Feb. 9, 1954 A. C. KELLE 2,668,892

CONTACT AND ARC RUNNER STRUCTURE FOR CIRCUIT INTERRUPTING DEVICES

Filed Dec. 30, 1950 2 Sheets-Sheet 1

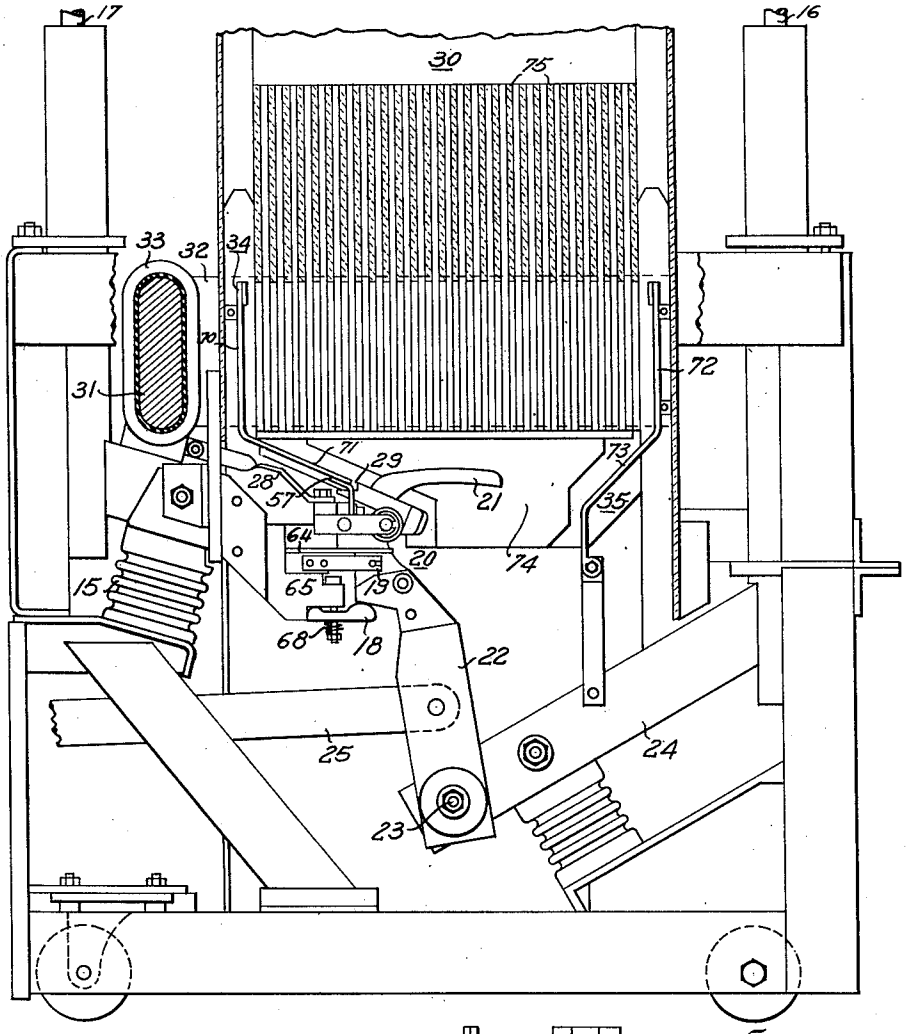


Fig. 1

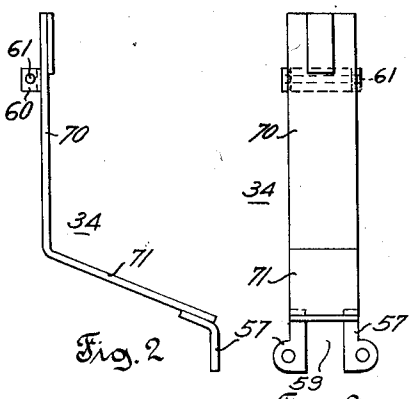


Fig. 2

Fig. 3

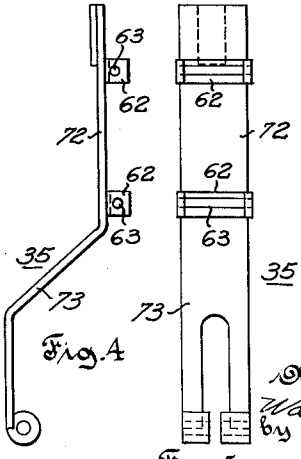


Fig. 4

Fig. 5

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Feb. 9, 1954 A. C. KELLE 2,668,892

