

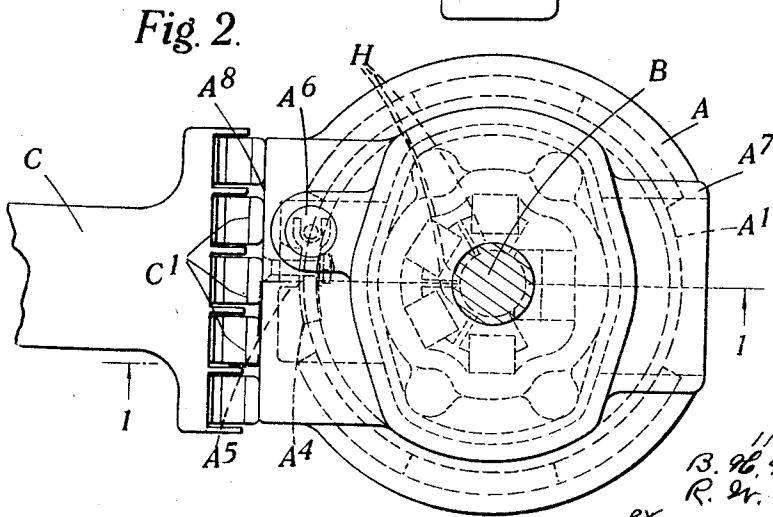
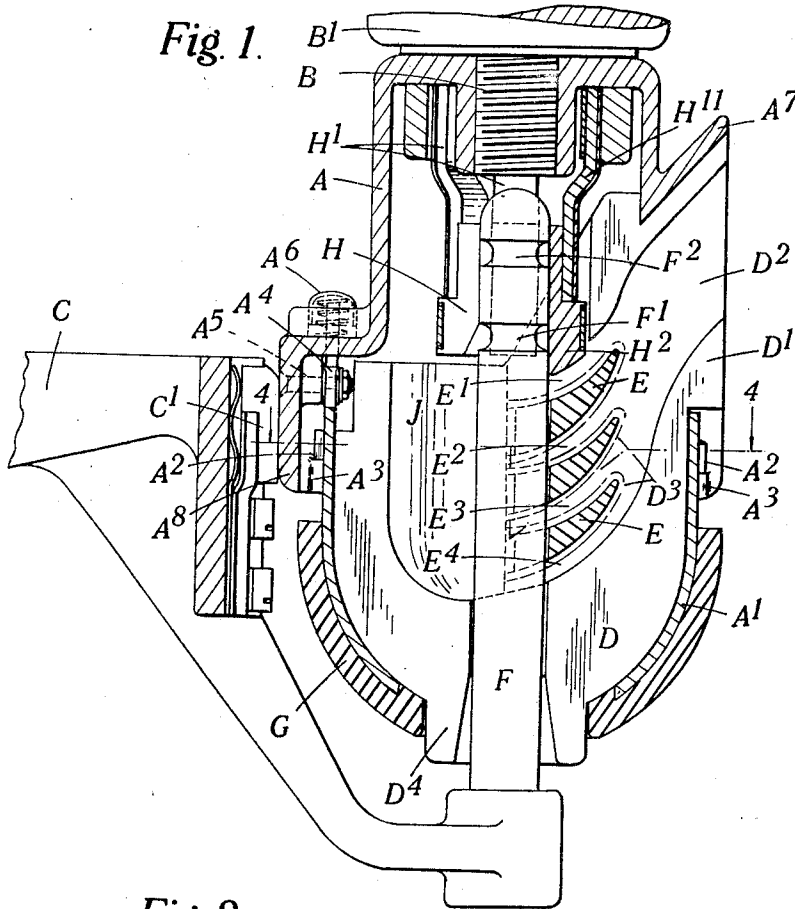
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B. H. LEESON ET AL
ELECTRIC CIRCUIT BREAKER

