Dec. 12, 1944. D. F. AMER ET AL 2,365,132

ELECTRIC CIRCUIT BREAKER OF THE GAS-BLAST TYPE

Filed Sept. 29, 1942 2 Sheets-Sheet 1

FIG. 1.

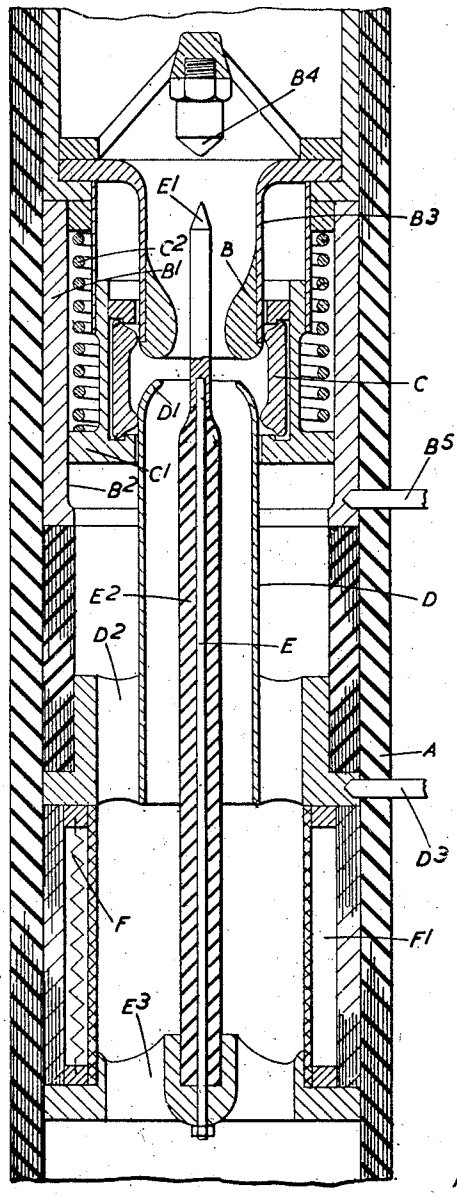


FIG. 2.

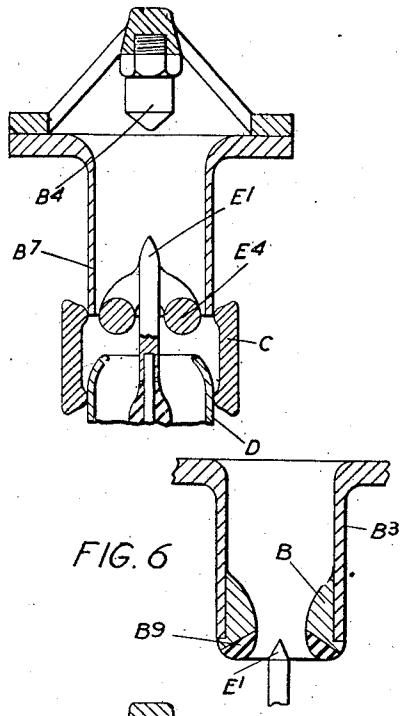


FIG. 6

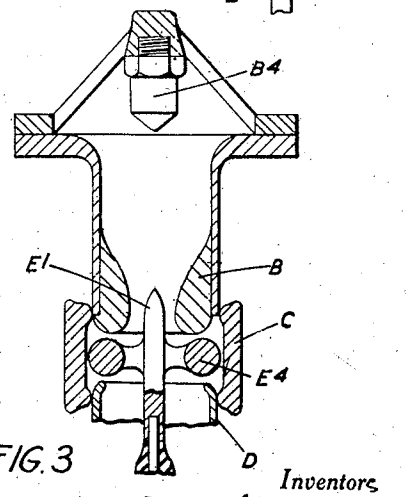


FIG. 3

Inventors
Donald F. Amer and
Arthur Rawlins
By Watson, Cole,
Grindle & Watson
Attorneys

Dec. 12, 1944. D. F. AMER ET AL 2,365,132

ELECTRIC CIRCUIT BREAKER OF THE GAS-BLAST TYPE

Filed Sept. 29, 1942 2 Sheets-Sheet 2

FIG. 4.