CONTACT AND ARC RUNNER STRUCTURE FOR CIRCUIT INTERRUPTING DEVICES

Filed Dec. 30, 1950 2 Sheets-Sheet 2

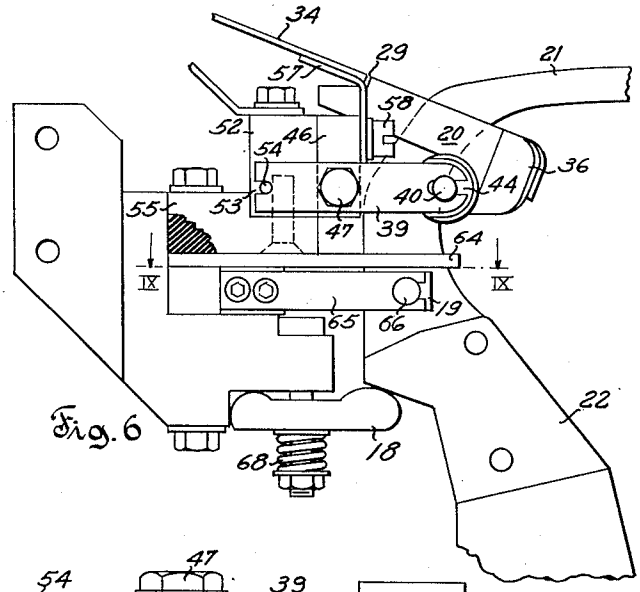


Fig. 6

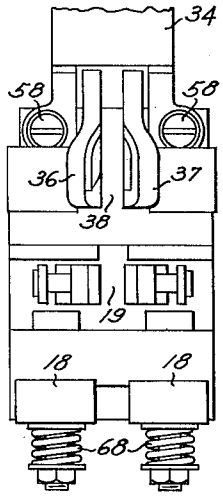


Fig. 7

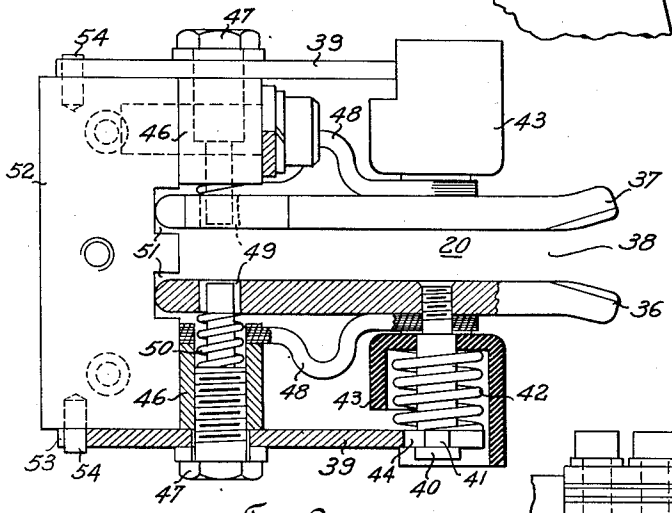


Fig. 8

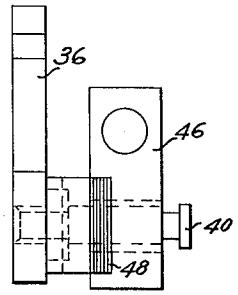


Fig. 11

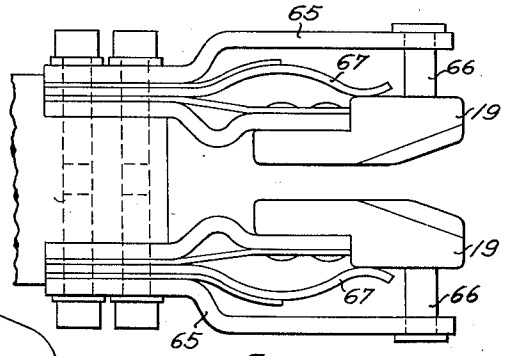


Fig. 9

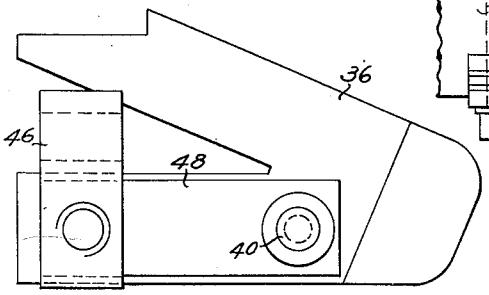


Fig. 10

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CONTACT AND ARC RUNNER STRUCTURE FOR CIRCUIT INTERRUPTING DEVICES

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Application December 30, 1950, Serial No. 203,613

6 Claims. (Cl. 200—147)

1

This invention relates to circuit interrupting devices and more particularly to an arc chute and contact structure used in connection therewith.