2,106,531

Filed Dec. 1, 1936

3 Sheets-Sheet 1



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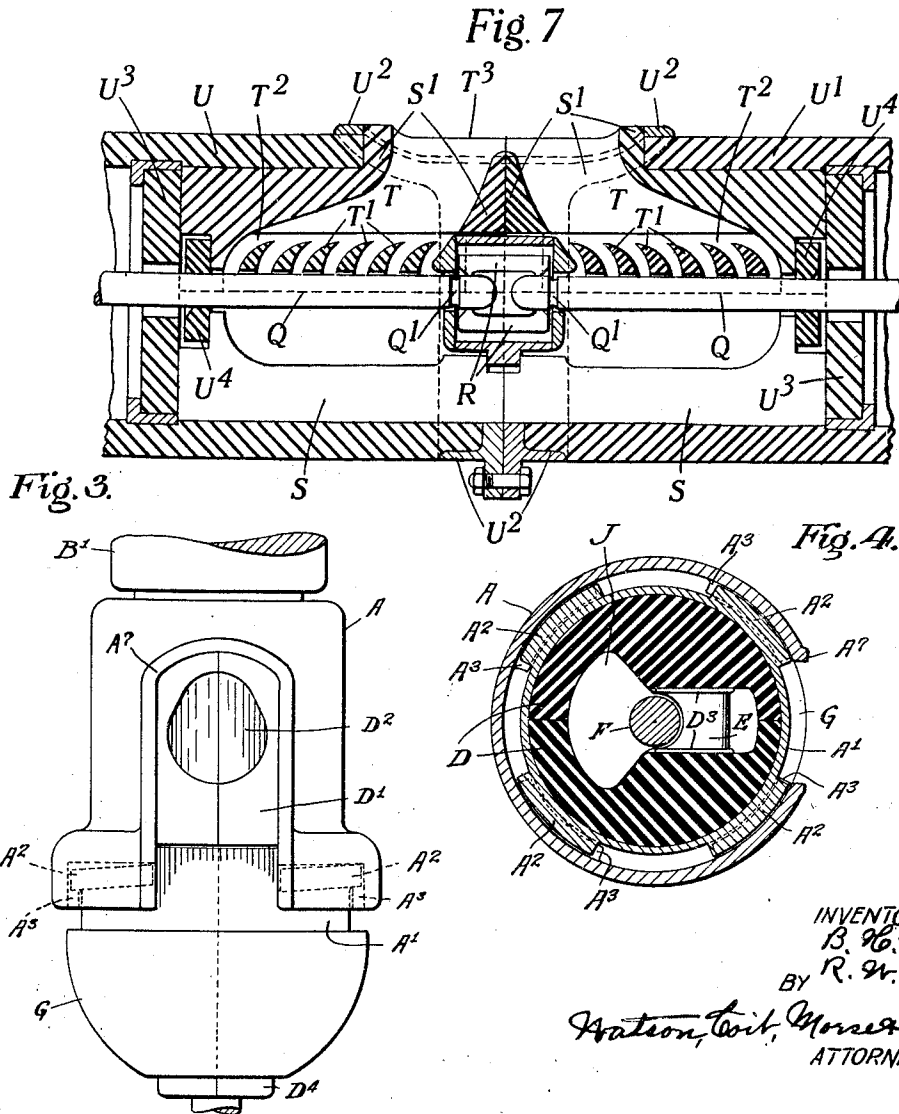
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UNITED STATES PATENT OFFICE

2,106,531

ELECTRIC CIRCUIT BREAKER

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18 Claims. (Cl. 200—150)

This invention relates to liquid-insulated A. C. electric circuit-breakers of the kind having an arc-control device comprising an enclosure of insulating material within which the arc is drawn by the separating movement of the circuit-breaker contacts, a relatively high pressure being developed in the enclosure by the arc to cause a blast of deionizing fluid to be discharged through the arc path and out from the enclosure at one side thereof. In existing circuit-breakers of this kind the arc-control device has usually been formed by a stack of insulating baffle plates with more or less central openings together constituting the enclosure within which the arc is drawn out, certain of the plates having a slot extending from one side of the opening to the periphery whilst the other plates are unslotted, thus forming a series of aligned vents or outlets on one side of the device for the escape of the arc gases and deionizing fluid. It has been found however that with such arc-control devices there is occasionally some uncertainty of operation under relatively light fault conditions (as contrasted with normal load conditions and with severe fault conditions), the arc not being extinguished with sufficient rapidity to ensure satisfactory operation in all circumstances.

The present invention has for its main object to provide an improved construction of arc-control device whereby an increased rapidity of arc extinction will be obtained, thus ensuring fully satisfactory operation for all conditions of circuit interruption likely to occur in practice.

A more detailed object of the invention is to reduce the resistance to discharge of the arc gases and deionizing fluid from the enclosure by providing a series of aligned short vents leading into a common discharge orifice so shaped that the discharge of fluid through one vent will by ejector action set up a suction at the other vents. The common discharge passage and the baffles which separate the individual vents from one another are preferably "streamlined", that is are provided with smoothly curved surfaces so shaped as to conform to the natural conditions of fluid flow and to afford a flow passage of gradually increasing cross-sectional area from the enclosure to the outside of the device.

