July 21, 1953 J. D. WOOD ET AL 2,646,482

HIGH-VOLTAGE CIRCUIT BREAKER

Original Filed Jan. 11, 1947 4 Sheets-Sheet 1

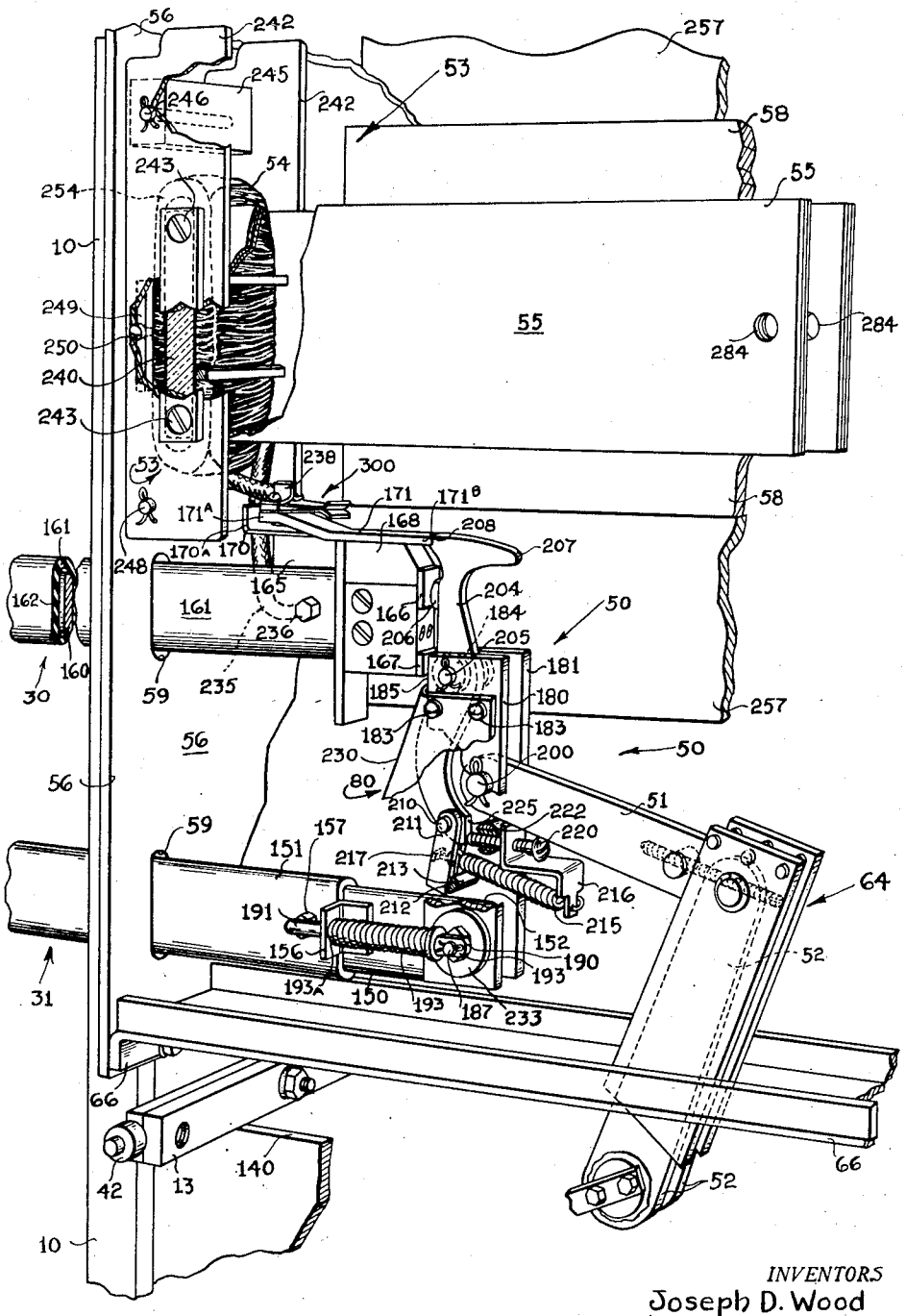

Fig. 1.

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HIGH-VOLTAGE CIRCUIT BREAKER

Original Filed Jan. 11, 1947 4 Sheets-Sheet 2

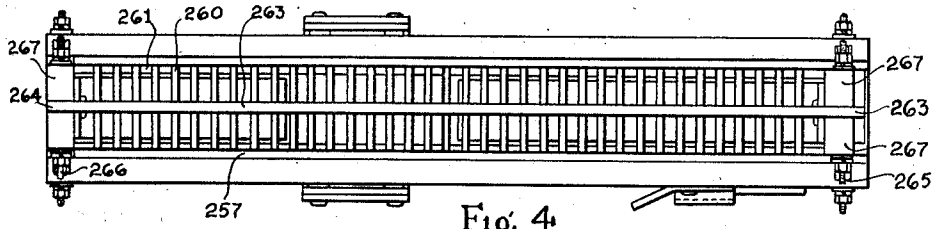


Fig. 4.