In the construction and operation of air magnetic breakers, it is important to design the breaker so that it transfers in a minimum length of time the arc from the point of its inception within the arc chute to the point where final arc extinction is to take place. Equally important is the necessity of designing the circuit interrupter so as to achieve a chute structure which comes relatively close to the desideratum of even thermal duty distribution.

Therefore, in accordance with the invention claimed a new and improved circuit interrupter is provided comprising an arc chute and a pair of cooperating contacts between which a gap is formed and an arc is ignited when the circuit is interrupted. The contacts comprise a slotted horn shaped fixed arcing contact and a horn shaped movable arcing contact firmly engaging the slot walls of the fixed arcing contact when in the circuit closed position. The fixed arcing contact is flexibly mounted so as to align itself when engaging the movable arcing contact. A flat metallic head runner is mounted adjacent the fixed arcing contact for transferring the arc from the fixed arcing contact to a region remote therefrom and a tail runner is arranged to transfer the arc from the movable arcing contact to a region remote therefrom. A blowout means such as a magnetic coil is used to transfer the arc terminal from the movable arcing contact to the tail runner when the gap between the arcing contacts and in turn the arc is of a predetermined length.

The arc is initially rapidly elongated in a direction perpendicular to the longitudinal axis of the barrier plates with a minimum of arc propulsion in a direction toward the exhaust end of the arc chute structure. This initial rapid substantially straight arc elongation is achieved within an expansion space which is situated below the transverse barrier plates of the chute. Hence preheating of the barrier plates is effectively avoided during the above initial period of arc elongation.

It is, therefore, one object of the present invention to provide a new and improved arc interrupting device in which the arcing contacts are self-aligning.

Another object of this invention is to provide a new and improved arc interrupting device in which the relatively fixed arcing contact and arc

2

runner structure is broken up into two nonintegrated or substantially separate parts.

A further object of this invention is to provide a new and improved arc interrupting device in which the movable horn shaped arcing contact is so designed and positioned in the device that it equally distributes the cooling duty of the arc chute throughout its structure.

A still further object of this invention is to provide a new and improved arc interrupting device in which the arc is initially rapidly elongated in a direction perpendicular to the axis of the barrier plates of the arc chute with a minimum of arc propulsion in a direction toward the exhaust end of the arc chute structure.

A still further object of this invention is to move the arc into the arc chute in such a manner that each barrier plate equally distributes the heat of the arc.

A still further object of this invention is to eliminate arcing between the tertiary and arcing contacts.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawing, in which:

Fig. 1 is a view in cross section, of a magnetic blowout type of circuit breaker employing the present invention;

Fig. 2 is a front view of the head runner shown in Fig. 1;

Fig. 3 is a side view of the head runner shown in Fig. 2;

Fig. 4 is a front view of the tail runner shown in Fig. 1;

Fig. 5 is a side view of the tail runner shown in Fig. 4;

Fig. 6 is an enlarged view of the arcing contact structure shown in Fig. 1;

Fig. 7 is an end view of the contact structure shown in Fig. 6 with the movable arcing contact omitted for the sake of clearness;

Fig. 8 is a partial plan view of the stationary arcing contact structure shown in Figs. 1, 6 and 7 with parts thereof in cross section;

Fig. 9 is a plan view of the tertiary contact structure taken along the line IX—IX of Fig. 6;

Fig. 10 is a side view of the stationary arcing contact structure shown in Figs. 1 and 6; and

Fig. 11 is an end view of the elements shown in Fig. 10 looking from the left.

Referring more particularly to the drawings by characters of reference, Fig. 1 illustrates a magnetic blowout type of circuit breaker including as elements thereof a pair of terminal studs

16 and 17 for connecting the circuit breaker to line conductors (not shown). Although in general, circuit breakers of the type considered in Fig. 1 are provided with a plurality of similar pole structures, one for each phase of a polyphase electric circuit, only one such pole structure is shown in the drawing and the circuit breaker will be described in detail as if it was of the single pole unit type.