A further object of the invention is to provide means whereby the body of liquid in a vent and beyond the end thereof is already set in motion before the blast of deionizing fluid is discharged through the vent, thus relieving the blast of the necessity for accelerating such body of liquid from rest and enabling a more powerful blast to

be discharged. This can be achieved by disposing the moving contact member in such close proximity to the vents as substantially to close some or all of them so that as the vents are opened by the contact member the arc is drawn out close to them and is thus located in the position most favourable to the deionizing effect of the fluid blast, and by providing one or more ducts in such contact member so arranged that the pressure set up by the arc in the enclosure will cause liquid to be ejected through some or all of the vents before the arc is drawn past such vents. In order to assist in locating the arc close to the vents part of the fixed contact may itself constitute a portion of the wall of the first vent. Magnetic forces resulting from the disposition of the conductors leading to the contacts or from the provision of magnetic material adjacent to the vents may also be utilized to deflect the arc towards the vents. The arrangement is preferably such that the vents, as they are opened by the movement of the contact member, are substantially sealed by the arc during the arcing period, whereby the pressure will increase more rapidly during such period and a more violent discharge blast will take place during the succeeding zero current pause.

In circuit-breakers having two (or more) breaks each provided with an arc-control device, it may sometimes be convenient to combine the arc-control devices together in a single structure having a single outlet orifice common to the discharge passages of the arc-control devices. Thus for a circuit-breaker with two breaks in series, the two moving contact members may be movable in line with one another in opposite directions and may cooperate with a common fixed contact member.

For convenience of inspection and at the same time to ensure adequate mechanical strength, the insulating structure of the device is preferably enclosed in a metal container formed in two parts which can be rigidly locked together, for example by means of a breech-block joint. Another feature of importance when more than one break is used in series is the increased capacitance between fixed and moving contacts as a result of the metal enclosure. This ensures a better distribution of the restriking voltage transient between the individual breaks under earth-fault conditions.

The invention may be carried into practice in various ways, but three convenient practical constructions of arc-control device according there-

to are illustrated by way of example in the accompanying drawings, in which

Figure 1 is a longitudinal section (taken on the line 1—1 of Figure 2 through one construction of arc-control device intended for use in circuit-breakers for voltages from, say, 11,000 to 33,000 volts.

Figure 2 is an external view of the device viewed from the top of Figure 1,

Figure 3 is an external view of the device from the right-hand side of Figure 1,

Figure 4 is a transverse section on the line 4—4 of Figure 1,

Figures 5 and 6 are longitudinal and transverse sections (taken respectively on the lines 5—5 and 6—6) through a modified form of the device shown in Figures 1-4, and

Figure 7 is a longitudinal section through an alternative construction employing two arc-control devices in a single structure and intended for use in a 132,000 volt circuit-breaker.

Although suitable for use in other types of circuit-breaker, the constructions of Figures 1-4 and Figures 5-6 will for convenience be described with reference to their use in a single-phase oil-immersed metal-clad circuit-breaker having two fixed contacts on the lower ends of lead-in conductors carried in insulating bushings from the cover plate of the circuit-breaker oil-tank and cooperating moving contacts on a bridging member actuated by the usual circuit-breaker operating mechanism, the drawings in each case showing one arc-control device only.

In the construction of Figures 1-4 the arc control device consists of an insulating structure enclosed in a two-part metal casing AA¹. The upper part A of the casing is directly connected to the end of the lead-in conductor B passing through the insulating bushing B¹, and constitutes a housing for the fixed arcing contact structure. The lower part A¹ of the casing is cup-shaped with a central hole at its lower end, and is provided at its upper end with spaced outwardly projecting lugs A² with inclined faces which cooperate with corresponding inwardly projecting lugs A³ on the lower end of the upper part A of the casing to constitute a breech-block joint for rigidly securing the two parts of the casing together. In order to prevent inadvertent relative rotation of the two parts of the casing, a catch A⁴ is provided to engage in a recess in the upper edge of the lower part A¹ of the casing, this catch being pivoted at A⁵ to the upper part A. A spring-controlled press-button A⁶ is provided for releasing the catch when it is desired to separate the two parts of the casing. The upper part A of the casing is provided on one side (namely the side furthest from the second break of the circuit-breaker) with a spout-like projection A⁷ having a wide slot extending up from the bottom edge of the part A nearly to the level of the lower end of the insulating bushing.

On the side remote from the projection A⁷ the upper part A of the casing is provided with a flat face A⁸ constituting the main fixed contact. A group of spring-mounted contact blocks C¹ constitute the main moving contact for engagement with the face A⁸ and are carried by the movable bridging contact member C.

