bushing for the interrupter, the terminal bushing including an elongated conductor having insulation disposed thereabout, the terminal bushing extending through and being supported intermediate the ends thereof by the grounded supporting means, the terminal bushing projecting into one end of the casing and having the interior end thereof terminating adjacent the mid-portion of the casing, stationary contact means associated with the interior end of the terminal bushing, line terminal means for the interrupter disposed adjacent the other end of the casing, a movable contact disposed within the casing and cooperable with the stationary contact means to establish an arc, and actuating means for the movable contact carried by the grounded supporting means.

10. In a circuit interrupter, supporting means

at ground potential, a casing secured to said grounded supporting means and having a major part of the side walls thereof of insulating material, only a single terminal bushing for the interrupter, the terminal bushing including an elongated conductor having insulation disposed thereabout, the terminal bushing extending through and being supported intermediate the ends thereof by the grounded supporting means, the terminal bushing projecting into one end of the casing and having the interior end thereof terminating adjacent the mid-portion of the casing, stationary contact means associated with the interior end of the terminal bushing, line terminal means for the interrupter disposed adjacent the other end of the casing, a movable contact disposed within the casing and cooperable with the stationary contact means to establish an arc, actuating means for the movable contact carried by the grounded supporting means and including an insulating elongated operating rod extending substantially longitudinally of the terminal bushing interiorly of the casing.

LEON R. LUDWIG.
BENJAMIN P. BAKER.

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