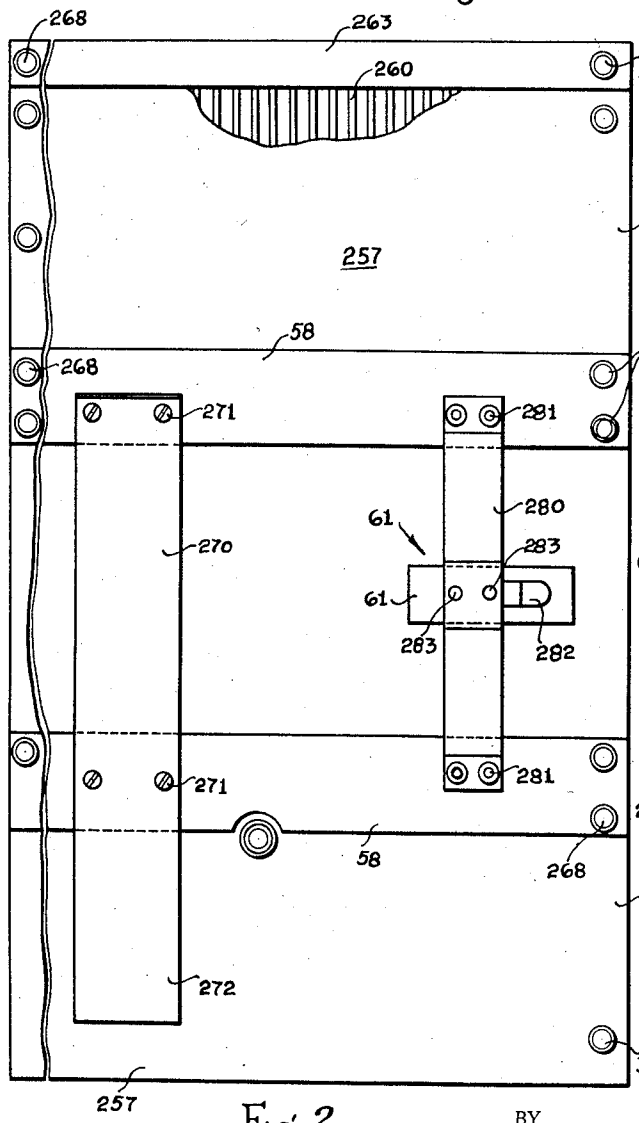
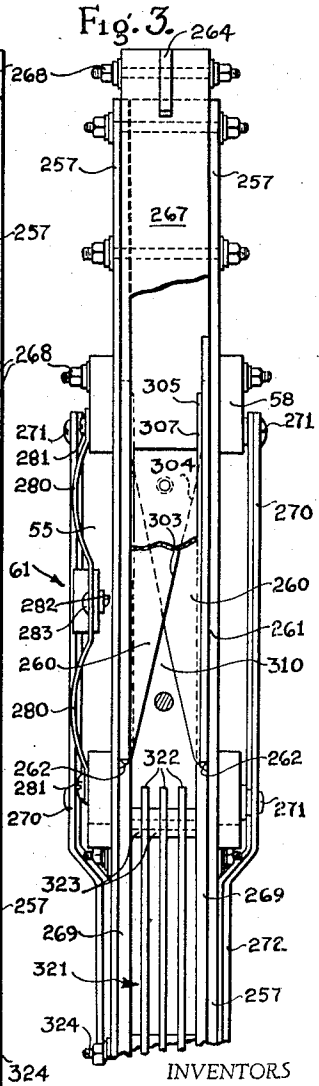


Fig. 2.

Fig. 3.



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HIGH-VOLTAGE CIRCUIT BREAKER

Original Filed Jan. 11, 1947 4 Sheets-Sheet 3

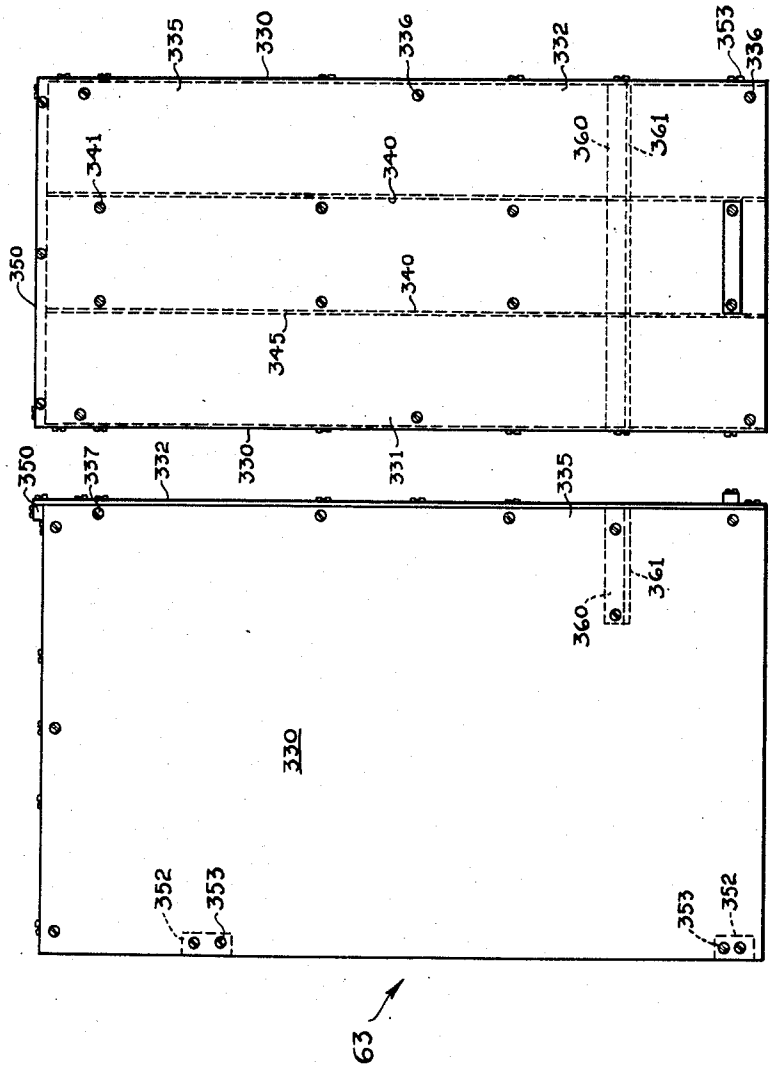

FIG. 6.