The insulating structure within the casing is in the form of a longitudinally divided hollow block D with a projection D¹ on the upper part of one side which fits within the slot in the projection A⁷ of the upper part of the casing and

is bored with a shaped discharge passage D² communicating with the hollow interior of the block, the vertical dividing plane between the two halves of the block passing centrally through the discharge passage. Each half of the block is provided with ribs D³ around small recesses at the inner end of the discharge passage D² for holding the ends of shaped baffles E, which lie horizontally one above the other across the throat of the discharge passage, thus dividing up the throat of this passage into a series of vertically aligned vents E¹E²E³E⁴.

The block D has a central projection D⁴ at its lower end which passes through the central hole in the lower part A¹ of the casing and is bored to constitute a throat through which the rod-like moving arcing contact F enters the device, the lower end of the throat being flared for self-alignment purposes. An insulating cup-shaped ring G surrounds the bottom end of the throat projection and covers over the lower part of the metal casing.

In the normal closed position of the circuit-breaker the moving contact rod F extends through the hollow insulating block D to the fixed contact in the upper end of the casing, the rod lying very close to the baffles E in the throat of the discharge passage D² so as substantially to close the vents E¹E²E³E⁴. The fixed arcing contact is in the form of a group of contact blocks H engaging the moving contact rod F on all sides and carried by spring blades H¹ attached to the upper part A of the casing. One of the contact blocks, namely that adjacent to the discharge passage D², is made longer than the others and thus constitutes an arcing tip H² lying in a recess in the top wall of the throat of the discharge passage, the lower face of this arcing tip H² being so shaped as itself to constitute a portion of the wall of the uppermost vent E¹.

The hollow interior of the insulating block D is asymmetrically arranged so as to constitute an oil-filled enclosure J lying on the side of the contact rod F remote from the vents and discharge passage. The walls of the enclosure J are smooth and are curved generally in conformity with the smooth curves of the walls of the discharge passage D² which extends in an inclined upward direction from the enclosure towards its discharge orifice. The baffles E are of a smoothly curved wedge shape, and the shape of the complete outlet including the vents and the discharge passage is such that the space available for fluid flow has a gradually increasing cross-sectional area from the enclosure to the discharge orifice.

The moving contact rod F is provided with one or more ducts F¹F², which may be in the form of grooves around the rod or holes through it, these ducts being so arranged as to open communication between the enclosure J and a vent before the arc is drawn past the vent. In the arrangement illustrated wherein four vents E¹E²E³E⁴ are employed, two ducts F¹F² are provided in the rod in such positions that the second F² will open one vent when the arc is being drawn past the previous vent and when the first duct F¹ is just closing the next succeeding vent, the vents and ducts being so spaced that during the main portion of the movement past the vents one or other of the ducts will be in communication with a vent.

In the normal closed position of the circuit-breaker both ducts lie above the uppermost vent

E¹. On operation of the circuit-breaker the downward movement of the rod F first opens the uppermost vent E¹ through the first duct F¹, but no flow takes place since the arc has not yet been formed. The arc begins to form as the upper end of the moving contact rod reaches the first vent E¹, and at this stage the third vent E³ is open through the first duct F¹ whilst the second duct F² has not yet reached the second vent E². As the pressure builds up in the enclosure J owing to the arc, a momentary jet of oil will be discharged through the first duct F¹ and the third vent E³, followed by another jet through the second vent E² and second duct F², the arc meanwhile having been drawn past the first vent E¹. Then a jet of oil is discharged through the fourth vent E⁴ and another jet through the third E³, the arc being drawn past the second vent E², and so on. These momentary jets of oil from the vents follow one another more or less continuously and cause a fairly steady flow of oil through the lower part of the discharge passage D², thus ensuring that the oil in this passage is already in movement in readiness for the blasts of arc gases and deionizing fluid which are discharged through the vents during the zero current periods. During the intervening arcing periods the arc in effect seals the vents, past which it has been drawn, thus increasing the rate at which the pressure is built up in the enclosure. In the uppermost vent E¹ this pressure causes the arc to travel into the vent itself along the surface of the arcing tip H², thereby ensuring not only that the arc is held closely against the vents, but also that the arc is constantly being brought into contact with a fresh (and therefore cooler) point on the arcing tip. Thus during the arcing period, owing to the arc sealing effect, a very heavy pressure is built up on one side of the arc and simultaneously a suction is produced on the other side owing to the ejector action resulting from the flow through the discharge passage D². There is therefore an extremely violent blast of deionizing fluid through the arc path and the vents immediately the sealing effect breaks down at the zero current period, this blast not only effectively deionizing the arc path but also causing an enhanced ejector action in readiness for the next blast, if the arc should restrike as the voltage rises. The streamlined shape of the various flow passages ensures that the flow will be unimpeded by eddies which would be set up by any pockets or corners in the passages, and further ensures that particles of metal or carbon will be carried away and will not be deposited in pockets or corners where they might tend to encourage restriking of the arc after a zero current period. It will be appreciated that the number, size and disposition of the ducts in the moving contact rod may be varied, and the arrangement may be such that a continuous jet, in contrast with a series of intermittent jets is discharged through one or more of the lower vents before the arc is drawn past such vent or vents. The operating mechanism for the circuit-breaker is so arranged that the moving contact rod F is withdrawn from its normal closed position at very high speed, and the whole arrangement is such that great rapidity of arc extinction is ensured, the circuit being interrupted during the first few cycles under all conditions of fault. When the operation has been completed, the device is instantly refushed with oil and the smoothness of the surfaces ensures that there is no danger of gas being entrapped in pockets, a

