Feb. 10, 1942. L. J. LINDE 2,272,214

AIR BLAST CIRCUIT BREAKER

Filed Dec. 22, 1939

Fig. 1.

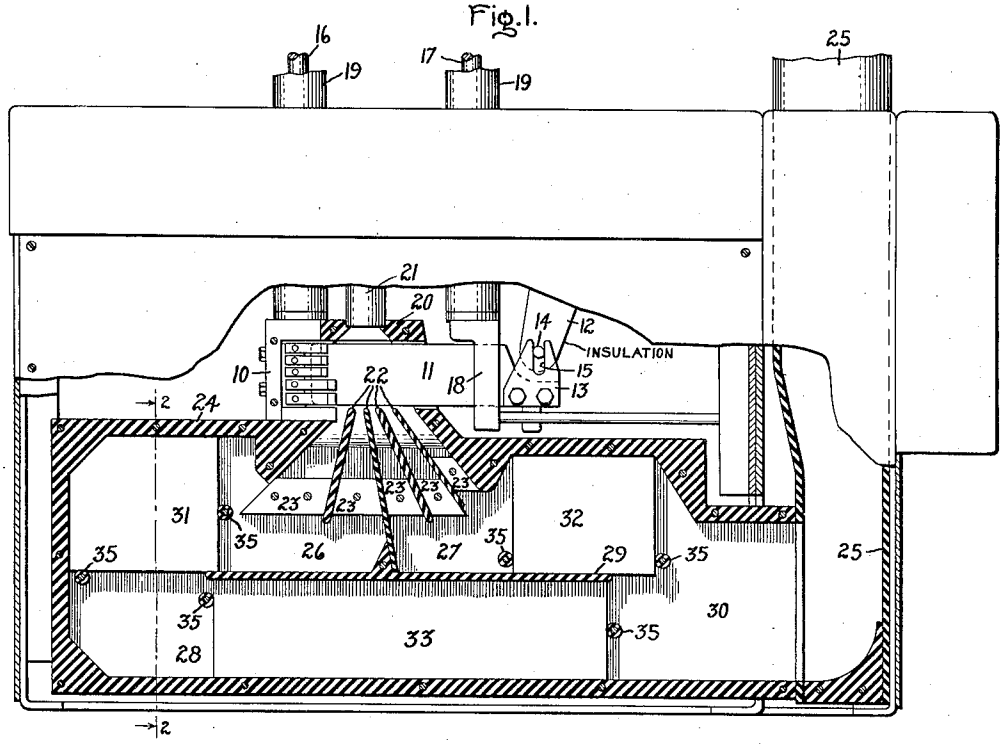
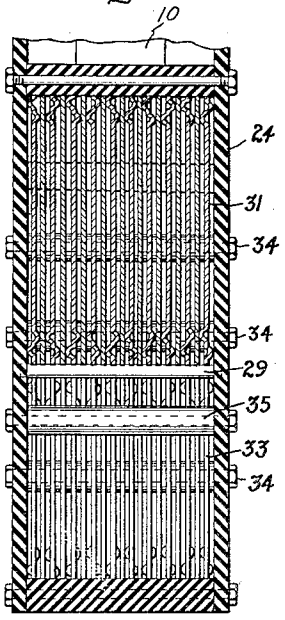


Fig. 2.



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2,272,214

AIR BLAST CIRCUIT BREAKER

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Application December 22, 1939, Serial No. 310,603

7 Claims. (Cl. 200—148)

My invention relates to improvements in electric circuit breakers and particularly to electric circuit breakers of the gas blast type.

Recent improvements in the design of gas blast electric circuit breakers have greatly increased the interrupting capacity of breakers of this type. In the operation of gas blast breakers of higher capacity the problem of burning completely and cooling sufficiently the gases from the arc chamber before they are exhausted to the atmosphere has become increasingly difficult and it is accordingly an important object of the present invention to provide an electric circuit breaker of the gas blast type having improved means for insuring the complete combustion and adequate cooling of the gases from the arc chamber before they are exhausted to the atmosphere.

It is another object of the invention to provide an improved electric circuit breaker of the gas blast type of such size and shape that it may be interchanged with existing oil breakers of the same rating and which, at the same time, is capable of operating under severe conditions without exhausting gases to the atmosphere that will damage equipment or injure an operator or other attendant who happens to be near the circuit breaker unit during its operation.

