June 2, 1942. L. S. HOBSON 2,284,658

GAS BLAST ELECTRIC CIRCUIT BREAKER

Filed June 17, 1941

Fig. 1.

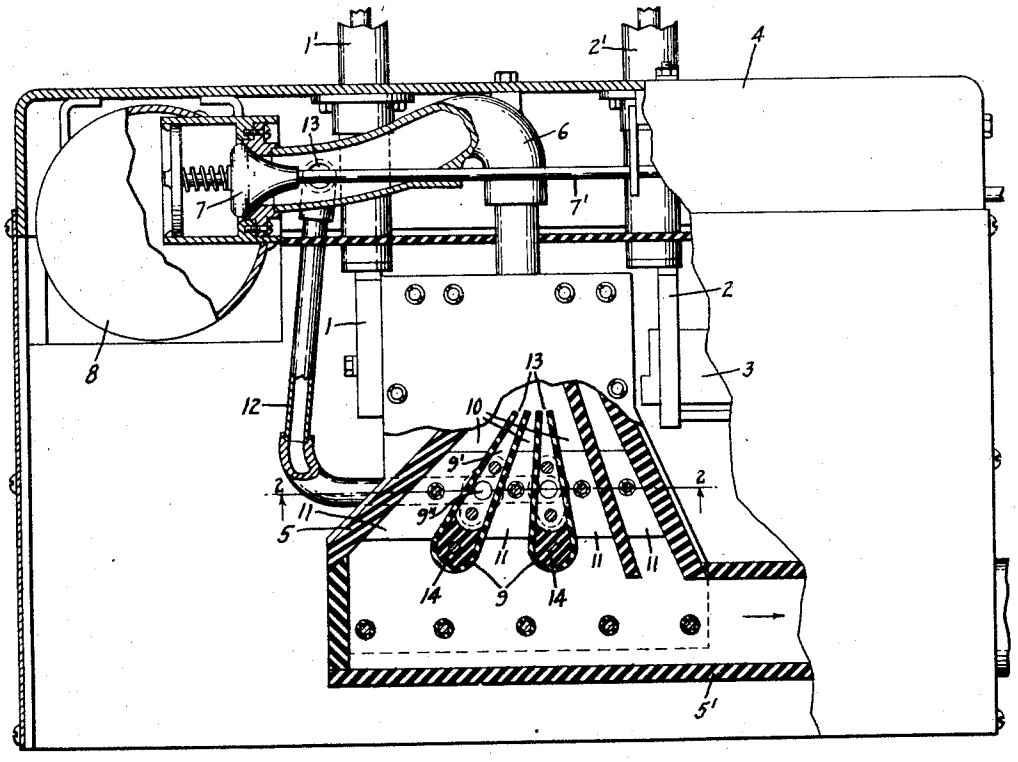
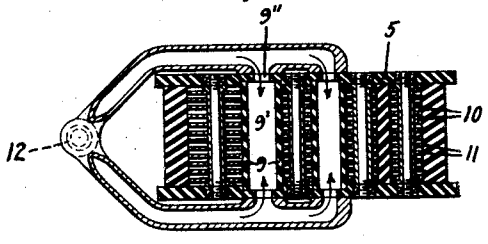


Fig. 2.



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GAS BLAST ELECTRIC CIRCUIT BREAKER

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6 Claims. (Cl. 200—148)

My invention relates to gas blast circuit breakers, more particularly to circuit breakers of this type wherein the arc to be interrupted is caused by the gas blast to impinge on insulating barriers or partitions comprising arc extinguishing structure, such as arc chute structure, and has for its principal object the provision of an improved gas blast circuit breaker of the aforesaid type wherein the insulating arc barriers are shielded from the more intense heat of the arc while functioning efficiently as arc extinguishing means.

A further object of my invention is the provision of improved means for introducing gas, such as air, under pressure into the arc chute at a point adjacent to said arc extinguishing structure on the side of the arc opposite to that directly acted upon by the interrupting gas blast, and specifically at the arc impinging edge portions of the insulating barriers so that it is interposed with respect to said edge portions and the arc.

The interruption of heavy overload and short circuit currents at voltages, such as 15 kv., has been accomplished by means of a gas blast in combination with an arc chute having insulating barriers or partitions which divide the chute into passages through which the hot arc gases and products of arcing are vented to atmosphere. The arc to be interrupted is preferably drawn transversely of the aforesaid passages at the entrance end of the chute and impinges under impact of the gas blast on the exposed edge portions of the insulating barriers. For heavy current interrupting duty, the insulating barriers are preferably composed of a vaporizable material, such as a hard fibre, that does not become conducting in the presence of the arc. A gas blast circuit breaker of this character is disclosed and claimed in an application, Serial No. 303,126 (D–64,679), filed November 6, 1939, by D. C. Prince et al. for "Circuit breaking apparatus and method of operating the same," and assigned to the same assignee as the present invention.