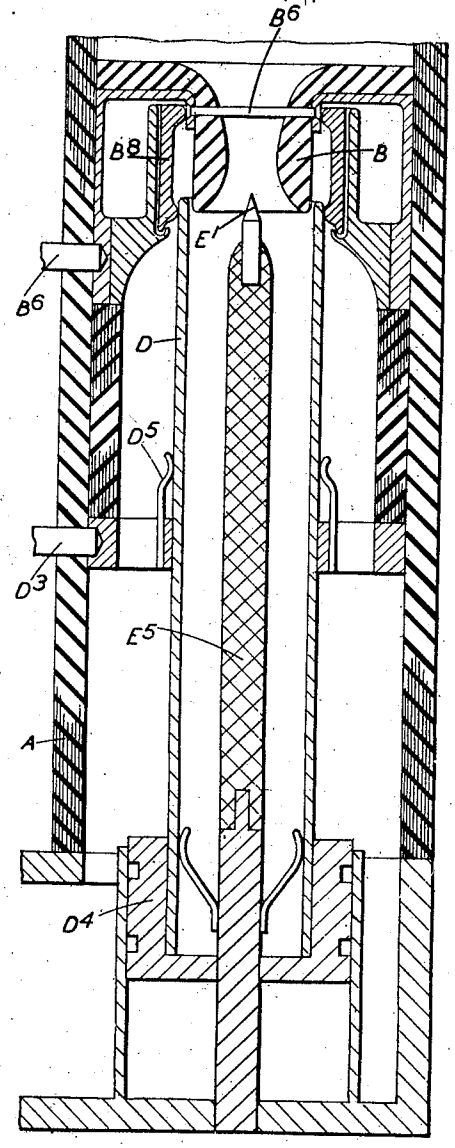
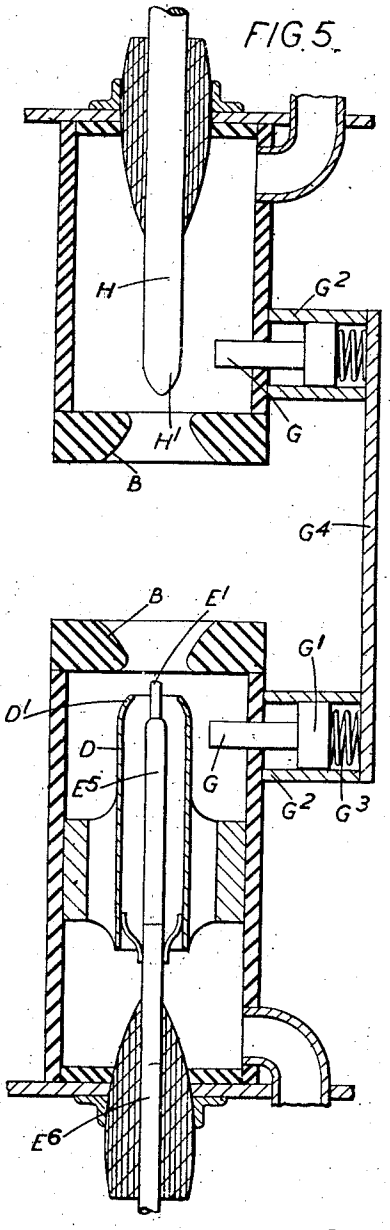


FIG. 5.



Inventors
Donald F. Amer and
Arthur Rawling
By Watson, Cole, Grindle
+ Watson
Attorneys

Patented Dec. 12, 1944 2,365,132

UNITED STATES PATENT OFFICE

2,365,132

ELECTRIC CIRCUIT BREAKER OF THE GAS-BLAST TYPE

Donald Foster Amer, Newcastle-on-Tyne, and Arthur Rawling, Wallsend-on-Tyne, England, assignors to A. Reyrolle & Company Limited, Hebburn-on-Tyne, England, a company of Great Britain

Application September 29, 1942, Serial No. 460,160
In Great Britain September 25, 1941

16 Claims. (Cl. 200—148)

This invention relates to electric circuit-breakers of the kind in which a blast of deionising gas is caused to flow through a nozzle or vent to assist in extinguishing the arc between the arcing contacts of the circuit-breaker.

