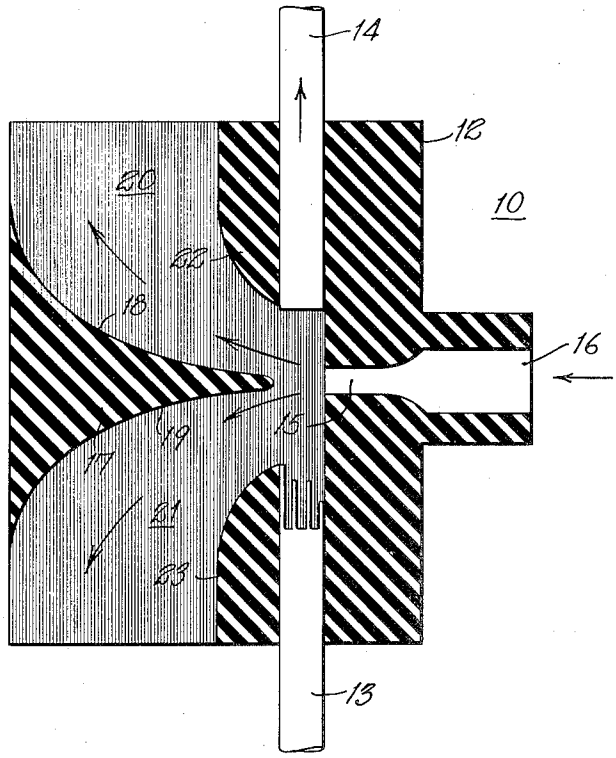
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CIRCUIT BREAKER

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CIRCUIT BREAKER

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This invention relates to electric circuit breakers and more particularly to transverse fluid blast breakers of the type which are used to interrupt high voltage, high alternating current circuits.

It has been well known to the art that a stream of a dielectric fluid such as air or oil introduced into the air gap between two separating contacts will extinguish the resulting arc as the alternating current passes through the zero portion of the cycle. To prevent the arc from restriking, it is required that the dielectric fluid be introduced at a rate which increases the insulating value of the resulting barrier at a greater rate than the voltage builds up across the contacts, a condition which in the absence of an arc can be obtained with a fluid velocity resulting from a relatively low fluid pressure ratio. However, in circuit breakers such as are used to interrupt high voltage, high current circuits it has been found that fluid pressures of several hundred pounds are required successfully to extinguish the resutling arc, a factor which materially increases the cost, complexity, and maintenance of the breakers and auxiliary equipment.

It is, therefore, the objects of this invention to provide a circuit breaker which will interrupt a high voltage, high current circuit, which will prevent restriking of the arc, which is adaptable to be used with either a gaseous or liquid dielectric fluid, which requires a relatively low fluid pressure for successful operation, which simplifies the breaker structure, which reduces maintenance, and which advances the art generally.

A fluid blast circuit breaker according to the invention comprises a housing having two load carrying contacts which are relatively movable with respect to each other to form an air gap for interrupting a high voltage, high current circuit. On one side of the air gap is located fluid directing means, such as a suitable nozzle, for direct-in a gaseous or liquid fluid against one end of a baffle which is located upon the opposite side of the gap so that the arc resulting from separation of the contacts is interrupted during the zero current portion of the cycle by the two layers of dielectric introduced upon either side of the baffle. The sides of the baffle form respectively the sides of two passageways which carry away the expended dielectric fluid. These passageways are made of sufficient and preferably progressively increasing area so as to be able to remove the expended fluid without building up substantially any back pressure.

These and other objects and aspects of the invention will be apparent from the following description of a specific example which refers to a drawing wherein the single figure is a schematic view of a circuit breaker incorporating the invention.

The embodiment of the invention chosen for the purpose of illustration comprises an air blast circuit breaker **10** having a housing **12** of a suitable electrically non-conducting material. Mounted in a slot in the housing is a pair of relatively movable load carrying contacts such as the stationary resilient finger type contact **13** which is secured in the housing and the cooperating movable blade

14. The terminals by means of which the load carrying contacts are tied into the external circuit and the mechanism for reciprocally moving the blade **14** between the open retracted position illustrated and the circuit completing position wherein the end thereof is in contact with the fingers of the stationary contact **13** are conventional and forming no part of the present invention will not be described further.