seep hole (not shown) being provided at the upper end of the device to prevent any accumulation of gas there.

In the foregoing arrangement the upper part A of the casing is directly connected to the lead-in conductor B. It is sometimes preferable however to insulate the whole casing from the contacts, dispensing altogether with main contacts outside the structure of the arc-control device and utilizing the contacts within the structure themselves as the main contacts. Such an arrangement is shown in Figures 5 and 6, which also differs from the construction of Figures 1-4 in respect of the formation of the block D, which is in this instance formed of three parts instead of two in order to accommodate an insert of magnetic material in the neighbourhood of the vents. In other respects the arrangement of Figures 5 and 6 is similar to that of Figures 1-4 and the same reference letters are employed where applicable.

In the construction of Figures 5 and 6, the upper part A of the metal casing is secured by bolts K¹ to a metal flange K shrunk on to the insulating bushing B¹, the bolts being shrouded in insulating material K² with a further insulating layer K³ between the flange K and the upper part A of the casing to provide adequate insulation between the casing and the fixed contact. The casing AA¹ is thus insulated both at the upper end by the insulation K²K³B¹ and at the lower end by the cup-shaped ring G to break at two points the possible conducting path from the moving contact through the casing to the fixed contact in the event of an arc persisting after the moving contact has been withdrawn from the lower end of the insulating structure.

The spring blades H¹ supporting the blocks H of the fixed contact are in this instance attached to a metal plug L screwing in to a housing L¹ which is secured to the end of the lead-in conductor B within the lower end of the insulating bushing. The hemispherical upper end of the moving contact rod F may also make butt contact (not shown) with a further contact of the spring-controlled plunger type.

The insulating block is in this construction divided longitudinally into three parts MM¹M² in order to enable an insert N of soft iron (preferably made in two parts, as shown, for convenience of assembly) to be provided around the back of the vents, the distortion of the magnetic field around the arc due to this insert causing the arc to be drawn towards the vent throats to assist in ensuring the arc sealing action above mentioned. The common discharge passage M³ is formed in the part M of the insulating block, and the baffles E are held in position by means of projections at their ends engaging in shaped slots in two side plates OO¹, the portion of the insulating structure comprising the baffles and side plates being assembled and inserted in recesses in the sides of the throat of the discharge passage, in which it is held in position by the parts M¹M² of the block. This arrangement enables the portion of the insulating structure most likely to be damaged by the arc (namely the baffles E and side plates OO¹) to be readily removed and replaced if necessary, these parts being made for example of fibre, whilst the three main parts MM¹M² are made of moulded insulating material. A cup-shaped ring P of insulating material is provided around the three parts of the insulating block to insulate the iron insert N from the lower part A¹ of the metal casing.

The provision of the two-part metal casing AA¹ in these two constructions not only relieves the insulation of the very heavy mechanical stresses and thereby makes it possible to make the whole device of relatively small size, but also enables the device to be rapidly and easily dismantled for inspection purposes. The metal casing also has the advantage in the case of a two-break circuit-breaker of increasing the capacitance between the fixed and moving contacts at the zero current pause during separation and thereby of ensuring a better distribution of the restriking voltage transient between the two breaks.