It is known that insulating arc extinguishing structure composed of organic material such as hard fibre vaporizes when subjected to the intense heat of arcing. The resulting gases and vaporized material include hydrogen, hydrocarbon gases, carbon monoxide and incandescent particles which, when vented to atmosphere in a highly heated state, combine with oxygen in the atmosphere so as to burn and cause considerable flame at the arc chute exhaust. This flame is obviously very objectionable if not completely confined, particularly in indoor stations since it tends to break down the dielectric strength of the surrounding air and thereby cause failure of the circuit breaker and also possible damage to adjacent apparatus. Furthermore, flame emission from the circuit breaker casing cannot be tolerated where there is a possibility of injury to station attendants.

The vaporization of the insulating material of the arc barriers is also objectionable from the standpoint of maintenance since the barrier material is eroded away, which in time may necessitate replacement of the barriers. It has also been proposed to use arc barriers of refractory insulating material, such as porcelain and Pyrex glass, for example, but these materials fuse in the presence of high current arcs and become conducting so as to cause failure of the circuit breaker.

In accordance with a specific application of my invention, the arc impinging edges of the insulating arc barriers are shielded from more direct contact with the arc by means of auxiliary air jets issuing from the aforesaid barrier edges under pressure in opposition to the main interrupting blast. The auxiliary jets are at such pressure that they do not to any appreciable extent oppose the arc interrupting function of the main blast. With this arrangement, the arc-impinging edges of the insulating arc barriers are protected from vaporizing or fusing, and in the case of vaporizable barriers, the arc flame is materially reduced by this control of the gas generating characteristics of the organic insulating material.

Furthermore, in the case of vaporizable organic materials, the combustible gases, et cetera, that are generated by vaporization of the fibre or other material, are more readily burned within the arc chute by the auxiliary supply of oxygen introduced by the auxiliary air jets so that flame emission from the breaker is minimized.

My invention will be more fully set forth in the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Referring to the drawing, Fig. 1 is an elevational view, partly in section, of a gas blast circuit breaker embodying the present invention and Fig. 2 is a plain sectional view taken along the line 2—2 of Fig. 1.

The circuit breaker illustrated by way of example in Fig. 1 is of the air blast type and comprises the conductor terminals 1 and 2 between

which the circuit is interrupted by the movable contact blade 3. The details of the contact structure form no part of the present invention and are omitted in the interest of clearness, it being sufficient to note that the circuit is opened by withdrawing the movable blade contact 3 away from contact with the fixed terminal structure at 1. The blade 3 is in sliding electrical contact with the terminal at 2. The circuit breaker proper is mounted in a suitable casing 4 through the upper wall of which extend the insulating lead-in bushings 1' and 2' respectively of the conductor terminals.

When the contact 3 is moved (by actuating means not shown) toward the right as viewed in Fig. 1 to open the breaker, an arc gap is formed at the entrance of the insulating arc chute 5. The arc chute defines an arc extinguishing space and may be of any suitable type such as the "cross-blast" type shown by way of example having a diverging exhaust portion. A conduit 5' is connected to the exhaust end of the chute for venting the arc gases to atmosphere.

The arc chute 5 is connected at its entrance end opposite the aforesaid arc gap with a gas supply conduit 6 which is in turn connected through a blast control valve 7 to the gas pressure supply tank 8. The gas supply tank 8 can be maintained at practically constant pressure by a compressor unit or the like (not shown). When the breaker is to be opened, the valve stem 7' can be operated in relation to or with the movable contact 3 so that a blast of gas, such as air, is directed through the supply conduit 6 to traverse the arc gap and blast the arc into the chute for extinguishing it. A gas blast circuit breaker arrangement of this character is disclosed in the aforesaid Prince et al. application.

For the purpose of more effectively extinguishing heavy current arcs, the chute 5 is provided with insulating barrier structures 9 extending transversely of the arc. In effect, the barrier structures 9 constitute partitions in the arc chute defining gas passages 10 for venting the blast gases. Spaced copper cooling plates 11 are disposed in these passages in edge-wise relation to the flow of gases, as shown by Fig. 2, for cooling the same. Accordingly, it will be noted that the gas blast tends to drive the arc against the edges of the barriers adjacent to the arc gap and that the blast and arc gases flow through the diverging passages 10 to the exhaust end of the chute.