FIG. 5.

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HIGH-VOLTAGE CIRCUIT BREAKER

Original Filed Jan. 11, 1947 4 Sheets-Sheet 4

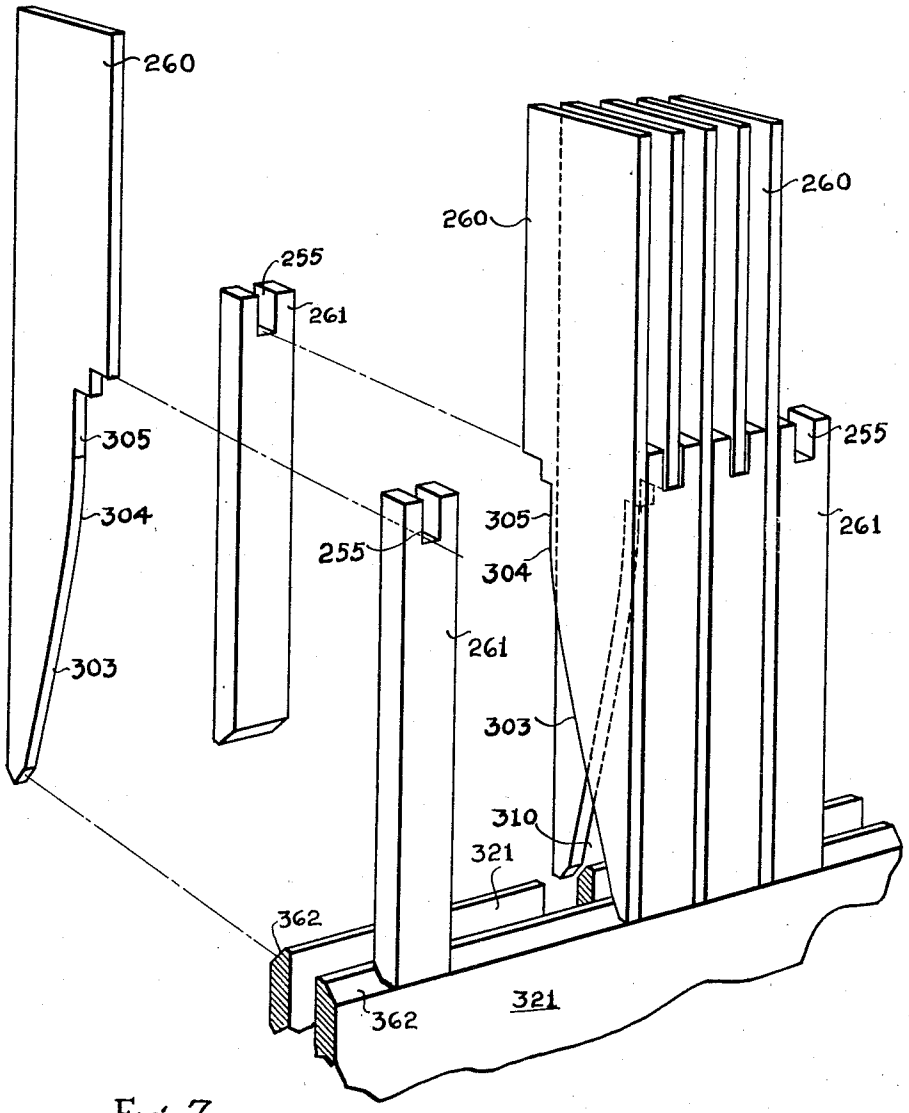

Fig. 7.

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UNITED STATES PATENT OFFICE

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HIGH-VOLTAGE CIRCUIT BREAKER

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Original application January 11, 1947, Serial No. 721,648, now Patent No. 2,613,299, dated October 7, 1952. Divided and this application June 4, 1947, Serial No. 752,426

12 Claims. (Cl. 200—147)

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Our present invention which is a division of United States application Serial No. 721,648, filed January 11, 1947, now Patent 2,613,299, October 7, 1952, relates to high voltage high capacity circuit breakers, and more particularly to circuit breakers having an interrupting rating of 50,000 kva. and better in any voltage range between 2300 and 5000 volts and at current ratings of 600 and 1200 amperes.

In a high voltage high capacity breaker the first and most important step involved is the construction of the arc chute and of the arc blow-out mechanism so that any arc which is drawn between the contacts as they open may be readily extinguished before damage to the breaker or to the circuit may occur.

Our novel circuit breaker includes a simple unitary arc chute structure made as a single unit provided with a disconnect and so arranged that it may readily be mounted on the circuit breaker and connected thereto or removed therefrom as a whole without the necessity for special tools.

Our novel arc chute thus combines the essential ideas of simplified construction for greater economy and simplified arrangement in the form of a single unit assembly which may readily be mounted on any circuit breaker of the class to which the arc chute is to be applied. The arc chute may readily be removed for inspection of the contacts of the circuit breaker or for replacement or repair of any part that may require such replacement or repair.

Many objects of our invention will become apparent from the following description of the drawings in which

Figure 1 is an enlarged side front view in perspective partially broken away showing the lower terminal assembly, upper terminal assembly, the blow-out coil assembly and the movable contact bridge assembly.

Figure 2 is a side view of the arc chute assembly.

Figure 3 is a front view of the arc chute assembly.