Further objects and advantages of the present invention will become apparent as the following description proceeds, reference being had to the accompanying drawing in which Fig. 1 is an elevational view partly in section showing an embodiment of my invention, and Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1.

The invention specifically claimed in this application is also disclosed, inter alia, in a copending application, Serial No. 363,325, filed October 29, 1940, by W. K. Rankin for "Gas blast electric circuit breaker," assigned to the same assignee as the present invention and having claims generic to the present invention.

Referring to the drawing, the circuit breaker comprises a fixed contact 10 including a plurality of spring pressed fingers and a movable contact 11 which is operated by any suitable mechanism (not shown) through an oscillatable insulating arm 12 connected thereto by a cross-head 13. A pin 14 carried near the end of the insulating arm 12 is slidably received in a slot 15 in the cross-head 13. Fixed contact 10 is connected to one line conductor 16 while movable contact 11 is connected to the other line conductor 17 by means of a sleeve 18 of conducting material in which the movable contact is slidably mounted. The conductors are mounted in insulated relation to the breaker enclosing structure by suitable bushings 19. The relatively movable contacts 10 and 11 are arranged to separate within an arc confining structure 20 of insulating material. A conduit 21 opening into the interior of the arc confining chamber at one side of the relatively movable contacts is provided to supply a blast of arc extinguishing gas, such as air, to the arc confining chamber when the contacts are separated. On the opposite side of the relatively movable contacts a plurality of barriers 22 are arranged to provide an arc chute having a plurality of divergent passages through which different sections of the arc are driven during the interrupting operation of the breaker. The arc confining chamber 20 is preferably shaped to fit rather closely over the opposite sides of the movable contact so that the passages formed by the barriers 22 are substantially shut off from the gas blast from conduit 21 when the contacts are closed and are progressively opened during separating movement of the contacts. With this construction, the passages formed by the barriers 22 open at one end at longitudinally spaced points along the path of contact separation and each is adapted to receive the gases from the corresponding section of the arc path. Each of the passages formed by the barriers and the walls of the arc confining chamber is provided with a plurality of spaced cooling plates 23 of good heat conducting material, such as copper. The circuit breaker construction thus far described, on which the present invention is an improvement, is more fully disclosed and is claimed in the copending application of D. C. Prince et al., Serial No. 303,126, filed November 6, 1339, which is assigned to the same assignee as the present invention.

The results of tests conducted on a circuit breaker of the above construction indicate that the arc is usually interrupted at an early point in the separating movement of the relatively movable contacts. Experience also teaches that the hottest gases emerging from the arc chamber come from the passages of the arc chute opening adjacent the fixed contact 10 and further that these gases often contain a considerable percentage of unburned combustible gas. This latter condition exists, particularly, in circuit breakers where the barriers 22 and the arc confining chamber 20 are formed of material, such as hard fiber, which has a tendency to evaporate under the action of the arc. In accordance with the present invention an improved arrangement is provided for confining the gases from the arc chamber until they are completely burned and sufficiently cooled before they are exhausted to the atmosphere. The improved construction is also designed to utilize to best advantage the available space in an air blast breaker unit which is of such a size and shape that it may be interchanged with oil breaker units of the same rating as are now in service. As illustrated in the drawing, the gases from the arc confining chamber 20 pass through the passages formed by the barriers 22 and through an

opening in the side of an elongated housing 24 of insulating material which extends in a direction generally perpendicular to the barriers 22. The housing 24, which is generally rectangular in cross-section, is closed at one end and at the other end opens into an exhaust tube 25. In the preferred construction illustrated, the tube extends upwardly so that the hot gases are exhausted in that direction. The interior of the housing is divided into upper passages 26 and 27 and lower passage 28 by baffle structure comprising a longitudinally extending partition member 29 and one of the diverging barriers 22 of the arc chute which extends below the other barriers and cooperates with the partition member 29 and the side walls to form the oppositely opening upper passages 26 and 27. The partition member 29 terminates a considerable distance from each end of the housing so that the passages 26 and 28 are in communication adjacent the closed end of the housing and the passages 27 and 28 merge near the open end of the housing 24 to form an enlarged and free space or combustion chamber 30 in which the gases from passages 27 and 28 may mix and burn. In the drawing the arc confining chamber 20 and the housing 24 are illustrated as integrally formed. It is to be understood, however, that the entire insulating structure may be fabricated from suitable sheet insulating material.

