

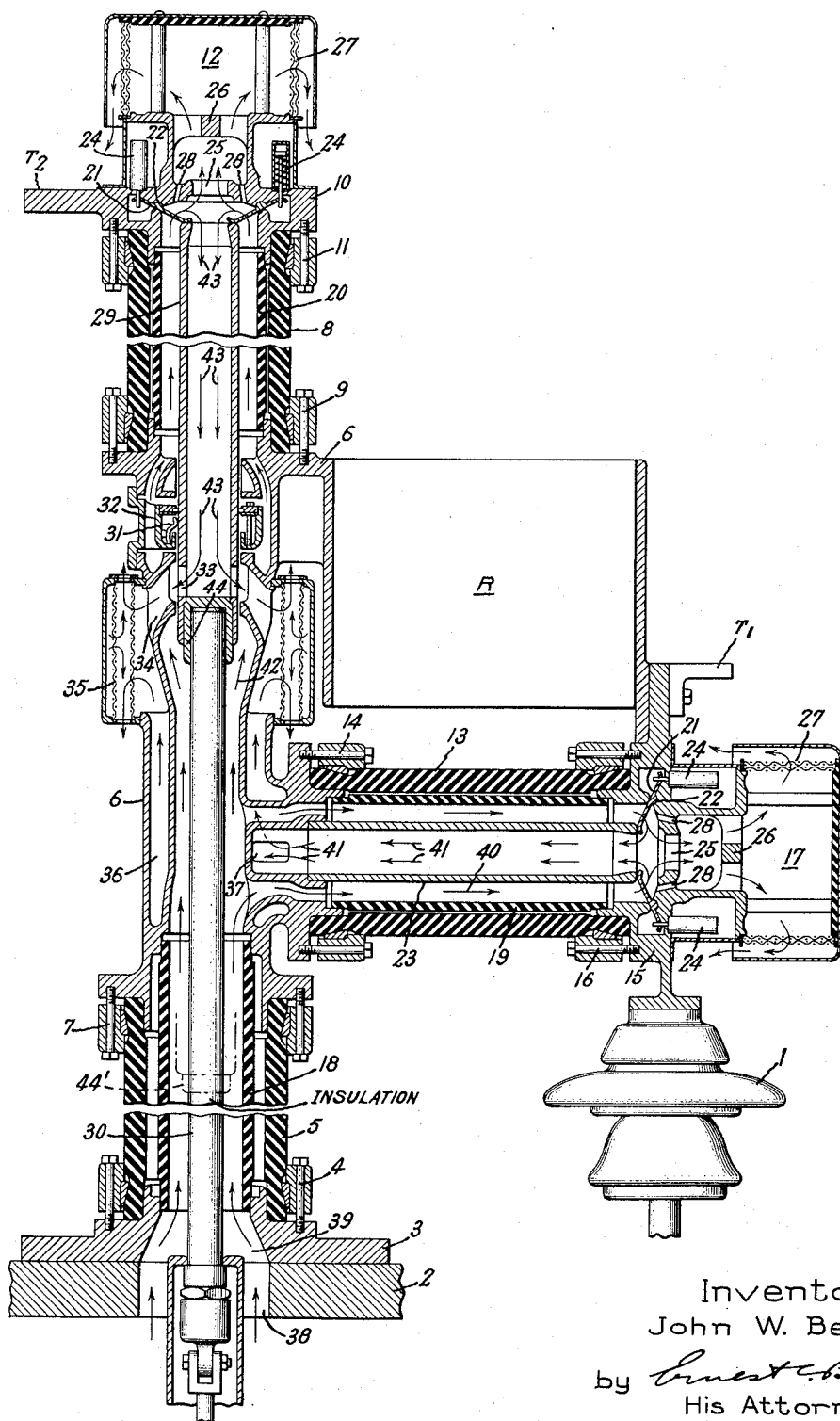
July 14, 1953

J. W. BEATTY

2,645,697

ELECTRIC CIRCUIT BREAKER

Filed Dec. 21, 1950



Inventor:
John W. Beatty,
by *Ernest C. Britton*
His Attorney.

UNITED STATES PATENT OFFICE

2,645,697

ELECTRIC CIRCUIT BREAKER

John W. Beatty, Lansdowne, Pa., assignor to General Electric Company, a corporation of New York

Application December 21, 1950, Serial No. 202,100

8 Claims. (Cl. 200-148)

1

This invention relates to electric circuit breakers and more particularly to a circuit breaker of the gas blast type having biased-closed interrupting contacts arranged in series with isolating contacts and wherein resistance means is connected in parallel with the interrupting contacts.