Figure 4 is a top view of the arc chute assembly.

Figure 5 is a side view of the interphase barrier.

Figure 6 is a front view of the interphase barrier.

Figure 7 is a perspective and partially exploded view of a portion of the arc chute of our novel circuit breaker.

The specific novel assemblies or sub-assemblies forming an essential part of the novel circuit breaker here shown are the operating mechanism shown in Figure 3 of the parent application Serial

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No. 721,648, filed January 11, 1947, now Patent 2,613,299, October 7, 1952, the lower terminal assembly shown in Figure 1, the upper terminal assembly of Figure 1, the movable contact arm or bridge assembly of Figure 1, the blow out assembly of Figure 1, the arc chute assembly of Figures 2, 3 and 4. The specific operation of these individual assemblies renders possible the entire high speed high capacity circuit breaker which our novel unit embodies. Additional assemblies which facilitate the operation are specifically described in connection with Figures 5 and 6 which show the interphase barrier assembly and Figures 10, 11 and 12 of the parent application Serial No. 721,648, filed January 11, 1947, now Patent 2,613,299, October 7, 1952, which show the rack and indicator assembly.

The various assemblies above mentioned will be described in order, going from the bottom toward the top of the circuit breaker without specific emphasis on any one of the assemblies over the other.

It must be emphasized, however, that an important feature of the circuit breaker is in the novel arc chute construction in conjunction with the novel blow out construction.

The operating mechanism utilizes as closely as possible the simple principle of the lever operated switch with only enough addition thereto to provide automatic response to overcurrent conditions in order to trip the circuit breaker and also to provide a solenoid closing means. The simplification of this operating mechanism makes possible the production of the inexpensive circuit breaker herein described.

Thus, while the arc chute assembly and the blow-out assembly make possible the high capacity operation and high speed operation which are essential to the operation of the circuit breaker as a whole, the simplicity of the other assemblies makes possible the economical and efficient construction.

The upper terminal assembly **30**, and the lower terminal assembly **31** for each of the three poles is formed from a single bar of copper of rectangular cross section appropriately insulated by phenolic insulation as described more specifically hereinafter in connection with Figure 1. The terminal assembly elements **30, 31** are carried by the vertical supports **10** and **11**, as well as the central vertical support **32** which is carried between the lower Masonite plate **12**, and the upper cross bar **14**, as shown in Figure 2 of parent application Serial No. 721,648, filed January 11, 1947, now Patent 2,613,299, October

7, 1952. Each of the vertical members 10, 11 and 32 is recessed at 33, 33 to receive the terminal members and accurately position the same. Each of the terminal members is provided with a side plate or flange 35 hereinafter more specifically described in connection with Figure 2 of parent application Serial No. 721,648, filed January 11, 1947, now Patent 2,613,299, October 7, 1952. Each of the vertical reinforcements 10, 11 and 32 is a rectangular steel member, so that while the recesses 33, 33 are cut out in the vertical reinforcement they are incised only in the portion of the rectangular steel member which is normal to the back panel 56. The legs of each of the rectangular members 10, 11 and 32 carry the bolts 36, 36 which engage the flange members 35 of the terminal element. Thus it will be seen that two bolts or screws 36 are all that are necessary to secure each of the terminal elements in place, these bolts being locked in secured position by the nut 37 as shown in Figure 2 of parent application Serial No. 721,648, filed January 11, 1947, now Patent 2,613,299, October 7, 1952.

Each of the upper and lower terminal assembly members 30 and 31 also carry the spring biased disconnect contact elements 38, 38 shown also in Patent Number 2,029,028. The intermediate cross bar 13, which is secured to the vertical members 10, 11 and 32 by the bolts 40, also carries at its outer end the wheels 42 on an appropriate shaft extension thereof, the said wheels 42 cooperating with appropriate tracks in the compartment to guide the truck into and out of the compartment properly.

The movable contact assembly shown generally at 50 of Figure 1 is connected at its lower end to the lower terminal assembly 31 in the manner hereinafter described, and is provided with a link 51 which is connected to the contact operating arms 52 projecting up from the operating mechanism assembly 46. The movable contact bridge assembly which of course has as many poles as there are upper and lower terminal assemblies, three in the particular instance shown, is provided with contact elements hereinafter more particularly described in connection with Figure 1. The blow out coil assembly 53 which includes the coil 54 of Figure 1 and the laminated blow out iron legs 55, is mounted on the upper insulating back panel 56 also across the bars 15 and 14 and the upper portion of vertical supporting members 10 and 11 and is supported thereby.

It is spaced from the bars 10, 11, 32, 14, 15 by the upper insulating back panel 58 which panel is secured across the bars 10, 11 and 32 as shown in Figure 1. Appropriate openings 59, 59, are provided in the panel 56 to permit the terminal members 30 and 31 to project therethrough in a manner shown in Figure 1.

The arc chute assembly 57 is supported by the blow out assembly 53 and particularly by the laminated legs 55 of the blow out iron which ride between the bracing bars 58, 58 on each side of the arc chute as shown in Figure 2, and as will be more specifically described hereinafter in connection with Figures 1 and 2.

As will also be hereinafter pointed out the front arc runner 291 (Figure 25 of the parent application Serial No. 721,648, filed January 11, 1947, now Patent 2,613,299, October 7, 1952) of the arc chute is not connected in any way to any of the other elements of the circuit breaker but is brought into the circuit by the proximity of the moving contact 20A thereto during the opening operation. The rear runner 290 (Figure 25 of the parent application Serial No. 721,648, filed January 11, 1947, now Patent 2,613,299, October 7, 1952) of the arc chute 57 is connected to the circuit breaker through the blow out coil mechanism 53 by the clip arrangement indicated generally at 300 of Figure 1, and also hereinafter more specifically described. The arc chute is entirely supported by the laminated legs 55 of the blow out iron on each side, being retained in position by the latch assembly 61 (Figure 2) also hereinafter more specifically described.