In order to provide for rapid cooling of the gases within the housing 24 a plurality of stacks of cooling plates 31, 32 and 33 are provided in the passages 26, 27 and 28, respectively. As clearly shown in Fig. 2 the metal plates are spaced by suitable projections formed on each face of the alternate plates of each stack. Suitable bolts 34, each of which is provided with a suitable spacing sleeve 35 of insulating material, cooperate with the side walls of the housing 24 and the partition member 29 to hold the plates in proper position.

The advantages of the construction of the present invention will be better understood from a consideration of the circuit interrupting operation of the breaker. As the relatively movable contacts are separated an arc is drawn therebetween. In timed relation with the separation of the contacts a blast of air, or other arc extinguishing gas, is supplied to the arc chamber through the conduit 21. The blast may be controlled by any suitable means (not shown) such as a blast valve operated by the contact operating mechanism. The arc is blown against the edge of the barriers 22 and into the passages formed thereby where it is extinguished and the circuit interrupted. In this interrupting process the arc is first elongated as it bends over the edges of the barriers 22 until it finally divides into serially related sections which are separated by the barriers. After interruption of the arc, however, the gases, and particularly those from the vicinity of the fixed contact 10, are highly heated and may contain a considerable percentage of unburned gases. As previously pointed out, this is particularly true where the barriers 21 are formed of hard fiber or other insulating material having the property of evaporating sufficiently under the action of the arc to prevent the ends of the barriers from becoming conductive during the circuit interrupting operation. By the present invention, the gases from the vicinity of the fixed contact 10 are conducted toward the closed end of the housing 24 and then returned to the open end of the housing through two stacks of cooling plates 31 and 33. The gases from the side of the arcing chamber or arc chute remote from the fixed contact are conducted directly to chamber 30 at the open end of the housing 24 through the upper passage 27 where they are mixed with the gases from the lower passage of the housing 24 before they are exhausted to the tube 25. The gases from the upper passage contain a very small percentage of combustible gas and are to a large extent fresh air supplied by the conduit 20. The mixture of the gases from the upper and lower passages in the chamber 30 before they are exhausted to the tube 25 provides for the complete combustion of any unburned gases from the lower passage 28 of the housing 24. Thus it is seen that the hottest gases and those containing combustible gases in quantity are led through a tortuous, circuitous path to a combustion space, while the less highly heated and less combustible gases from that portion of the path of contact travel remote from the fixed contact are led directly to the combustion space where the gases may mix and burn. This division of gases from the arc chamber makes it possible to exhaust gases to the atmosphere from the tube 25 which are not detrimental to the surrounding equipment or dangerous to personnel without utilizing an unreasonable amount of space for handling the gases.

It has been found with the present construction that under the severest operating conditions no flame or exceedingly hot gases are emitted from the upper end of the exhaust tube 25. The construction also takes advantage of all of the available space in a circuit breaker unit of the size and shape required for substitution in the metal clad units which have previously found widespread application in oil circuit breaker installations.

While I have shown and described my invention in connection with a particular form of gas blast circuit breaker, it will be apparent to those skilled in the art that many features thereof are of general application and I intend in the appended claims to cover all modifications falling within the true scope and spirit of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A gas blast circuit breaker for interrupting power arcs comprising relatively movable contacts, means independent of the interrupting arc for directing a gas blast transversely through the arc gap formed upon separation of said contacts, and insulating structure including an arc chute into which the arc is driven by said gas blast from said arc gap, said arc chute including barriers extending transversely of said arc gap and forming passages arranged to be opened to said blast in succession in accordance with separation of said contacts and deflecting baffle means associated with said barriers for causing appreciable elongation of the path of the blast gases traversing the initially opened passages prior to exhaust of the gas from said structure as compared with the paths of blast gases from subsequently opened passages, the blast gases from said subsequently opened passages being comparatively cool when the arc is interrupted at said initially opened passages, and means for directing all said blast gases into a common mixing chamber before final venting thereof to atmosphere.

2. A gas blast circuit breaker comprising relatively movable contacts, means for directing a

gas blast transversely through the arc gap formed upon separation of said contacts, and insulating structure including an arc chute having barriers extending divergently from said arc gap for directing said gas blast through said arc gap and for dividing the arc into serially related sections to cause interruption thereof, said barriers being arranged to form passages that are opened to said blast in succession in accordance with separation of said contacts whereby most of the highly heated arc gases incident to the interruption of a short arc traverse the initially opened passages, and deflecting means including baffle structure for causing reversal and elongation of the path of the blast gases traversing said initially opened passages prior to exhaust of said gases from said insulating structure.