It has been proposed in such circuit-breakers to employ what is sometimes known as "resistance switching" by providing in the gas-discharge passage from the nozzle or vent an auxiliary electrode connected through a resistance to one of the arcing contacts of the circuit-breaker, the arrangement being such that any restriking of the arc after the arc has gone out will take place between the auxiliary electrode and the other arcing contact, so that the arc energy will be limited by the series resistance and will be readily and easily extinguished by the gas-blast.

Such an arrangement however involves the provision of insulation in the discharge passage in a position where it is necessarily exposed to the arc, with consequent risk of an insulation breakdown or of harmful effect on the performance of the circuit-breaker owing to the generation by the action of the arc on the insulating material of gases in the discharge passage causing back pressure or otherwise varying the effect of the gas-blast on the arc.

The present invention has for its object to provide resistance switching in a circuit-breaker of the above-mentioned kind without giving rise to such difficulties.

In the circuit-breaker according to this invention, the arcing contacts are so arranged that the arc between them extends generally centrally through the nozzle or vent so that the gas-blast flows along and all around the arc, and the auxiliary electrode, which is connected through a resistance to the first arcing contact and is so arranged that any restriking of the arc after the arc has gone out will take place to the auxiliary electrode rather than to such first arcing contact, is supported wholly from the high pressure side of the nozzle or vent.

Preferably, the first arcing contact, to which the auxiliary electrode is connected through a resistance is located on the high pressure side of the nozzle or vent, and the arc (if any) after restriking also extends generally centrally in the gas stream flowing through the nozzle or vent. To this end the auxiliary electrode preferably lies substantially in alignment with the axis of the nozzle or vent, and in a preferred arrangement the first arcing contact is constituted by the end of a tube surrounding a rod, on the end of which the auxiliary electrode is supported. Such rod and tube conveniently have their axes substantially parallel to the axis of the nozzle or vent. The rod supporting the auxiliary electrode may be made of a material having relatively high specific resistance, so that the rod itself constitutes the resistance connecting the auxiliary electrode to the first arcing contact.

The arcing contacts are preferably fixed, the arc being initially formed by the separating movement of the relatively movable arc-initiating contacts and being blown by the gas-blast to a position in which it extends between the arcing contacts. The separating movement of the arc-initiating contacts may take place in a direction transverse to the arc gap between the arcing contacts or in a direction substantially parallel thereto. The first and second arcing contacts may be fixed respectively in the high pressure zone and in the low pressure zone with respect to the gas flow through the nozzle or vent.

Instead however of employing a single nozzle, there may be two nozzles in axial alignment, the gas-blast being constituted by two streams of gas flowing towards one another respectively through the two nozzles and discharging outwardly between the nozzles. In such case there are preferably two sets of arc-initiating contacts connected in series with one another and respectively associated with the two nozzles, and two fixed arcing contacts disposed respectively on the high pressure sides of the two nozzles. The two gas streams may cause the two arcs to be transferred from the arc-initiating contacts in such a manner that they merge into a single arc extending between the two arcing contacts. With such arrangements there may be a single auxiliary electrode supported from the high pressure side of one nozzle and connected through a resistance to one fixed arcing contact. Alternatively there may be two auxiliary electrodes respectively connected through resistances to two arcing contacts and supported from the high pressure sides of the two nozzles.

The invention may be carried into practice in various ways, but some convenient alternative

constructions of circuit-breaker according thereto are illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a longitudinal section through one construction,

Figures 2 and 3 are partial views illustrating modifications of the construction of Figure 1,

Figures 4 and 5 respectively show two further alternative constructions, and

Figure 6 shows another modification of the construction of Figure 1.

In the construction of Figure 1 which also incorporates the invention forming the subject of the concurrent U. S. Patent application Serial No. 460,161 the circuit-breaker is enclosed within an insulating casing A of generally cylindrical form, to one end of which gas under pressure is introduced, when required, from a suitable reservoir, whilst the other end serves for the discharge of the arc gases.

Although it may be mounted in other positions, the casing A is shown vertical in the drawings with its discharge end uppermost.