The construction shown diagrammatically in Figure 7 is more especially intended for use in open-type high voltage circuit-breakers, and differs from the foregoing constructions primarily in the use of a single composite structure for the two arc-control devices of two breaks in series. In this construction the two moving contact rods Q move in line with one another in opposite directions and cooperate with a single central fixed contact, which may consist of a group of segmental contact blocks R spring-pressed inwardly to engage with the ends of the moving contact rods. The insulating structure of each arc-control device is, in the example illustrated, formed in three parts longitudinally divided in a manner analogous to that described with reference to Figures 5 and 6, the two parts S being separated in a plane passing through the discharge passage T which is bored through the third part S¹, the six parts of the insulating structures of the two devices cooperating to hold the fixed contact structure in position. Baffles T¹ held at their ends in insulating plates T² are inserted in recesses in the throats of the discharge passages T and the two discharge passages lead to a single outlet orifice T³. The six parts SS¹ are held in position by an insulating tube formed in two parts UU¹, metal reinforcing bands U² shrunk on to the inner ends of these parts being utilized for bolting the parts rigidly to one another. The two parts UU¹ of the insulating tube are closed at their outer ends by annular discs U³ through which the moving contact rods Q pass, throat washers U⁴ fitting closely around the rods and free to move laterally for self-alignment purposes being provided to seal the ends of the arc-control devices more effectively during the separating movement of the contacts. Thus with simultaneous opening of the two breaks the oil discharge through one discharge passage will assist the discharge through the other discharge passage by ejector action. The use of two moving contacts cooperating with a common electrically floating fixed contact gives in effect a contact separation velocity twice that of the individual moving contacts in a single arc-control device structure.

In an open-type high-voltage circuit-breaker the whole of the above structure will usually be mounted horizontally on the top of a central supporting pillar and will be enclosed together with the actuating device for the moving contacts within an outer insulating casing carrying the circuit terminals at its ends. The provision of the double-break arc-control device directly above the central supporting pillar has the advantage that the reaction due to the high-pressure discharge is directly taken by the pillar, thus relieving the outer casing of considerable mechanical stresses. Further as a result of the reduced electrostatic capacitance of the fixed contacts to

earth, a more uniform potential distribution is secured for all types of fault, resulting in more efficient circuit-breaking.

It will be appreciated that the above arrangements have been described by way of example only and may be modified in various ways within the scope of the invention.

What we claim as our invention and desire to secure by Letters Patent is:—

1. An arc-control device for a liquid-insulated alternating current electric circuit-breaker, comprising cooperating relatively movable contacts, and an enclosure of insulating material surrounding such contacts and having at one side a series of aligned vents leading into a common discharge passage whereby a relatively high pressure will be developed in the enclosure by the arc formed on separation of the contacts to cause a blast of deionizing fluid to be discharged through the arc path and out from the enclosure through the vents and discharge passage, the discharge passage being so shaped as to deflect the discharge from certain vents past the discharge openings of other vents so that a discharge of fluid through a vent will by ejector action set up a suction at the other vents.

2. An arc-control device for a liquid-insulated alternating current electric circuit-breaker comprising cooperating relatively movable contacts, and an enclosure of insulating material surrounding such contacts and having at one side a series of aligned vents leading into a common discharge passage whereby a relatively high pressure will be developed in the enclosure by the arc formed on separation of the contacts to cause a blast of deionizing fluid to be discharged through the arc path and out from the enclosure through the vents and discharge passage, the common discharge passage and the individual short vents being provided with smoothly curved surfaces so shaped not only as to conform to the natural conditions of fluid flow and to afford a flow passage of gradually increasing cross-sectional area from the enclosure to the outside of the device but also as to deflect the discharge from certain vents past the discharge openings of other vents so that the discharge of fluid through one vent will by ejector action set up a suction at the other vents.

3. In a liquid-insulated alternating current electric circuit-breaker having a plurality of breaks, a structure having a single outlet orifice and enclosing a plurality of arc-control devices, one for each break, each arc-control device comprising cooperating relatively movable contacts, and an enclosure of insulating material surrounding such contacts and having at one side a series of aligned vents leading into a common discharge passage whereby a relatively high pressure will be developed in the enclosure by the arc formed on separation of the contacts to cause a blast of deionizing fluid to be discharged through the arc path and out from the enclosure through the vents and discharge passage, the discharge passage being so shaped as to deflect the discharge from certain vents past the discharge openings of other vents so that a discharge of fluid through a vent will by ejector action set up a suction at the other vents, the discharge passages of the arc-control devices all opening into the single outlet orifice.

4. The combination with the features of claim 1, the insulating enclosure being formed in a plurality of separate parts, of readily detachable

means for holding such parts together comprising a two-part metal container surrounding the enclosure, and means for rigidly locking the two parts of the container together.

5 5. The combination with the features of claim 10, the insulating enclosure being formed in a plurality of separate parts, of readily detachable means for holding such parts together comprising a two-part metal container surrounding the enclosure, and means for rigidly locking the two parts of the container together.