The final unit assembly comprises the interphase barrier assembly indicated generally at 63 of Figures 5 and 6. The interphase barrier being supported at the rear end by resting on the cross bar 65 (Figure 2 of the parent application Serial No. 721,648, filed January 11, 1947, now Patent 2,613,299, October 7, 1952) secured across the lower end of the panel 56 and by resting at the front end on the angle iron 66 carried by the racking and indicator assembly 43.

Blow out assembly

The blow-out assembly 53 comprising the coil 54 and the laminated blow-out iron legs 55 is shown in Figure 1. The coil 54 is connected by the lead 235 and bolt 236 (Figure 1) to the upper terminal bar 160. The opposite end of coil 54 is connected by lead 238 to extension 171*a* on contact bar 171 passing through a slot in the upper extension 170*a* of insulating strip 170 (Figure 1). Coil 54 is wound on an iron core 240 to which is secured the laminated blow-out iron legs 55 on either side.

We have found that preferably four such side plates on each side ⅛" thick ensures a proper distribution of magnetic blow-out flux over the full length of the side plates. Also we have found that in order to obtain a proper blow-out flux without inserting too much impedance in series with the arc it is desirable that the coil 54 consist of 18 turns of copper strips of $\frac{3}{16}$ x ⅜.

The side frame members 242, 242 (Figure 1) of the blow-out assembly are secured against the core 240 by bolts 243 which also secure the plates 55 against the core. The side frame members 242 of the blow-out assembly have secured therebetween the upper block 245 by means of pin 246 and the lower block (not shown) by means of pin 248 and plate 249 by means of screws 250.

Blocks 245 and its corresponding lower block are provided with tapped openings by means of which the entire blow-out assembly may be readily secured to the frame of the circuit breaker. It will thus be seen that the entire blow-out assembly may be readily mounted on and removed from the circuit breaker as a single unit.

Arc chute

The blow-out assembly serves as support for the arc chute described in Figures 1, 2, 3, and 4. The arc chute assembly 57 mounted above the contact assembly 80 provides for a positive and efficient arc interruption. It consists of insulation side walls 257 (Figures 2–5), front and back arc runners 291 and 290, respectively, and a series of ceramic plates 260 (Figure 7) mounted in spaced relation transverse of the arc path and a strong magnetic blow-out field to force the arc into the arc chute.

The sides 257 (Figures 2 and 4) have fastened at their lower portion, adjacent the arcing area, inner arc resisting insulating plates 269—269

of special composition hereinafter described. The arc resisting plates **269** are chamfered along their upper edges at **262—262** to provide a straight locking edge for the cross plates **260** and the spacers **261**. The lower ends of the cross plates **260** and the spacers **261** are appropriately shaped to fit the chamfered edge **262**.

As the arc is driven into the chute by the magnetic field, it passes rapidly through the arc extinguishing ceramic plates **260** which are rectangular in shape at the top and have a long tapered lower edge extending from the center of one side of the plate to the lower corner on the opposite side of the plate. A ceramic spacer **261** is provided to support each plate and position it with respect to adjacent plates and forms with the long tapered surface of the plate, a triangular opening with the apex at the top for the passage of the arc. Each plate with its spacer presents a decreasing area for the arc as it rises and gradually squeezes it into a narrow slot **307**.

The plates **260** are assembled alternately in an interleaved relation and spaced from each other so that the long tapered surfaces cross at the center of the chute directly above the path of the arc as it travels up the chute. As the arc passes the crossover point of the plates it is forced into a zigzag or sinuous path gradually but rapidly increasing its length and bringing it into contact with larger and larger cool surfaces of the plates. The arc must thus bend around the edges of the plates which are effective in circuit interruption. The positive and efficient arc interruption is affected by the cooling, lengthening and squeezing of the arc at numerous points all along its path.

Provision for the interruption of low current arcs is built into the arc chute. No moving parts or auxiliary equipment are necessary. Short circuit or normal overcurrents are extinguished before the moving arc horn **207** passes the front arc runner **291**. The arc formed by currents of low value is extended in the chute beyond the front arc runner **291** and effectively cooled and deionized by a set of plates **322** (Figure 3) located in the current path.

Arc travel toward the front of the chute involves a transfer from the arc contact arm **207** to the forward arc runner **291**. The absence of the return connection from this runner to the lower lead is a new feature in high voltage breaker design. Without this connection the dielectric strength of the open breaker is not dependent upon the arc chute, whose inner surfaces are bound to deteriorate through use. Without this connection, the arc between the contact arm **204** and runner **291** continues as long as the arc exists. On high values of current the arc is extinguished before the arc contact arm **204** passes the runner **291**.

Progress of the arc up into the chute brings it in contact with the cross plates **260** which are shaped and assembled so as to cause the arc to follow a gradually increasing zigzag farm, thereby securing a long arc length in a short length of chute. Maximum length in a crosswise direction is realized at a point opposite with the top of the blowout iron side plates **55** where it enters a narrow confining slot **307**. The length of the plates **260** above this point is used to cool and deionize the incandescent gases which result.

When the current to be interrupted is of low value, low magnetic action existing at that time

is still sufficient. The arc is extended by the long travel of the arcing tips and cooled by the specially located plates **322** below the front arcing horn **291**.