At a suitable position in the length of the casing A a metal nozzle B diverging towards the discharge end is mounted in a metal housing B^1 secured in the casing, and the inner surface B^2 of such housing around the nozzle is formed as a cylinder in which can slide a piston C^1 carrying a bridging contact member C in the form of a group of inwardly spring-pressed contacts. This piston C is moved by the gas pressure in a direction towards the discharge end of the casing against the action of a spring C^2, and the nozzle B is provided with an external contact surface B^3 with which the bridging contact member C always remains in engagement throughout the piston stroke.

In the normal closed position of the circuit-breaker the bridging contact member C serves to bridge the gap between the nozzle B and a fixed conducting tube D mounted on the high pressure side of the nozzle in axial alignment therewith. The end D^1 of this tube D nearest the nozzle constitutes one of the arcing contacts of the circuit-breaker, and the other arcing contact is constituted either by the low pressure end of the nozzle B itself or (as shown) by a central additional contact B^4 connected to the nozzle at the low pressure end thereof. The two arcing contacts D^1 B^4 are thus both fixed, at an appropriate distance apart, and the gap between them is normally closed by the bridging contact member C.

Centrally disposed within the conducting tube D is a conducting rod E whose end E^1, constituting an auxiliary electrode, projects from the end of the tube towards or into the nozzle F The other end of this rod E, which is suitably shrouded with insulating material E^2, projects from the other end of the conducting tube D and is supported by webs E^3 within the main insulating casing A. The conducting tube D itself is likewise supported by webs D^2 within the casing A and the two sets of webs D^2 E^3 are connected together through a resistance F, which may conveniently be housed in an annular compartment F^1 surrounding the projecting end of the central rod E.

One of the outgoing terminals B^5 of the circuit-breaker is connected to the metal housing B^1 around the nozzle B and thence to the nozzle itself, whilst the other D^5 is connected to the conducting tube D around the central rod E.

Thus normally when the circuit-breaker is closed, the current flows through the nozzle B, the bridging contact member C and the conducting tube D, whilst the auxiliary electrode E^1 and its resistance F are out of circuit. When it is desired to open the circuit breaker, gas under pressure is admitted to the casing A and fills the spaces within and around the conducting tube D. The gas pressure acts on the piston C^1 and drives it towards the discharge end of the casing within the metal housing B^1, thus breaking the connection between the bridging contact member B and the conducting tube D and drawing out an arc between these parts. The gas-blast acts on this arc immediately it is formed and tends to blow the arc through the nozzle B. One arc root remains anchored on the arcing contact constituted by the end D^1 of the conducting tube. The other arc root is blown across from the bridging contact member C on to the high pressure end of the nozzle B, and thence along the nozzle surface to the second arcing contact B^4 at the low pressure end of the nozzle.

In this position the arc will be to some extent bowed out through the nozzle and its main length will lie more or less along the axis of the nozzle in a position favourable to arc extinction by the gas blast, the gas flowing through the nozzle along the arc on all sides thereof. If the auxiliary electrode E^1 projects well into or through the nozzle throat (as shown) the arc will probably come into contact with this electrode, in which case part of the arc will be shunted by the resistance, which will act in some degree to control the arc energy. After the arc has gone out, any restriking which may occur will take place between the auxiliary electrode E^1 and the second arcing contact B^4 owing to the fact that the dielectric strength of this gap will be less than that of the gap between the auxiliary electrode E^1 and the conducting tube D, and the current will therefore be limited by the resistance F and in the case of an A. C. circuit-breaker will be at unity power factor thus greatly facilitating complete extinction by the gas-blast, which again will flow through the nozzle along the arc on all sides thereof.

In some instances it may be desired to vary the effective breakdown distances from the nozzle to the auxiliary electrode and to the conducting tube, without alteration of the dimensions of the parts. This may be effected, as shown in Figure 6, by providing an insulating lining B^9 over part of the nozzle B near the throat thereof. This would not materially affect the movement of the arc along the nozzle surface, since the gas-blast would readily cause the arc root to jump across the insulated portion of the nozzle surface.

Again in cases where a separate second arcing contact (such as the boss B^4 shown in Figure 1 or the bar B^6 shown in Figure 4) is provided the whole nozzle B may be made of insulating material, as is indicated for example in Figure 4.