The circuit interrupter or breaker in Fig. 1 comprises essentially means for opening the circuit to form the interrupting arc and an arc extinguishing structure. Specifically, the circuit opening means comprises a fixed contact assembly supported on an insulator 15 and including a current carrying contact 18, tertiary contacts 19, and an arcing contact 20, cooperating with a movable contact 21 comprising current carrying, tertiary and arcing contacts combined in a single structure. Arcing contact 21 is mounted on a lever 22 which is pivotally mounted at 23 on an extension 24 of the circuit breaker stud 16 and is operated by means of a reciprocally movable rod 25. The operating rod 25 is suitably connected to an actuating mechanism (not shown) for operating the movable contact between closed and open circuit positions. Fig. 1 illustrates the movable contact 21 in closed position. The arcing contacts are electrically connected to the lower ends of terminal studs 16 and 17. Accordingly, when the breaker is connected in series in a power circuit and the arcing contacts are separated, an arc may be initiated across the gap formed between the contacts.

For the purpose of interrupting this power arc, an arc extinguishing structure, such as an arc chute 30, may be mounted so as to receive the power arc which is under the influence of a magnetic blowout means. The arc chute preferably is disposed about and directly above the arcing contacts, as shown, when the blowout means act upward, but may be mounted in any other suitable location when the blowout means act in other directions. The magnetic blowout structure can assume any preferred form so that a brief description thereof will be sufficient. The magnetic blowout means may comprise a core 31, poles 32, and a coil 33. The latter is electrically connected to the terminal stud 17 and, through a strap 28, to a metallic arc runner 34 so that the arc current (as the arc travels along the runner) flows through the blowout coil in a manner well known in the art.

Normally the current is carried in the closed circuit position of the breaker by contact 21 and the spring biased contact 18. While the movable arcing contact 21 is actuated to open circuit position, current is shunted from fixed contact 18 first to fixed contact 19 and then to fixed arcing contact 20. As the arc is drawn by the movable arcing contact 21, the arc terminal on arcing contact 20 is transferred to arc runner 34 which is adjacent to and connected to contact 20 but separated therefrom by a gap 29. The arc terminal is driven across gap 29 to reach a flat side of arc runner 34. When the movable arcing contact 21 approaches a predetermined position in its opening stroke, the other arc terminal transfers from the movable arcing contact 21 to an arc runner 35 which directs the arc into the arc chute 30.

Arc runners 34 and 35 are each divided into two sections. Arc runner 34 comprises a first section 70 arranged within arc chute 30 substantially parallel to the direction of arc transfer in a zone relatively remote from the point of arc initiation, and a second section 71 conductively connected to section 70 and arranged in angular relationship with respect to the direction of arc transfer and to the first section 70 for transferring one terminal of the arc from the fixed arcing contact 20 to the first section 70. Arc runner 35 comprises a first section 72 arranged within arc chute 30 and parallel with section 70 of arc runner 34 but spaced therefrom at the opposite side of the arc chute, and a second section 73 arranged in angular relationship with respect to the first section 72 and conductively connected thereto for transferring the other terminal of the arc from the movable arcing contact 21 to the first section 72. The slope of section 71 of arc runner 34 is smaller than the slope of section 73 of arc runner 35 when the longitudinal axis of the arc chute is vertical, as in the embodiment illustrated in Fig. 1.

The sloping sections 71 and 73 of the arc runners 34 and 35 are arranged in an expansion space or zone 74 which is situated below a plurality of transverse barrier plates 75 forming a part of arc chute 30. Barrier plates 75 are arranged to form a parallelepipedic body in between the parallel sections 70 and 72 of arc runners 34 and 35 and provide a constricted passage to retard and limit the expansion of the arc as it moves through arc chute 30. The points of juncture of arc runner section 70 with section 71 and of section 72 with section 73 are disposed adjacent the entrance of the constricted passage defined by the barrier plates at opposite ends of such entrance.

One end of the blowout coil 33 is connected to the arcing contact 20 and the other end to tertiary contact 19. When the movable arcing contact 21 parts from contact 19, the flow of current is transferred from contact 19 to contact 20 through the blowout coil 33. The movable arcing contact 21 subsequently parts from contact 20 to draw an arc. Accordingly, the blowout coil is already energized at the inception of the arc interruption to influence the arc in a well known manner, i. e., to drive it into the arc chute in an expanding loop. It will be apparent to one skilled in the art that the blowout field can be utilized in the most efficient manner by disposing the iron poles 32 so as to cooperate with the blowout coil in the conventional manner outside of the arc chute.