In circuit breakers of this type a blast of gas is used to extinguish the arc drawn between the interrupting contacts after separation thereof and resistance means connected across the interrupting contacts is for the purpose of limiting the recovery voltage peaks tending to cause a restrike of the arc between the interrupting contacts. Since the resistance in parallel with the interrupting contacts allows current to bypass the interrupting contacts after the arc is extinguished at these contacts, it is necessary to interrupt this current at the isolating contacts. In high voltage breakers such interruption may prove difficult, if not impossible, unless special provision for interrupting the arc at the isolating contacts is made.

A principal object of this invention is to provide an improved means for interrupting the resistor current at the isolating contacts and for establishing an isolating gap in a gas blast breaker having resistor means in shunt with its main interrupting contacts, and to arrange the isolating gap means in such a way that the entire assembly is protected from the weather by a common enclosing housing and so that the entire assembly is compact and requires a minimum of space.

According to the invention a gas blast circuit breaker is provided having a conducting structure formed of at least two relatively movable parts, each of which forms a portion of a series circuit through the breaker. A first contact structure is normally biased into engagement with one of the parts of the conducting structure and a second contact structure is normally biased into engagement with another of the parts of the conducting structure. Both of these contact structures are separable from the conducting structure by a blast of gas which also acts to extinguish the arcs drawn between the contact structures and the conducting structure. After extinguishment of the arcs, one of the parts of the conducting structure is moved relative to its associated contact structure so as to establish an isolating gap for the breaker and a resistor is ordinarily connected between the other part of the conducting structure and its associated contact structure. As already stated, the resistor is in shunt with

2

one of the contact structures and a part of the conducting structure which together comprise the interrupting contacts of the breaker.

A comparable arrangement, wherein a pair of series arcs are drawn in an interrupting circuit with a resistor in shunt across one of them, is disclosed and claimed in U. S. Patent 2,222,719 to D. C. Prince; while another comparable arrangement is disclosed in the co-pending application Serial No. 201,961, Roxburgh et al.; both of these being assigned to the assignee of this present application.

The invention will be better understood with reference to the accompanying drawing in which the single figure thereof is a side sectional view of a gas blast circuit breaker embodying the principles of the invention.

Referring to the drawing, the numeral 1 is used to designate an insulating support for a portion of the breaker while the numerals 2 and 3 designate base plate members forming a support for another portion of the breaker. It will be understood that suitable insulating means not shown would be disposed underneath the plate 2 to form a support therefor which also might constitute a structure for housing an appropriate operating mechanism, source of gas or air pressure, and other associated components. Secured to the base plate 3 by means of suitable bolts 4 is a structurally strong insulating cylinder 5 on which is mounted the metallic assembly 6 which assembly is secured to cylinder 5 by means of bolts 7 and their associated clamping means. Disposed on the assembly 6 is an upper insulating cylinder member 8 secured to assembly 6 by means of bolts 9 and their associated clamping means. Mounted on the cylinder 8 is the contact assembly 10 which assembly is secured to cylinder 8 by means of bolts 11 and their associated clamping means. Exhaust chamber 12 is disposed on the assembly 10.

The horizontal insulating cylinder 13, which may be similar or identical to cylinder 8, is connected to the central assembly 6 by means of bolts 14 and their associated clamping means, while another interrupting contact assembly 15 is supported by insulator 1 and is secured to the outer end of insulating cylinder 13 by means of bolts 16 and their associated clamping means. Exhaust chamber 17, similar or identical to 12, is mounted on the contact assembly 15.

For the purpose of affording a passage through which pressure fluid such as compressed air can be supplied to the interrupting contacts 10 and 15, an insulating sleeve 18 is disposed within the

3

insulating cylinder 5. Similarly, sleeve 19 disposed within the cylinder 13 affords conduit means for transmitting pressure gas to the interrupting contact structure 15, while insulating sleeve 28 disposed within insulating cylinder 8 serves as a means of conveying pressure gas to the interrupting contact assembly 10.