Although it will usually be preferable, it is not essential to the invention for the vent B controling the flow of gas between the two arcing contacts to be shaped like a nozzle, and various alternative shapes may be used. Figure 2 shows a variant in which the gas flow is controlled by a ring E^4 carried by and surrounding the auxiliary electrode E, within a simple tube B^7 connected to the metal housing B^1. Again, such a ring E^4 may be provided in addition to the nozzle B, so that it lies between the lower end of the nozzle and the end D^1 of the conducting tube D, in such a

position as to be contacted by the bridging member C during the opening movement, as shown in Figure 3. Such arrangements will bring the resistance F definitely into circuit during the opening movement, across part of the arc, and will thus tend to control the arc energy to some extent before the arc goes out, but in other respects these variants will operate generally in the manner above described, the gas stream acting to scavenge the apparently small gap between the ring E^4 and the nozzle tube B^7 in Figure 2 or the corresponding small gap in Figure 3 and thereby to ensure that any restriking of the arc will take place in the desired position between the auxiliary electrode E^1 and the second arcing contact B^4, where it will be readily extinguished.

The direction of movement of the bridging contact member C need not be towards the discharge end of the casing, and in fact such movement need not take place axially, a lateral arc-initiating movement being shown for example in Figure 5. The bridging contact member may also be dispensed with altogether, the arc being formed by relative axial movement between the nozzle B and the conducting tube D. Such an arrangement, wherein the tube D is movable is shown in Figure 4, which as already mentioned also serves to show the use of an insulating nozzle with a bar-shaped second arcing contact B^6 across its low pressure end.

In the construction of Figure 4, the tube D is normally connected to the second arcing contact B^6 and to the circuit-breaker terminal B^5 through a stationary group of spring-pressed contact members B^8, and at its lower end carries a piston D^4, which is moved downwardly by the gas pressure to open the circuit-breaker, the tube D^4 being permanently connected to the circuit-breaker terminal D^3 through a spring contact D^5 past which the tube slides.

The auxiliary electrode E^1 is provided, as before, on the end of a rod centrally mounted within the tube, and is connected to the tube D through a resistance. Figure 4 also serves to show an alternative form of resistance, which may be employed in any of the arrangements in substitution for a helically wound resistance housed in a compartment, such as F^1 in Figure 1, adjacent to the casing A. In the alternative shown in Figure 4, the rod E^5 which carries the auxiliary electrode is itself made of a suitable resistance material, such for example as silicon graphite, the auxiliary electrode being in the form of a metal tip on the end of the rod. This modification has the advantage of providing a compact structure of shorter overall length.

The foregoing arrangements are all shown as single-break arrangements, employing a single nozzle or vent and a single set of arc-initiating contacts. Such arrangements can readily be modified as double-break arrangements, by duplicating the parts shown preferably in axial alignment with one another with the two gas streams flowing towards one another through the two nozzles and discharging outwardly from the low pressure space between the nozzles. In such case, of course, the terminal B^5 in each half can be omitted the two metal housings B^1 being directly connected together within the main casing A. The two second arcing contacts can also be dispensed with, if desired, the two arcs being blown towards one another by the gas-blasts, so that they merge into a single arc between the two arcing contacts on the high pressure sides of the two nozzles. Again it is not essential to provide the auxiliary electrode and its resistance in both halves.

Figure 5 illustrates, quite diagrammatically, one typical example of such alternatives, this figure also showing by way of variant a lateral arc-initiating movement. Thus the lower break in Figure 5 has a nozzle or vent B (shown as of insulating material), as arcing contact D^1 constituted by the end of a conducting tube D, and an auxiliary electrode E^1 supported on a resistance rod E^5, the tube D and the lower end of the resistance rod E^5 being connected to a terminal rod E^6 which supports the resistance rod and passes through a bushing in the wall of the main casing. Arc-initiation is effected by means of a contact member G, for example of the spring finger type, normally engaging with the conducting tube D, but movable laterally out of engagement therewith by means of a piston G^1 sliding in a cylindrical housing G^2 exposed to the pressure of the gas in the main casing around the contacts against a spring G^3. The housing G^2 is connected to a similar housing G^2 in the upper half by a lead G^4.