Referring now to Figs. 2 to 11, fixed arcing contact 20 is formed in the shape of a slotted horn shaped finger type contact which firmly grips the movable blade-like arcing contact 21 when in circuit closed position. Contact 20 comprising two elements 36 and 37 forming a slot 38 therebetween for receiving contact 21 is supported by steel bars 39 and screw threaded pins 40 protruding therefrom. Pins 40 have narrow neck portions 41 slidably arranged in slots 44 of steel bars 39.

Fig. 8 shows a partial plan view of the stationary arcing contact structure 20 with parts in cross section, but it is to be understood that the contact structure is symmetrical with respect to the median plane of slot 38. Pins 40 are surrounded by helical springs 42 which are in turn surrounded by cylindrical spring protective housings 43 of any suitable insulating material such as laminated synthetic resin or fiber. The steel bars 39 are supported by blocks 46 to which they are secured by screws 47. One terminal of shunts 48 is secured to blocks 46 while the opposite terminal of shunts 48 is arranged between contact elements 36, 37, respectively, and spring protec-

tive housings 43. Thus springs 42 establish contact pressure between shunts 48 and contact elements 36 and 37, respectively.

The rear ends of contact elements 36 and 37 of arcing contact 20 are provided with bores 49 into which project the shanks of screws 47. Screws 47 are surrounded by helical springs 50 biasing contact elements 36 and 37 and tending to reduce the space left between them. The rear ends of contact elements 36 and 37 are arranged in suitable guiding grooves 51 in a block 52 supported on insulator 15 through a block 55 of insulating material. The steel bars 39 are provided with slots 53 at one end thereof. Pins 54 entering slots 53 and secured to block 52 prevent undesired rotation of steel bars 39 about the axes of screws 47. It is obvious from the foregoing that contact elements 36 and 37 of fixed arcing contact 20 are capable of being moved transversely and of being tilted in various directions within the limits determined by the play of neck portions 41 of pins 40 in bars 39, the play of the shanks of screws 47 in bores 49 and the play of contact elements 36 and 37 in the grooves 51. A contact arrangement permitting such a freedom of adjustment is generally referred to as floating.

Arc runner 34, commonly known in the art as a head runner, comprising a flat metallic strip is provided with an extending bracket 57 secured to block 52 by means of screws 58. Bracket 57 is slotted, and the rear end of contact elements 36 and 37 enter into a gap 59 formed between the slotted end of bracket 57. The upper end of arc runner 34 is supported by a bracket 60 and a pin 61 secured to the frame of the interrupting device at one end thereof.

Arc runner 35, commonly known in the art as a tail runner, comprising a flat metallic strip is supported by the frame of the interrupting device on the other end of the arc chute 30 by brackets 62 and pins 63. The arc runner 35 being slotted at one end thereof to permit the passage of the movable horn shaped arcing contact 21 through the plane of the runner, is so arranged that it receives the arc terminal from the movable arcing contact 21 after the arcing contacts 20, 21 have separated a predetermined distance. The arc runners are constituted as flat strips on which the roots of the arc travel on the flat sides so as to increase the rate of dissipation of the heat of the arc in the arc runners.

The tertiary contacts 19 (shown in Figs. 1, 6 and 9), which relieve contact 18 of any arcing upon transfer of the flow of current to the magnetizing coil 33 energizing the magnetic blowout system, are arranged below the horn shaped arcing contact elements 36 and 37 of arcing contact 20. Tertiary contacts 19 are protected against the action of arc flames and hot gases formed at the point of break of arcing contacts 20, 21 by insulating barriers 64 projecting in cantilever fashion from left to right. Bars 65 are arranged parallel to the tertiary finger contacts 19 and form abutments for contact extension arms 66, which limit the inward movement of finger contacts 19. Leaf springs 67 arranged between tertiary finger contacts 19 and bars 65 provide the required contact pressure between tertiary contacts 19 and the movable arcing contact 21.

The stationary main or fixed current carrying contact 18 is acted upon by helical springs 68 for providing a firm engagement between contact 18 and movable arcing contact 21.