10 6. The combination with the features of claim 15, the insulating enclosure being formed in a plurality of separate parts, of readily detachable means for holding such parts together comprising a two-part metal container surrounding the enclosure, and means for rigidly locking the two parts of the container together.

20 7. The combination with the features of claim 12, the insulating enclosure being formed in a plurality of separate parts, of readily detachable means for holding such parts together comprising a two-part metal container surrounding the enclosure, cooperating projections on the two parts of the container so arranged that by relative longitudinal and rotary movements of the two parts the projections can be brought into a position of locking engagement with one another, and a spring catch for holding the parts in such locking position.

30 8. An arc-control device for a liquid-insulated alternating current electric circuit-breaker, comprising a fixed contact, an enclosure of insulating material housing such contact and bored on one side with a passage leading from the hollow interior of the enclosure to the outside thereof, spaced baffles extending across the throat of such passage and dividing it into a series of aligned short vents leading into a common discharge passage, and a moving contact member normally extending through the enclosure to engage with the fixed contact and in such close proximity to the aligned vents as substantially to close at least some of them, whereby the arc is drawn by the separating movement of the contacts close to the aligned vents and a relatively high pressure is developed within the enclosure to cause a blast of deionizing fluid to be discharged through the arc path and out from the enclosure through the vents and discharge passage, the discharge passage being so shaped as to deflect the discharge from certain vents past the discharge openings of other vents so that the discharge of fluid through one vent will by ejector action set up a suction at the other vents.

55 9. An arc-control device for a liquid-insulated alternating current electric circuit-breaker, comprising a fixed contact, an enclosure of insulating material housing such contact and bored on one side with a passage leading from the hollow interior of the enclosure to the outside thereof, spaced baffles extending across the throat of such passage and dividing it into a series of aligned short vents leading into a common discharge passage, and a moving contact member normally extending through the enclosure to engage with the fixed contact and in such close proximity to the aligned vents as substantially to close at least some of them, whereby the arc is drawn by the separating movement of the contacts close to the aligned vents and the vents as they are opened by the contact member are substantially sealed by the arc during the arcing period so that the relatively high pressure developed within the enclosure by the arc during

the arcing period causes a blast of deionizing fluid to be discharged during the succeeding zero current pause through the arc path and out from the enclosure through the vents and discharge passages, the surfaces of the discharge passage and of the baffles being smoothly curved and so shaped not only as to conform to the natural conditions of fluid flow and to afford a flow passage of gradually increasing area from the inside to the outside of the device but also as to deflect the discharge from certain vents past the discharge openings of other vents so that the discharge of fluid through one vent will by ejector action set up a suction at the other vents.

10. An arc-control device for a liquid-insulated alternating current electric circuit-breaker, comprising a fixed contact, an enclosure of insulating material housing such contact and having a series of aligned vents at one side, and a moving contact member normally extending through the enclosure to engage with the fixed contact and in such close proximity to the vents as substantially to close at least some of them, whereby the arc is drawn by the separating movement of the contacts close to the aligned vents and a relatively high pressure is developed within the enclosure to cause a blast of deionizing fluid to be discharged through the arc path and out from the enclosure through the vents, the moving contact member being provided with at least one duct through which the pressure within the enclosure causes liquid to be ejected through at least some of the vents before the arc is drawn past such vents.

35 11. An arc-control device for a liquid-insulated alternating current electric circuit-breaker, comprising a fixed contact, an enclosure of insulating material housing such contact and having a series of aligned vents at one side, and a moving contact member normally extending through the enclosure to engage with the fixed contact and in such close proximity to the vents as substantially to close at least some of them, whereby the arc is drawn by the separating movement of the contacts close to the aligned vents and the vents as they are opened by the contact member are substantially sealed by the arc during the arcing period so that the relatively high pressure developed within the enclosure by the arc during the arcing period causes a blast of deionizing fluid to be discharged during the succeeding zero current pause through the arc path and out from the enclosure through the vents, the moving contact member being provided with at least one duct through which the pressure within the enclosure causes liquid to be ejected through at least some of the vents before the arc is drawn past such vents.

60 12. An arc-control device for a liquid-insulated alternating current electric circuit-breaker, comprising a fixed contact, an enclosure of insulating material housing such contact and bored on one side with a passage leading from the hollow interior of the enclosure to the outside thereof, spaced baffles extending across the throat of such passage and dividing it into a series of aligned short vents leading into a common discharge passage, and a moving contact member normally extending through the enclosure to engage with the fixed contact and in such close proximity to the aligned vents as substantially to close at least some of them, whereby the arc is drawn by the separating movement of the contacts close to the aligned vents and a relatively high pressure is developed within

the enclosure to cause a blast of deionizing fluid to be discharged through the arc path and out from the enclosure through the vents and discharge passage, the discharge passage being so shaped that the discharge of fluid through one vent will by ejector action set up a suction at the other vents and the moving contact member being provided with at least one duct through which the pressure within the enclosure causes liquid to be ejected through at least some of the vents before the arc is drawn past such vents.