The upper half is of simpler construction and comprises an insulating nozzle or vent B and a lateral arc-initiating contact member G similar to those of the lower half, whilst the conducting tube D is replaced by a simple terminal rod H passing directly through a bushing in the main casing wall, the lower end H^1 of such rod constituting the arcing contact. The auxiliary electrode and the resistance are omitted altogether in the upper half.

Thus normally the current passes from the terminal rod E^6 through the tube D, the lower contact member G^2, the connector G^4 and the upper contact member G^2 to the terminal rod H. When the circuit-breaker is to be opened, pressure gas is admitted simultaneously to the two halves and operates both arc-initiating contact members G^2, thus drawing out two arcs in series which are at once blown through the nozzles B until they merge into a single arc between the two arcing contacts D^1 and H^1, where it is acted on by the two blasts from both ends. After the arc has gone out, and any restriking will take place across the gap between the upper arcing contact H^1 and the auxiliary electrode E^1 with the resistance of the rod E^5 in series, such are readily and easily being extinguished by the gas blasts.

It will be appreciated that the foregoing arrangements have been described by way of example only and that the invention is equally applicable to many other constructional forms of gas-blast circuit-breaker.

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

1. An electric circuit-breaker comprising in combination a restricted vent through which a blast of deionising gas flows to assist in extinguishing the arc, arcing contacts so arranged that the arc between them extends generally centrally through the vent and the gas-blast flows along and all round the arc one of such contacts being located on the high pressure side and the other on the low pressure side of the vent, an auxiliary electrode, a resistance through which such electrode is connected to the said arcing contact on the high pressure side, means insulating said electrode from the arcing contact on the low pressure side and means for supporting the auxiliary electrode wholly from the high pressure side of the vent, the auxiliary electrode being so arranged that any restriking of the arc will take place in

series with the resistance to such electrode rather than to the said arcing contact on the high pressure side.

2. An electric circuit-breaker as claimed in claim 1, in which the auxiliary electrode lies substantially in alignment with the axis of the restricted vent, so that any restriking of the arc will take place generally centrally with respect to the gas stream flowing through the vent.

3. An electric circuit-breaker as claimed in claim 1, in which the supporting means for the auxiliary electrode is in the form of a rod made of a material having relatively high specific resistance and itself constituting the resistance between the auxiliary electrode and the arcing contact on the high pressure side of the vent, whilst the said arcing contact on the high pressure side of the nozzle is constituted by the end of a tube surrounding such rod, the tube and the rod being disposed substantially in alignment with the axis of the nozzle.

4. An electric circuit-breaker, comprising in combination a restricted vent through which a blast of deionising gas flows to assist in extinguishing the arc, arcing contacts so arranged that the arc between them extends generally centrally through the vent and the gas-blast flows along and all round the arc, one of such arcing contacts being located on the high pressure side and the other on the low pressure side of the vent, an auxiliary electrode, a rod located on the high pressure side of the vent and made of material having relatively high specific resistance, such rod acting at one end to support the auxiliary electrode and being connected at the other end to the said arcing contact on the high pressure side so as to constitute a resistance connecting the auxiliary electrode to the said arcing contact, and means insulating said electrode from the arcing contact on the low pressure side the auxiliary electrode being so arranged that any restriking of the arc will take place in series with such resistance to the auxiliary electrode rather than to the said arcing contact on the high pressure side.

5. An electric circuit-breaker comprising in combination a nozzle through which a blast of deionising gas flows to assist in extinguishing the arc, arcing contacts so arranged that the arc between them extends generally centrally through the nozzle and the gas-blast flows along and all round the arc, one of such arcing contacts being constituted by the end of a tube located on the high pressure side of the nozzle, the other of said contacts being located on the low pressure side of the nozzle, an auxiliary electrode mounted substantially in alignment with the nozzle axis, a rod disposed within the arcing contact tube on the high pressure side of the nozzle and constituting the support for the auxiliary electrode, a resistance through which the auxiliary electrode is connected to the arcing contact tube, and means insulating said electrode from the arcing contact on the low pressure side of the nozzle, the auxiliary electrode being so arranged that any restriking of the arc will take place in series with the resistance to such electrode rather than to the arcing contact tube.