In air magnetic breakers it is desirable to achieve a substantially equal distribution of the cooling duty throughout the entire plate or stack structure forming arc chute 30. The stack of plates in arc chute 30 is provided for absorbing heat and reducing the temperature of the arcing zone. Generally, the cooling duty imposed upon certain parts of the stack structure is far in excess of the cooling duty imposed upon other parts of that structure. Different parts of the arc chute are exposed to the heat of the arc at different times during the interruption of the arc, and the heat of the arc varies during its passage through the arc chute.

To achieve a more equal distribution of the cooling duty throughout the stack structure, the horn shaped end of the movable arcing contact remote from the stationary arcing contact was increased in length. This resulted in earlier transfer of the arc from the movable arcing contact 21 to the cooperating slanting part of the adjacent tail arc runner 35.

The theory underlying the determination of the specific increase in length of the arc transfer horn of the movable arcing contact is as follows:

At the time of contact separation, the arc length is virtually zero, i. e., the arc core is virtually a hot spot and the whole arc virtually a fire ball. As both contact separation and arc elongation progress, the arc is progressively converted from a substantially spherical gas discharge to gas discharge wherein length predominates, and width is small in comparison to length.

Equalization of the cooling duly throughout the chute requires a transfer of the arc terminal on the movable contact to the cooperating tail runner at the earliest possible time. Existence of a suitable mechanical force for arc transfer is a condition precedent to any transfer of an arc. The mechanical force acting upon a conductor in a magnetic field is proportional to the length of the conductor and this is true, of course, with regard to metallic conductors as well as conductors formed by arcs. In the above referred to process of conversion of an arc from a hot gas sphere into a hot gas column there is a critical arc length at which the magnetic action upon the arc is just high enough for arc transfer. For this reason, the horn shaped end of the movable contact has been designed to come alongside its cooperating arc runner at the time at which this critical arc length is just being reached. If the horn shaped end of the movable contact was made longer, only disadvantages, but no benefits would ensue from such an increase in length. On the other hand, if the horn shaped end of the movable contact was made shorter, as in the lower interrupting capacity designs of the prior art, arc transfer could not be effected at the earliest possible time as determined by magnetic force requirements. Any delay in transferring the arc from the movable contact to its cooperating tail runner throws too large a portion of the total cooling duty of the arc chute upon the part thereof immediately adjacent to the stationary arcing contact.

The critical arc length at which arc transfer from the movable contact to the tail runner can be effected depends upon the particular design under consideration, and more particularly upon the intensity and configuration of the magnetic field in the region of initial contact separation. It was found for breakers of the 4 kv. range as illustrated in Figs. 1 to 11 that the critical arc length was reached when the gap formed between the arcing contacts was about one and one half

(1½) inches. An extrapolation of this finding to other air magnetic breakers with blowout means at the point of arc initiation results in the conclusion that the critical gap length is in excess of one inch and not more than two inches.

The above range of critical gap length may be compared with the gap length of about three and three fourths (3¾) inches which was established in previous air magnetic breakers between the arcing contacts prior to coincidence in space of the tail runner and of the movable arcing contact.

In the magnetic breaker illustrated, the speed of initial contact separation of the arcing contacts is in the order of 12 ft./sec. By the time the horn shaped extension of the movable arcing contact coincides in space with the tail runner, the speed of the former has increased to the order of 22 ft./sec.

Under normal interrupting conditions an arc is initiated immediately upon separation of the arcing contacts 20 and 21. The terminal of the arc on fixed arcing contact 20 is driven over arc runner 34 toward the exhaust end of arc chute 30 by the magnetic blowout means and the thermal effect of the arc. When the movable arcing contact 21 has separated a predetermined distance from the fixed arcing contact 20 the other terminal of the arc jumps from contact 21 to arc runner 35 and is also driven by the blowout means and the thermal effect of the arc toward the exhaust end of arc chute 30.

The point of arc initiation is relatively close to the longitudinal axis of the arc chute and to the plane of symmetry of the arc chute which is parallel to the barrier plates 75, and this plane of symmetry intersects the arc close to the center thereof when the arc has reached its critical length. The arc is initially rapidly elongated in a direction perpendicular to the longitudinal axis of the barrier plates 75 with a minimum of arc propulsion in a direction toward the exhaust end of the chute structure 30. This initial rapid substantially straight arc elongation is achieved within the expansion space 74 which is situated below the transverse barrier plates 75 of chute 30. Hence, preheating of the barrier plates is effectively avoided during the above initial period of arc elongation.