Adjacent one side of the slot wherein the movable blade **14** slides is a nozzle **15** which is connected with a supply of compressed air (not shown) by means of a conduit **16**. Directly opposite the mouth of the nozzle **15** is the narrow end of a baffle **17** which is formed of an insulating material and is preferably a part of the housing **12**. The opposite sides **18** and **19** of the barrier **17** gradually diverge forming the side walls of two passageways **20** and **21** whose opposite walls are formed respectively by portions **22** and **23** of the housing **12**.

As the movable blade **14** is retracted by the above mentioned mechanism, an air gap is formed in the housing slot between the end of the blade and the stationary contact **13** wherein an electrical arc is drawn. A blast of air is substantially simultaneously released from the nozzle **15** forcing the arc to bend around the narrow end of the barrier **17** until the current passes through a zero portion of a cycle, at which itme the arc is interrupted leaving the air in the gap in a highly ionized state. As the continued discharge of non-ionized air from the nozzle moves the ionized air downstream, the ionized air is divided into two equal columns on either side of the barrier **17** and the non-ionized air interposed between the respective columns of ionized air and tip of barrier **17** forms two layers of high dielectric material which increase in thickness as the columns are moved downstream. To re-establish the arc it is necessary that the voltage be great enough to break down these layers. It will be evident, therefore, that the arc will remain extinguished so long as the velocity of the air stream across the air gap is sufficient to increase the thickness of the layers of non-ionized air on either side of the baffle at a rate greater than the rate of the rise of voltage across the contacts during the next half cycle. Although in the absence of an arc a very low pressure drop across the nozzle **15** will supply the air velocity theoretrically required across the air gap, it has been found that the heating of the air as it passes through the arc (or in the case of an oil circuit breaker the gas formed by disintegration of the oil) so increases in volume that the back pressure rises in the region adjacent the air gap causing the air velocity to drop.

In circuit breakers as constructed heretofore, it has been the practice to overcome this drop in air velocity by increasing the pressure of the air supply until the arc does not restrike, indicating that the velocity was above the critical value. While this provided satisfactory operation in circuit breakers operating in the low and medium voltage ranges, it was found that to prevent the restriking of an arc in large capacity breakers where the voltage and current were both high required an air supply pressure as great as several hundred pounds, which resulted in a heavy, complicated and expensive breaker structure and air supply. In a circuit breaker according to my invention these disadvantages are overcome by making the passage **20** and **21** large in cross sectional area and progressively increasing the area throughout their length so as to offer a minimum of restricting back pressure to the flow of the heated air from the region adjacent the arc. By eliminating restricted passages and arc chutes, it is possible to obtain the pressure ratio required to maintain the air velocity above the critical point while reducing the pressure of the air supply to that approaching what is required in the absence of an arc. It will be

apparent that the above described principles of operation are not limited to circuit breakers of the type using air as a dielectric fluid but are equally applicable to circuit breakers using oil or other dielectric liquids.

As will be apparent from the drawing, the throughflow area of the fluid blast nozzle **15** is substantially less than the combined throughflow areas of the fluid escape passages **20** and **21** at their entrance ends, where these passages lead away from the gap between contacts **13—14**. As a result, the spent blast fluid can escape freely from the gap through the passages **20** and **21** without building up any substantial back pressure in the gap, in spite of the rapid expansion of the blast fluid as it is heated by the arc.

I claim:

1. A fluid blast breaker for interrupting high voltage, high current circuits, which comprises a housing having two electrical contacts adapted to be connected in the circuit and relatively movable with respect to each other to form a gap between the contacts, means located adjacent one side of said gap for directing a fluid jet at high velocity through said gap transversely of the direction of relative movement of said contacts, said fluid directing means including a nozzle opening into the gap, and an arc-splitting baffle disposed in the housing across the gap from the fluid directing means and having a relatively sharp end located adjacent said gap and directly opposite said nozzle, so that the arc formed by the movement of the contacts is forced against said baffle end by the fluid blast from the nozzle, said baffle partly defining unrestricted passageways leading from said gap for the escape

of expended fluid, the discharge end of said nozzle opening abruptly into said gap and having a throughflow area substantially less than that of the gap and substantially less than the combined throughflow areas of said passageways at their entrance ends where they lead away from the gap, said passageways having their minimum throughflow area at said entrance ends, whereby said fluid encounters the minimum throughflow area at said nozzle end and thereupon breaks away as a jet from its confining walls as it enters the suddenly increasing throughflow area of the gap, and substantially no back pressure is built up in the gap.

2. A fluid blast breaker according to claim 1 wherein the cross sectional area of the respective passageways progressively increases.

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