The plates **260** are held in position in the arc chute by the insulating cross-bar **263** (Figures 2–4) carried in the slot **264** of the end pieces **267**. Insulating cross-bar **263** is securely fastened by bolts **265, 266**, respectively, at the front and back end pieces **267** of the arc chute assembly **57** which extend up above the side plates **257**.

The side plates **257** are connected together at the front and back end of the arc chute by bolts **268** which connect them to the front and back strips **267**. The side plates are provided with insulating bracing bars **58** secured thereto by the bolts **268** and spaced apart by the width of the laminated blow-out iron legs **55**.

The materials used in the construction of the arc chute play an extremely important part in the performance of the circuit breaker.

The side plates **257** are made of Bakelite with a layer of fibre on each side. During interruption not only full voltage is applied to these plates but frequently switching surges of very high value are encountered. The high insulating value of Bakelite is desired, but it alone would not be satisfactory since it has the characteristic of carbonizing and "tracking" if any arc or high temperature arc gases come in contact with it. Consequently, the Bakelite is coated with fibre which does not have this characteristic. Furthermore, an arc resisting insulating varnish is applied to the fibre to keep it from absorbing moisture. Furthermore, the spacers **261** for the cross-plates **260** completely line the inside of the arc chute in the lower part where the arc is drawn and prevents the arc coming in contact with the side plates at any point.

The material of which the cross plates **260** and the spacers **261** are made, determines to a large extent the ability of the breaker to interrupt currents. The least expensive material that is at all suitable for this application is the asbestos cement board called Transite. This material gives fair operation and for low interrupting capacities is quite suitable. In an effort to increase the interrupting capacity, numerous materials were tried. Gas forming materials such as fibre were found to be unsatisfactory as they increased the display incident to circuit interruptions and the excess gas had a tendency to initiate arcing in other parts of the breaker. Inert materials were better. Porcelain, while quite good was too fragile and could not be manufactured in thin plates with sufficient accuracy to make it practical.

By far the best material found was the glass bonded mica consisting of mica dust and glass fused and pressed at high temperature and pressure. It is inert at the temperatures encountered in the arc chute, an excellent insulator, does not absorb moisture and is a non-gas forming material. This material when used for the arc plate and spacers increased the interrupting capacity to more than twice the value shown by other materials. It is used not only for the cross plates **260** and spacers **261** but also for the arc resisting plates **269** that come in contact with the arc.

The arc chute may be mounted in position by being slid on to the laminated blow-out iron legs **55** so that the reinforcing bars **58, 58** act as run-

ners to receive the laminated legs 55, thus holding the arc chute in position.

In order to ensure a further distribution of magnetic blow-out flux down into the region of the contacts, an additional iron plate 270 is provided on each side of the arc chute secured to the bracing bars 58 by screws 271 and having extension 272 extending down into the region of the contacts outside the plates 57.

The blow-out flux through the laminated blow-out iron legs 55 is also communicated to plate 270 and by extension 272 is communicated down into the region of the contacts to increase the blow-out effect in that region. The runners or bracing bars 58 on one side of the arc chute are provided with the bronze springs 280 connected as shown in Figure 2 between the runners or bracing bars 58 by screws 281 and a latch assembly 61 secured thereto in any suitable manner as by the screws 283, 283 (Figures 2 and 3) and having a projection 282 which engages a corresponding detent 284 in the laminated iron leg 55. Thus the arc chute is supported by the laminated legs 55 between runners 58 on each side and is latched in position by the latch assembly 61 engaging detent 284 in laminated legs 55. To remove the arc chute it is only necessary to press in the latch assembly 61 to disengage the detent 284 from laminated iron legs 55 so that the arc chute may be slid out. As already stated, the arc chute is provided with a back arc runner 290 and a front arc runner 291 converging below the arc chute and toward the center in the region of the contacts, the front arc runner 291 having extension 291C toward the contact and the rear arc runner 290 having extension 290A toward the contacts and the further rearward extension 293.

The portion 171A (Figure 1) of the upper terminal to which lead 238 of the blow-out coil is connected is also provided with the spring clip 300 (Figure 1) to receive the rearward extension 293 of the rear arc horn 290 of the arc chute 57. Thus no special connection need be made for the arc chute; but when the arc chute is slid into position, the rear extension 293 of the rear arc horn 290 moves into the spring clip 300 and the rear arc horn is thus connected to the end 238 of blow-out coil 54.

The section 290B of the rear arc horn rests on plate 171 to obtain further contact to the rear arc horn 290. Thus when the section of the arc on the stationary arcing contact jumps to section 290A of the rear arc horn, the current path is from terminal 30, bolt 236 to lead 235 to coil 54 to lead 238 to section 171A of member 171 and spring clip 300. Then from spring clip 300 to section 290B of rear arc horn 290. Then through the arc chute to the movable arcing contact and then to the front arc runner 291 as hereinafter more specifically described.

The cross plates 260 as shown particularly in Figure 3 are each of an insulating non-carbonizing material, preferably a glass bonded, mica ceramic material or of a material known as Transite. These plates are longitudinal members as shown in Figures 3 and 4 having a curve at section 303 of a very large radius; upward of this position they have a curve 304 of smaller radius; and above that position have an extension 305 entering the notch 260 and closing off that side of the plate.

The side of each plate opposite the curve is flat. When the arc is first drawn it is driven up by the blow-out mechanism into the notch 310 of V-shaped cross-section formed by the curves 303—304 of the alternately arranged plates. As the arc is driven up further beyond the apex of the notch, it is caused to zigzag laterally in flowing past the curves 304 of the alternately arranged plates. It thus passes through the relatively narrow notch 307 on one side of one plate and then through a similar relatively very narrow notch on the opposite side of the alternate plate and back and forth laterally through the arc chute.