The arc terminals are caused to reach substantially simultaneously the points on the arc runners 34 and 35 where their direction of travel changes from divergent to parallel. At this time the arc path is substantially a straight line perpendicular to the planes of the barrier plates 75. The initial elongation of the arc in such a way that the arc terminals reach substantially simultaneously the points where the directions of their respective arc runners change is achieved by proper coordination of all the factors which determine the speed of travel of the arc terminals. These factors include the intensity of the magnetic blowout field and the speed of separation of the contacts, the length of the movable arc horn and the length and slope of the arc runners.

There is a tendency that the time required for moving the arc terminal formed on the stationary arcing contact 20 along the inclined section 71 of the arc runner 34 be shorter than the time required for moving the other arc terminal along the section 73 of the arc runner 35. This tendency is mainly offset by giving the section 73 of arc runner 35 a greater slope than section 71.

After both arc terminals reach the ends of the inclined sections of the arc runners, the arc is moved without further elongation at right angles to the magnetic field, i. e., in a direction parallel to the plane of symmetry of the arc chute. This motion comes close to a translatory motion and results in a substantially equal distribution of the thermal duty among all the barrier plates, as evidenced by a fairly equal deterioration of the plates along the entire barrier stack.

It is within the scope of this invention to introduce the terminal end sections of the arc into the barrier plates either simultaneously with or after the introduction of the center section of the arc into the barrier plates, but before the center section of the arc has materially heated the barrier plates.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. An electric circuit interrupting device comprising a stationary contact, a movable switch blade, means for moving said blade into and out of engagement with said stationary contact, an arc extinguishing device comprising a pair of spaced flat metallic arc runners, a pair of cooperating arcing contacts between which an arc is ignited when the circuit is interrupted mounted adjacent said arc extinguishing device, said arcing contacts comprising a slotted horn shaped fixed arcing contact electrically connected to said stationary contact and a relatively movable arcing contact comprising a portion of said blade contact firmly engaging the slot walls of said fixed arcing contact when in circuit closed position, means for flexibly mounting said fixed arcing contact for self-alignment during contact engagement with said movable arcing contact, said blade actuating means separating said arcing contacts immediately following disengagement of said blade from said stationary contact during circuit opening operation, and insulating shield means arranged between said stationary contact and said horn shaped fixed arcing contact to protect said stationary contact from arc flames and hot gases formed at the point of break of said arcing contacts.

2. An electric circuit interrupting device comprising a stationary contact, a movable switch blade, means for moving said switch blade into and out of engagement with said stationary contact, an arc extinguishing device comprising a pair of spaced flat metallic arc runners, cooperating fixed and movable arcing contacts between which an arc is ignited when the circuit is interrupted mounted adjacent said arc extinguishing device, said arcing contacts comprising a slotted horn shaped fixed arcing contact electrically connected to said stationary contact and a movable arcing contact comprising a portion of said switch blade firmly engaging the slot walls of said fixed arcing contact when in circuit closed position, means for flexibly mounting said fixed arcing contact for self-alignment during contact engagement with said movable arcing contact, said switch blade actuating means separating said arcing contacts immediately following disengagement of said switch blade from said stationary contact during circuit opening operation, insulating shield means arranged between said stationary contact and said horn

shaped fixed arcing contact to protect said stationary contact from arc flames and hot gases formed at the point of break of said arcing contacts, said arc runners transferring said arc from the region of arc initiation to a region remote therefrom, one of said runners arranged adjacent to but spaced from said fixed arcing contact.

3. An electric circuit interrupting device comprising a stationary contact, a movable switch blade, means for moving said switch blade into and out of engagement with said stationary contact, an arc extinguishing device comprising a pair of spaced flat metallic arc runners, cooperating fixed and movable arcing contacts between which an arc is ignited when the circuit is interrupted mounted adjacent said arc extinguishing device, said arcing contacts comprising a slotted horn shaped fixed arcing contact electrically connected to said stationary contact and a movable arcing contact comprising a portion of said switch blade firmly engaging the slot walls of said fixed arcing contact when in circuit closed position, means for flexibly mounting said fixed arcing contact for self-alignment during contact engagement with said movable arcing contact, said switch blade actuating means separating said arcing contacts immediately following disengagement of said switch blade from said stationary contact during circuit opening operation, insulating shield means arranged between said stationary contact and said horn shaped fixed arcing contact to protect said stationary contact from arc flames and hot gases formed at the point of break of said arcing contacts, said arc runners comprising a head runner for transferring the arc from said fixed arcing contact to a region remote therefrom and a tail runner for transferring the arc from said movable arcing contact to said region remote therefrom, and blowout means for transferring the arc from said movable arcing contact to said tail runner.