In accordance with my invention, these arc-exposed edges or surfaces of the barriers are shielded from the most damaging heat of the arc by auxiliary jets of comparatively cool gas, such as air, forced out of the arc-exposed edges of the barriers in opposition to the extinguishing blast above described. That is, these jets of air under pressure are forced from the barriers so that the exposed edges thereof are bathed during the arc interrupting operation in a current of comparatively cool gas or air so as to be insulated, at least in part, from the intense heat of the arc. To this end, the barriers 9 are formed in part as hollow members defining spaces 9', each of which is in communication at 9'' with the gas supply conduit 6 through a pipe connection 12. The pipe 12 is connected to the conduit 6 at 13 downstream with respect to the control valve 7 so that opening of the valve in response to a circuit opening operation automatically admits air under pressure to the enclosed barrier spaces 9' as best illustrated by Fig. 2. The connection 12 is preferably arranged as a manifold extending through opposite walls of the arc chute as indicated by Fig. 2 so that the auxiliary supply of air is admitted at opposite sides to the barrier spaces 9', thereby insuring a quick build-up of the auxiliary air pressure in the barrier spaces or passages without delay. The auxiliary air supply is vented from the spaces 9' through narrow openings or slits 13 formed at the arc-exposed edges of the barriers so as to flow in direct opposition to the main extinguishing blast. As indicated by Fig. 2, the slits 13 preferably extend entirely across the exposed edges of the barriers.

Accordingly, when the breaker is opened, the arc instead of being driven directly against the exposed edges of the barriers by the main blast, is driven against a cushion of comparatively cool air flowing from the barrier edges. This interposed cushion of comparatively cool air or gas continues to flow from the barrier edges throughout the arc interrupting operation so as thermally to insulate to a considerable extent the insulating material of the barriers from the highly heated arc core. It will be apparent that this insulating function of the auxiliary jets tends to prevent fusing of the barriers where refractory material is used and also vaporization and erosion of the barriers where organic material, such as fibre, is used. Also as previously pointed out, the auxiliary supply of air is helpful in bringing about more complete combustion of the arc gases within the chute so as to reduce or minimize flame-throw from the breaker.

In order to reduce the volume of the spaces 9' for insuring more direct application of the auxiliary jets, the spaces may be partly filled with a suitable insulating material as indicated at 14.

It should be understood that my invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art without departing from the 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 comprising an arc chute, relatively movable contacts separable to form an arc gap in said chute, means for directing under pressure a blast of gas through said arc gap to extinguish arcing in said chute, said chute comprising insulating arc extinguishing structure against which the arc is urged under influence of said blast, and means for interposing at arc-exposed surfaces of said insulating structure an auxiliary supply of gas under pressure so as to shield said surfaces from the more intense heat of the arc.

2. A gas blast circuit breaker comprising an arc chute, relatively movable contacts separable to form an arc gap in said chute, means for directing under pressure a blast of gas through said arc gap to extinguish arcing in said chute, said chute comprising insulating arc extinguishing structure against which the arc is urged under influence of said blast, and means for directing at surfaces of said insulating structure in close proximity to said arc an auxiliary supply of gas under pressure in opposition to the extinguishing blast so that said surfaces are shielded by said auxiliary gas from the more intense heat of the arc.

3. A gas blast circuit breaker comprising an arc chute, insulating barriers constituting arc extinguishing structure in said chute, relatively movable contacts separable to form an arc gap adjacent to said barriers, means for directing

under pressure a blast of gas through said arc gap so as to urge the arc against the edges of said barriers, and means for directing at arc-impinging edges of said barriers an auxiliary jet of gas under pressure in opposition to the extinguishing blast so as to shield said barrier edges from the more intense heat of the arc.

4. A gas blast circuit breaker comprising an arc chute having an entrance portion and an exhaust portion, insulating barriers constituting arc extinguishing structure in said chute, relatively movable contacts separable to form an arc gap adjacent to said barriers at said entrance portion, means for directing under pressure a blast of interrupting gas through said arc gap so as to urge the arc against the edges of said barriers, and means for interposing air under pressure at arc-impinging edges of said barriers so as to shield said barrier edges from the more intense heat of the arc.

5. A gas blast circuit breaker comprising an arc chute, insulating barriers constituting arc extinguishing structure in said chute, relatively movable contacts separable to form an arc gap adjacent to said barriers, a source of gas pressure, means for directing under pressure a blast of interrupting gas from said source through said arc gap so as to urge the arc against the edges of said barriers, said barriers having gas passages connected with said source and vented at the aforesaid barrier edges, and means related to the interrupting blast admitting to said barrier passages an auxiliary jet of gas under pressure in opposition to the interrupting blast so as to bathe said edges in said auxiliary gas and thereby shield them from the more intense heat of the arc.

6. An air blast circuit breaker comprising an arc chute having an entrance portion and an exhaust portion, insulating barriers composed of a vaporizable material such as hard fibre constituting arc extinguishing structure in said chute, relatively movable contacts separable to form an arc gap transversely of and adjacent to said barriers, a source of air pressure, means for directing under pressure a blast of air from said source through said arc gap so as to urge the arc against the adjacent edges of said barriers, and auxiliary means for directing air under pressure in opposition to the extinguishing blast at said adjacent barrier edges so that said air is interposed with respect to said barrier edges and the air thereby to shield said barrier edges from the more intense heat of the arc.

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