If the arc is not extinguished when the arc has reached this point, the magnetic blow-out blows the arc up still further past extension 305 where in addition to the lateral zigzagging and lengthening of the arc, the arc is zigzagged vertically. This combination of extreme lateral zigzagging with vertical zigzagging of the arc ensures extinguishment of the arc before the top of the arc chute is reached. The combination of lateral zigzagging with vertical zigzagging limits the upward travel of the arc.

Thus, it will be seen that one of the essential elements of the arc chute herein described is first the lateral zigzagging or lengthening of the arc as it is blown up into alternating thin narrow slots on each side. Thereafter the portion of the arc between the cross-plates 260 is free to move up to superimpose on the lateral zigzagging or lengthening of the arc, a vertical zigzagging or lengthening.

Also it will be seen that there is no connection whatever between the front arc horn 291 and the lower terminal or any other terminal when the circuit breaker is closed or open.

Interphase barriers

The interphase barrier assembly 63 is a complete structure shown in Figures 5 and 6 sufficiently light to be easily handled by one man. Preferably it is installed as a complete unit, but if the oven storage space is at a premium, the interphase barrier may readily be stored knocked down to be assembled by driving a number of screws through registering openings.

The interphase barrier assembly as shown in Figures 5 and 6 comprise a pair of side plates 330 connected together by the front plate 332. Corner pieces 335, 335 are provided at each side to receive the screws 336, 336 of the front plate 332 and the screws 337, 337 of the side plates 330.

Further reinforcing strips 340 are secured to the front panel 332 by screws 341 to provide a means of securement and spacing for the interphase barriers 345. An additional notched top strip 350 is secured to the front panel 332 at the upper end, the notches therein providing spacing elements for the interphase barriers. The rear of the interphase barrier may have cross bars 352, 352 secured thereacross by screws 353 entering into the opposite outside panels 330. These cross bars may also be notched to receive and position the interphase barrier elements.

Each hole or space in the interphase barrier may have secured therein between appropriate reinforcing blocks 360 the horizontal barrier 361 to prevent ionized and heated gases from being blown down in the arc chute.

In Figures 10, 11 and 12 of the parent application Serial No. 721,648, filed January 11, 1947, now Patent 2,613,299, October 7, 1952, we have shown the racking and indicator assembly, which is carried by the operating mechanism assembly 46. The arm 400 carries at its outer ends the rollers 44, 44 which roll upon the track of the cubicle or compartment. Latches in the cubicle hold the arm 400 and lock it in position.

When the racking crank is inserted through opening 402 in the front plate 403 into the socket 404 of the racking screw 405 and turned, the relative positions of the frame 406 comprising the side elements 407, 407 and the arm 400 are changed. Since the frame 406 is fastened to the front wall of the mechanism 46 and the arm 400 is held in a fixed position within the cubicle by latches (not shown), the rotation of screw 405 moves the breaker from test to operating position.

This is so because the screw 405 passes through a threaded opening 410 in arm 400 and is rotatably carried in the bearing 411 of the rear frame element 412 of the frame 406. A shutter 420 prevents the insertion of the crank through opening 402 into the racking screw 405 whenever the breaker is closed. The indicator 430 is operated by link 421 which is connected at one end to the bell crank arm 431 of the indicator 430, and at the other end to the pin 109 in the contact operating arms 52. When the breaker is closed by either the solenoid closing mechanism 49 or the manual closing arm 130, the contact operating arms 52 are rotated counter-clockwise (with respect to Figure 1) and thereby draws the link 421 back to actuate the counter 441 and the indicator 430. When the indicator 430 is moved to the right, the breaker is in the closed position and the indicator 430 registers "on." At the same time, the centering spring 422 draws the shutter 420 to the right covering the opening 402. This prevents the racking crank from being inserted and the breaker from being racked out while in the closed position when it might be in service or conversely from being racked in, while closed, thereby damaging the separable contacts 38—38.

Since many variations and modifications of our invention should now be obvious to those skilled in the art, we prefer to be bound not by the specific disclosure herein contained, but only by the appended claims.

We claim:

1. An arc chute for circuit breakers having engaging and disengaging contacts comprising insulation side walls, front and back arc runners and a plurality of insulation plates mounted in spaced relation, means for generating a strong magnetic blow-out field for forcing the arc formed on interruption of said contacts into the arc chute, the circuit breaker plates being rectangular in shape at the top and having long tapered lower edges extending from the center of one side of the plate to the lower corner of the opposite side of the plate, and a ceramic spacer interposed between adjacent plates to said supported plate for supporting each plate and spacing said supported plate with respect to said adjacent plates, said ceramic spacer forming with the tapered surface of said supported plates a triangular opening.

2. An arc chute for circuit breakers having engaged and disengaged contacts comprising insulation side walls, front and back arc runners and a plurality of insulation plates mounted in spaced relation, means for generating a strong magnetic blow-out field for forcing the arc formed on interruption of said contacts into the arc chute, said plates being rectangular in shape at the top and having long tapered lower edges extending from the center of one side of the plate to the lower corner of the opposite side of the plate, and a ceramic spacer interposed between adjacent plates to said supported plate for supporting each plate and spacing said supported plate with respect to said adjacent plates, said ceramic spacer forming with the tapered surface of said supported plates a triangular opening, each of said spacer with its supported plate presenting a decreasing area for the arc as it rises and a narrow slot.