6. The combination with the features set forth in claim 5, of relatively movable arc-initiating contacts disposed on the high pressure side of the nozzle, the arc being initially formed by the separation of such contacts and being immediately transferred therefrom by the gas-blast to the arcing contacts which are fixed.

7. An electric circuit-breaker, comprising in combination a restricted vent through which a blast of deionising gas flows to assist in extinguishing the arc, relatively movable arc-initiating contacts which are disposed on the high pressure side of the restricted vent and by whose separation the arc is initially formed, arcing contacts to which the arc is transferred from the arc-initiating contacts by the gas-blast the arc when so transferred extending generally centrally through the vent so that the gas-blast flows along and all round the arc, one of such arcing contacts being located on the high pressure side and the other on the low pressure side of the vent, an auxiliary electrode, a rod located on the high pressure side of the vent and made of material having relatively high specific resistance, such rod acting at one end to support the auxiliary electrode and being connected at the other end to the said arcing contact on the high pressure side so as to constitute a resistance connecting the auxiliary electrode to the said arcing contact, and means insulating said electrode from the arcing contact on the low pressure side the auxiliary electrode being so arranged that any restriking of the arc will take place in series with such resistance to the auxiliary electrode rather than to the said arcing contact on the high pressure side.

8. An electric circuit-breaker as claimed in claim 7, in which the moving arc-initiating contact is in the form of a tube, and the arcing contact on the high pressure side is constituted by the end of such tube, the tube surrounding the resistance rod and constituting the connection therefrom to the said arcing contact.

9. An electric circuit-breaker comprising in combination a restricted vent through which a blast of deionising gas flows to assist in extinguishing the arc, relatively movable arc-initiating contacts which are disposed on the high pressure side of the restricted vent and by whose separation the arc is initially formed, fixed arcing contacts to which the arc is transferred from the arc-initiating contacts by the gas-blast the arc when so transferred extending generally centrally through the vent so that the gas-blast flows along and all round the arc one of such contacts being located on the high pressure side and the other on the low pressure side of the vent, an auxiliary electrode, a resistance through which such electrode is connected to the said fixed arcing contact on the high pressure side, means insulating said electrode from the arcing contact on the low pressure side and means for supporting the auxiliary electrode wholly from the high pressure side of the vent, the auxiliary electrode being so arranged that any restriking of the arc will take place in series with the resistance to such electrode rather than to the said fixed arcing contact on the high pressure side.

10. An electric circuit-breaker as claimed in claim 9, in which the auxiliary electrode lies substantially in alignment with the axis of the restricted vent, so that any restriking of the arc will take place generally centrally with respect to the gas stream flowing through the vent.

11. An electric circuit-breaker, comprising in combination a restricted vent through which a blast of deionising gas flows to assist in extinguishing the arc, relatively movable arc-initiating contacts which are disposed on the high pressure side of the restricted vent and by whose separation the arc is initially formed, arcing contacts to which the arc is transferred from the arc-initiating contacts by the gas-blast, the arc when so transferred extending generally centrally through

the vent so that the gas-blast flows along and all round the arc, one of such arcing contacts being located on the high pressure side and the other on the low pressure side of the vent, an auxiliary electrode, a resistance through which such electrode is connected to the said arcing contact on the high pressure side, means insulating said electrode from the other of said arcing contacts, and means for supporting the auxiliary electrode wholly from the high pressure side of the vent, the auxiliary electrode being so arranged that any restriking of the arc will take place in series with such resistance to the auxiliary electrode rather than to the said arcing contact on the high pressure side, the separating movement of the arc-initiating contacts taking place in a direction transverse to the arc gap between the arcing contacts.