4. An electric circuit interrupting device comprising a stationary contact, a movable switch blade, means for moving said switch blade into and out of engagement with said stationary contact, an arc extinguishing device comprising an arc chute, a plurality of barrier plates arranged within said arc chute, and a pair of spaced flat metallic arc runners, cooperating fixed and movable arcing contacts between which an arc is ignited when the circuit is interrupted mounted adjacent said arc extinguishing device, said arcing contacts comprising a slotted horn shaped fixed arcing contact electrically connected to said stationary contact and a movable arcing contact comprising a portion of said switch blade firmly engaging the slot walls of said fixed arcing contact when in circuit closed position, means for flexibly mounting said fixed arcing contact for self-alignment during contact engagement with said movable arcing contact, said switch blade actuating means separating said arcing contacts immediately following disengagement of said switch blade from said stationary contact during circuit opening operation, insulating shield means arranged between said stationary contact and said horn shaped fixed arcing contact to protect said stationary contact from arc flames and hot gases formed at the point of break of said arcing contacts, said arc runners transferring said arc from the region of arc initiation to a region of said chute containing said barrier plates, said arc runners being arranged to elongate said arc to the width of said arc chute before introducing said arc into said barrier plates.

5. An electric circuit interrupting device comprising a stationary contact, a movable switch blade, means for moving said switch blade into and out of engagement with said stationary contact, an arc extinguishing device comprising an arc chute, a plurality of barrier plates arranged within said arc chute, and a pair of spaced flat metallic arc runners, cooperating fixed and movable arcing contacts between which an arc is ignited when the circuit is interrupted mounted adjacent said arc extinguishing device, said arcing contacts comprising a slotted horn shaped fixed arcing contact electrically connected to said stationary contact and a movable arcing contact comprising a portion of said switch blade firmly engaging the slot walls of said fixed arcing contact when in circuit closed position, means for flexibly mounting said fixed arcing contact for self-alignment during contact engagement with said movable arcing contact, said switch blade actuating means separating said arcing contacts immediately following disengagement of said switch blade from said stationary contact during circuit opening operation, insulating shield means arranged between said stationary contact and said horn shaped fixed arcing contact to protect said stationary contact from arc flames and hot gases formed at the point of break of said arcing contacts, said arc runners comprising diverging sections arranged adjacent the fully open positions of the different said arcing contacts for receiving said arc from said arcing contacts and elongating said arc to the width of said chute and sections extending substantially parallel to the longitudinal axis of said chute, said diverging sections of said arc runners being arranged to elongate said arc in a direction perpendicular to said barrier plates to the full width of said arc chute before introducing said arc into said barrier plates.

6. An electric circuit interrupting device comprising a stationary contact, a movable switch blade, means for moving said switch blade into and out of engagement with said stationary contact, an arc extinguishing device comprising an arc chute, a plurality of barrier plates arranged within said arc chute, and a pair of spaced flat metallic arc runners, cooperating fixed and movable arcing contacts between which an arc is ignited when the circuit is interrupted mounted adjacent said arc extinguishing device, said arcing contacts comprising a slotted horn shaped fixed arcing contact electrically connected to said stationary contact and a movable arcing contact comprising a portion of said switch blade firmly engaging the slot walls of said fixed arcing contact when in circuit closed position, means for flexibly mounting said fixed arcing contact for self-alignment during contact engagement with said movable arcing contact, said switch blade actuating means separating said arcing contacts immediately following disengagement of said switch blade from said stationary contact during circuit opening operation, insulating shield means arranged between said stationary contact and said horn shaped fixed arcing contact to protect said stationary contact from arc flames and hot gases formed at the point of break of said arcing contacts, said arc runners comprising diverging sections extending adjacent the fully open positions of the different said arcing contacts for receiving said arc from said arcing contacts, and blowout means for

transferring said arc from said arcing contacts to said diverging sections, said arc runners cooperating with said blowout means to initially rapidly elongate said arc in a direction perpendicular to the longitudinal axis of said chute and to introduce the terminal end sections of said arc into said barrier plates after the introduction of the center section of said arc into said barrier plates but before the center section of said arc has materially heated said barrier plates.

ARTHUR C. KELLE.

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