13. An arc-control device as claimed in claim 8, in which part of the fixed contact itself constitutes a portion of the wall of the first vent.

14. An arc-control device as claimed in claim 10, in which part of the fixed contact itself constitutes a portion of the wall of the first vent.

15. An arc-control device for a liquid-insulated alternating current electric circuit-breaker, comprising a fixed contact, an enclosure of insulating material housing such contact and bored on one side with a passage leading from the hollow interior of the enclosure to the outside thereof, spaced baffles extending across the throat of such passage and dividing it into a series of aligned short vents leading into a common discharge passage, a portion of the wall of the first vent being constituted by part of the fixed contact, and a moving contact member normally extending through the enclosure to engage with the fixed contact and in such close proximity to the aligned vents as substantially to close at least some of them, whereby the arc is drawn by the separating movement of the contacts close to the aligned vents and the vents as they are opened by the contact member are substantially sealed by the arc during the arcing period so that the relatively high pressure developed within the enclosure by the arc during the arcing period causes a blast of deionizing fluid to be discharged during the succeeding zero current pause through the arc path and out from the enclosure through the vents and discharge passage, the discharge passage being so shaped that the discharge of fluid through one vent will by ejector action set up a suction at the other vents and the moving contact member being provided with at least one duct through which the pressure within the enclosure causes liquid to be ejected through some of the vents before the arc is drawn past such vents.

16. A liquid-insulated alternating current electric circuit-breaker having a plurality of breaks each provided with an arc-control device comprising a fixed contact, an enclosure of insulating material housing such contact and bored on one side with a passage leading from the hollow interior of the enclosure to the outside thereof, spaced baffles extending across the throat of such passage and dividing it into a series of aligned short vents leading into a common discharge passage, and a moving contact member normally extending through the enclosure to engage with the fixed contact and in such close proximity to the aligned vents as substantially to close at least some of them, whereby the arc is drawn by the separating movement of the contacts close to the aligned vents and a relatively high pressure is developed within the enclosure to cause a blast of deionizing fluid to be discharged through the arc

path and out from the enclosure through the vents and discharge passage, the discharge passage being so shaped that the discharge of fluid through one vent will by ejector action set up a suction at the other vents, and the moving contact member being provided with at least one duct through which the pressure within the enclosure causes liquid to be ejected through at least some of the vents before the arc is drawn past such vents, the arc-control devices being combined in a single structure having a single outlet orifice common to the discharge passages of the devices.

17. An arc-control device for a liquid-insulated alternating current electric circuit-breaker having two breaks in series, comprising a fixed contact member common to the two breaks, two moving contact members cooperating with the fixed contact member and disposed in line with one another on opposite sides thereof, a structure of insulating material housing the contact members and forming two separate enclosures within which the arcs formed by the movement of the two moving contact members from the fixed contact member are respectively drawn out, the structure being bored on one side with two passages leading respectively from the two enclosures to a single outlet orifice, and spaced baffles extending across the throat of each passage and dividing it up into a series of aligned short vents leading from the enclosure into a common discharge passage, the arrangement being such that the pressure developed by the arc in each enclosure causes a blast of deionizing fluid to be discharged through the arc path and out from the enclosure through the vents and the discharge passage.

18. An arc-control device for a liquid-insulated alternating current electric circuit-breaker having two breaks in series, comprising a fixed contact member common to the two breaks, two moving contact members cooperating with the fixed contact member and disposed in line with one another on opposite sides thereof, a structure of insulating material housing the contact members and forming two separate enclosures within which the arcs formed by the movement of the two moving contact members from the fixed contact member are respectively drawn out, the structure being bored on one side with two passages leading respectively from the two enclosures to a single outlet orifice, and spaced baffles extending across the throat of each passage and dividing it up into a series of aligned short vents leading from the enclosure into a common discharge passage, the arrangement being such that the pressure developed by the arc in each enclosure causes a blast of deionizing fluid to be discharged through the arc path and out from the enclosure through the vents and the discharge passage, the vents and the discharge passages being so shaped that the discharge of fluid through one vent will by ejector action set up a suction at the other vents and the two moving contact members each being provided with at least one duct through which the pressure within the enclosure causes liquid to be ejected through at least some of the associated vents before the arc is drawn past such vents.

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