12. An electric circuit-breaker, comprising in combination a restricted vent through which a blast of deionising gas flows to assist in extinguishing the arc, relatively movable arc-initiating contacts which are disposed on the high pressure side of the restricted vent and by whose separation the arc is initially formed, arcing contacts to which the arc is transferred from the arc-initiating contacts by the gas-blast, the arc when so transferred extending generally centrally through the vent so that the gas-blast flows along and all round the arc, one of such arcing contacts being located on the high pressure side and the other on the low pressure side of the vent, an auxiliary electrode, a resistance through which such electrode is connected to the said arcing contact on the high pressure side, means insulating said electrode from the other of said arcing contacts, and means for supporting the auxiliary electrode wholly from the high pressure side of the vent, the auxiliary electrode being so arranged that any restriking of the arc will take place in series with such resistance to the auxiliary electrode rather than to the said arcing contact on the high pressure side, the separating movement of the arc-initiating contacts taking place in a direction substantially parallel to the arc gap between the arcing contacts.

13. An electric circuit-breaker comprising in combination two nozzles in axial alignment through which a blast of deionising gas flows respectively in two streams directed towards one another and discharging outwardly from the space between the nozzles, two sets of arc-initiating contacts located respectively on the high pressure sides of the two nozzles, means for separating such arc-initiating contacts and thereby drawing out two arcs in series, arcing contacts to which the arcs are transferred by the gas blast from the arc-initiating contacts so that they extend through the nozzles, at least one auxiliary electrode, a resistance through which such auxiliary electrode is connected to one of the arcing contacts the arrangement being such that any restriking of the arc will take place to the auxiliary electrode rather than to such arcing contact, and means for supporting the auxiliary electrode wholly from the high pressure side of one of the nozzles.

14. An electric circuit-breaker, comprising in combination two nozzles in axial alignment through which a blast of deionising gas flows respectively in two streams directed towards one another and discharging outwardly from the space between the two nozzles, two fixed arcing contacts located respectively on the high pressure sides of the two nozzles, two sets of arc-initiating contacts located respectively on the high pressure sides of the two nozzles, means for separating such arc-initiating contacts and thereby drawing out two arcs in series, such arcs being transferred from the arc-initiating contacts by the gas-blast so that they merge into a single arc extending between the two fixed arcing contacts through the two nozzles, at least one auxiliary electrode, a resistance through which such electrode is connected to one of the arcing contacts, and means insulating said electrode from the other of said arcing contacts, the arrangement being such that any restriking of the arc will take place to the auxiliary electrode rather than to the arcing contact to which it is connected through the resistance, and means for supporting the auxiliary electrode wholly from the high pressure side of one of the nozzles.

15. An electric circuit-breaker, comprising in combination two nozzles in axial alignment through which a blast of deionising gas flows respectively in two streams directed towards one another and discharging outwardly from the space between the two nozzles, two sets of arc-initiating contacts located respectively on the high pressure sides of the two nozzles, means for separating such arc-initiating contacts and thereby drawing out two arcs in series, arcing contacts to which the arcs are transferred by the gas-blast from the arc-initiating contacts so that they extend through the nozzles, at least one auxiliary electrode, a rod mounted on the high pressure side of one of the nozzles and made of material having relatively high specific resistance, such rod acting at one end to support the auxiliary electrode and being connected at its other end to one of the arcing contacts so as to constitute a resistance between the auxiliary electrode and the said arcing contact, and means insulating said electrode from the arcing contact on the low pressure side, the auxiliary electrode being so arranged that any restriking of the arc will take place in series with the resistance to the auxiliary electrode rather than to the arcing contact to which it is connected.

16. An electric circuit-breaker, comprising in combination two nozzles in axial alignment through which a blast of deionising gas flows respectively in two streams directed towards one another and discharging outwardly from the space between the two nozzles, two sets of arc-initiating contacts located respectively on the high pressure sides of the two nozzles, means for separating such arc-initiating contacts and thereby drawing out two arcs in series, arcing contacts to which the arcs are transferred by the gas-blast from the arc-initiating contacts so that they extend through the nozzles, at least one auxiliary electrode, a resistance through which such electrode is connected to one of the arcing contacts the arrangement being such that any restriking of the arc will take place to the auxiliary electrode rather than to the arcing contact to which it is connected through the resistance, means insulating said electrode from the arcing contact on the low pressure side, and means for supporting the auxiliary electrode wholly from the high pressure side of one of the nozzles, the separating movement of the arc-initiating contacts taking place in a direction transverse to the arc gap between the arcing contacts.

DONALD FOSTER AMER.
ARTHUR RAWLING.