3. An arc chute for circuit breakers having engageable and disengageable contacts comprising insulation side walls, front and back arc runners and a plurality of insulation plates mounted in spaced relation, means for generating a strong magnetic blow-out field for forcing the arc formed on interruption of said contacts into the arc chute, said plates being rectangular in shape at the top and having long tapered lower edges extending from the center of one side of the plate to the lower corner of the opposite side of the plate, and a ceramic spacer interposed between adjacent plates to said supported plate for supporting each plate and spacing said supported plate with respect to said adjacent plates, said ceramic spacer forming with the tapered surface of said supported plates a triangular opening, said plates being assembled alternately in an interleaved relation and spaced from each other so that the long tapered surface crosses at the center of the arc chute directly above the path of the arc as it travels up the chute.

4. An arc chute comprising side plates of insulation material, insulating spacers closing the front and rear of said arc chute, an arcing horn mounted on said spacers, said arc chute including a plurality of ceramic plates, individual spacers for each of said plates, said plates and spacers forming arcing spaces which gradually become restricted toward the upper part of said arc chute, the spaces becoming narrow slots and finally closing off substantially half way up said arc chute.

5. An arc chute comprising side plates of insulation material, insulating spacers closing the front and rear of said arc chute, an arcing horn mounted on said spacers, said arc chute including a plurality of ceramic plates, individual spacers for each of said plates, said plates being tapered from one side half way up said arc chute to the opposite lower corner of each plate, alternate plates having their tapers extending in opposite directions to form interleaved plates so that said plates and spacers forming arcing spaces gradually become restricted toward the upper part of said arc chute, the spaces becoming narrow slots and finally closing off substantially half way up said arc chute.

6. In a circuit interrupter having a movable contact and a complementary contact, an arc chute comprising side plates of insulation material, insulating spacers closing the front and rear of said arc chute, a front and rear arcing horn, a blow-out coil, said front arcing horn being electrically connected to said blow-out coil at one end of said front arcing horn, said arc chute including a plurality of ceramic plates, individual spacers for said plates, said plates and spacers forming arcing spaces which gradually become restricted toward the upper part of said arc chute, the spaces becoming narrow slots and finally closing off substantially half way up said arc chute, said front arcing horn and blow-out coil being connected in circuit during the opening of the contacts by an arc from said front arcing horn to said movable contact.

7. An arc chute for a circuit interrupter comprising a plurality of parallel spaced insulating plates; each plate having a substantially rectilinear upper end; a transverse surface defining a recess in a side of each plate substantially centrally of each plate; a longitudinally curved surface connected to said transverse surface and

tapering downwardly toward the lower corner of the opposite side of the plate, and insulating spacers located between alternate plates.

8. An arc chute for a circuit interrupter comprising a plurality of parallel spaced insulating plates; each plate having a substantially rectilinear upper end; a transverse surface defining a recess in a side of each plate substantially centrally of each plate; a longitudinally curved surface connected to said transverse surface and tapering downwardly toward the lower corner of the opposite side of the plate, and insulating spacers located between alternate plates, an additional recess in each plate between each set of alternate plates supported on said insulating spacer.

9. An arc chute comprising at least a first, second and third arc chute plate, each of said plates having a substantially rectangular upper section and having a shoulder at the lower end of the section extending in from one edge of the plate, said plate being tapered from said shoulder to the other edge at its lowermost end, the second plate having its tapered edge extending in the opposite direction from that of the first plate and the third plate having its tapered edge extending in the opposite direction from that of the second plate, a removable spacer member interposed between alternate plates, the upper end of said spacer having a slot, the shoulder of its associated plate being seated in said slot so that adjacent plates are spaced from each other by the position of said spacer on each side of said slot and insulating plates extending transversely of said plates, one at each of the opposite edges of said plates for closing said plates along their upper rectangular section.

10. An arc chute comprising at least a first, second and third arc chute plate, each of said plates having a substantially rectangular upper section and having a shoulder at the lower end of the section extending in from one edge of the plate, said plate being tapered from said shoulder to the other edge at its lowermost end, the second plate having its tapered edge extending in the opposite direction from that of the first plate and the third plate having its tapered edge extending in the opposite direction from that of the second plate, and a removable spacer member interposed between alternate plates, the upper end of said spacer having a slot, the shoulder of its associated plate being seated in said slot so that adjacent plates are spaced from each other by the position of said spacer on each side of said slot.

11. An arc chute comprising at least a first, second and third arc chute plate, each of said plates having a substantially rectangular upper section and having a shoulder at the lower end of the section extending in from one edge of the plate, said plate being tapered from said shoulder to the other edge at its lowermost end, the second plate having its tapered edge extending in the opposite direction from that of the first plate and the third plate having its tapered edge extending in the opposite direction from that of the second plate, a removable spacer member interposed between alternate plates, the upper end of said spacer having a slot, the shoulder of its associated plate being seated in said slot so that adjacent plates are spaced from each other by the position of said spacer on each side of said slot and insulating plates extending transversely of said plates, one at each of the opposite edges of said plates for closing said plates along their upper rectangular section.

12. An arc chute comprising at least a first, second and third arc chute plate, each of said plates having a substantially rectangular upper section and having a shoulder at the lower end of the section extending in from one edge of the plate, said plate being tapered from said shoulder to the other edge at its lowermost end, the second plate having its tapered edge extending in the opposite direction from that of the first plate and the third plate having its tapered edge extending in the opposite direction from that of the second plate, and a spacer member interposed between alternate plates, the upper end of said spacer having a slot, the shoulder of its associated plate being seated in said slot so that adjacent plates are spaced from each other by the position of said spacer on each side of said slot.

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