3. An air blast circuit breaker for interrupting power arcs comprising relatively movable contacts, means independent of the interrupting arc for directing an air blast through the arc gap formed upon separation of said contacts for interrupting the arc within a part of the complete opening movement of said contacts, and an insulating structure including an arc chute through which said air blast is directed for receiving and confining the arc during the arc interrupting operation and for rendering harmless the gases that exhaust from said structure, at least a portion of said arc chute being formed of material adapted to emit combustible gases when subjected to the arc heat, means defining passages in said chute leading directly from points spaced longitudinally of the path of contact travel, and baffle means arranged so that the gases from the blast traversing the first formed part of the arc path are directed along an elongated path and subsequently directed into and mixed with fresh air from the air blast traversing that part of the path of contact travel established after arc interruption for insuring substantially complete combustion of said gases in said insulating structure prior to exhaust to atmosphere.

4. An air blast circuit breaker comprising relatively movable contacts, means for directing an air blast through the arc gap formed upon separation of said contacts for interrupting the arc within a part of the complete opening movement of said contacts, and an arc chute through which said air blast is directed for receiving and confining the arc during the arc interrupting operation and for rendering harmless the gases that exhaust from said chute, said arc chute including barriers composed of insulating structure adapted to emit combustible gases when subjected to the arc heat, said barriers defining passages in said chute leading directly from points spaced longitudinally of the path of contact travel whereby the gases from the blast traversing the first formed part of the arc path exhaust through the corresponding passage, and deflecting means for reversing and elongating the path of the aforesaid gases so that they are subsequently directed into and mixed with fresh air from the air blast traversing that part of the path of contact travel established after arc interruption for insuring substantially complete combustion of said gases in said chute prior to exhaust to atmosphere.

5. An air blast circuit breaker comprising relatively movable contacts, means for directing an air blast transversely through the arc gap formed upon separation of said contacts for interrupting the arc within a part of the complete opening movement of said contacts, an insulating arc chute through which said air blast is directed for receiving and confining the arc during the arc interrupting operation, said arc chute including hard fibre barriers that emit combustible gases when subjected to the arc heat, said barriers extending transversely of said air gap and in the direction of said blast so as to define passages in said chute leading directly from points spaced longitudinally of the path of contact travel, and a combustion chamber connecting with said passages for mixing said combustible gases with additional fresh air for insuring substantially complete combustion of said gases prior to their exhaust from said chamber, the gases from the blast traversing the first formed part of the arc path being directed through a tortuous path and mixed with fresh air from a fresh air blast passing directly from that part of the path of contact travel established after arc interruption to said chamber.

6. An air blast circuit breaker comprising relatively movable contacts, means for directing an air blast transversely through the arc gap formed upon separation of said contacts for interrupting the arc within a part of the complete opening movement of said contacts, an arc chute having a narrow blast entrance opening at which said arc gap is formed and a flared exhaust opening, said arc chute including insulating barriers extending divergently from said arc gap and adapted to emit combustible gases when subjected to the arc heat, said barriers defining diverging passages in said chute leading directly from the point of contact separation and also points spaced longitudinally of the path of contact travel, and a housing connecting with the chute exhaust opening, said housing having a baffle for deflecting the blast gases from said point of contact separation along a loop-like path in said chamber and thereafter to mix with fresh air from the air blast traversing by way of a direct and comparatively short passage that part of the path of contact travel established after arc interruption.

7. An air blast circuit breaker comprising relatively movable contacts, means for directing an air blast through the arc gap formed by the separation of said contacts for interrupting the arc within a part of the complete opening movement of said contacts, an arc chute through which said air blast is directed for receiving and confining the arc during the arc interrupting operation, said arc chute including barriers extending transversely of said arc gap and defining passages in said chute leading from longitudinally spaced points along the path of contact travel whereby the gases from the blast traversing the first formed part of the path of contact travel are directed into the corresponding passage, an elongated housing extending in substantially the direction of contact travel and having an open end and a closed end, said arc chute having the exhaust end thereof communicating with the interior of said housing intermediate the ends thereof, said housing including means for deflecting the gases from the first formed portion of said path of contact travel toward the closed end of said housing and back toward the open end thereof, and means for directing the air traversing the latter formed portion of said path of contact travel into said first mentioned gases near the open end of said housing where they are mixed and burned before they are exhausted to the atmosphere.

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