Contact assembly 15, hereinafter frequently called the main interrupting contacts, comprises a plurality of radially disposed finger contacts 21 which are fulcrumed around an annular portion 22 of the assembly structure 15, the contact fingers 21 being biased into good conducting engagement with the tubular conducting structure 23 by suitable spring means 24. Contact structure 15 is provided with an exhaust opening 25 and with an apertured spider member 26, which constitutes an arcing electrode, through which exhaust of gases to the exhaust chamber 17 may be effected. Thus the finger arrangement comprising the radially arranged fingers 21 is similar to that disclosed and claimed in U. S. Patent 2,427,195 to Cox et al.; while the electrode member 26 may conform to that described and claimed in U. S. Patent 2,391,759 to Wilcox, both of these being assigned to the assignee of the present application.

Suitable muffler means 27 may be disposed within the exhaust chamber 17 for cooling purposes thereby preventing the flaming or incandescent products of arcing from escaping to atmosphere. Ports 28 are provided in the assembly 15 to assist the finger contacts 21 holding in the open position against the structure 15 during the application of the blast as explained in the aforesaid Cox et al. patent. Contact assembly 10, hereinafter called the secondary interrupting contacts is similar in construction to contact assembly 15; or, as in some applications, it is convenient to make it identical thereto. Thus, the various parts of secondary contact assembly 10 have been assigned designating numerals corresponding to the numerals assigned to the parts of the main interrupting contact assembly 15. In view of the description of assembly 15 above, it is believed that another detailed description of the parts of secondary interrupting contact 10 is not necessary.

The contact fingers 21 of the secondary interrupting contact 10 are biased into engagement with the tubular conducting structure 29 which, according to one aspect of the invention is movable, i. e. conducting tubular member 29 is arranged to be drawn downwardly by means of the insulating operating rod 30 after interruption of the breaker circuit is accomplished by the extinguishing gas blast applied to the secondary interrupting units 10 and the main interrupting unit 15. It may be observed here that the conducting structure intermediate the main gas-blown contacts 15 and the secondary contacts 10 comprises the fixed tubular conducting element 23, the associated movable tubular conducting member 29 which constitutes the so-called isolating blade or contact, with the fixed and movable tubular elements 23 and 29 electrically interconnected through the agency of the metallic supporting and gas-dividing structure 6 which holds the several circuit breaker cylindrical components 5, 8 and 13 rigidly together.

Thus, electrical contact between assembly 6 and movable conducting isolator 29 is achieved through the agency of the sliding contact members 31 which are spring-biased into engagement and which are supported on the sub-structure

4

32 formed integrally with a flanged bolted cover member which as shown, may be readily removable as a subassembly from the assembly 6. Suitable openings 33 are provided in the lower end of movable conducting isolator 29 through which exhaust gases proceeding from arcing contacts 10 may escape from within the member 29 through the short radial conduits 34 cored into the support casting 6 and thence through the cooling muffler arrangement 35 to atmosphere. Similarly, arc products from the main arcing contacts 15 can exhaust to atmosphere through the same muffler in passing from the left-hand interior portion of the tubular conducting structure 23 via the space 36 of assembly 6 after flowing radially through the passages 37 from the interior of tubular structure 23.

It, therefore, will be apparent that the circuit through the interrupter comprises the terminal T₁, main interrupting contacts 15, fixed tubular structure 23, assembly 6, sliding contact 31, movable tubular isolator 29, secondary interrupting contacts 10 and terminal T₂.

For the purpose of limiting the recovery voltage peaks tending to cause restrikes of the arc drawn between the main interrupting contacts 15 and the cooperating fixed tubular structure 23, a schematically represented resistor R is provided and is connected as a shunt current path around the main interrupting contacts. Preferably such resistor comprises windings arranged in such a way that adjacent turns neutralize one another so as to render the device non-inductive.

When the interrupter performs an interrupting and isolating operation, a blast of arc extinguishing fluid such as pressure gas, is directed through the openings 38 and 39 respectively of the base plates 2 and 3 and follows the course indicated by arrows 40 to impinge upon the contact fingers 21 of the main interrupting contacts 15. The force of this blast will cause the finger contacts 21 to move out of engagement with the fixed tubular structure 23 and the arc drawn between the tube 23 and the fingers 21 is extinguished by pressure fluid which exhausts axially in opposite directions, i. e., through the opening 25, through the spider electrode 26 and the exhaust chamber 17; and also through the bore of fixed tube 23 following the path of the arrows 41 through the ports 37 and out through the muffler 35 as already described.

As determined by any convenient throttling of the flow passages, a predetermined portion of the pressure fluid supplied through openings 38 and 39 is directed upwardly along the course indicated by the arrows 42 to impinge upon the normally closed finger contacts 21 of the secondary interrupting contacts 10. These finger contacts also are separated from the movable tubular isolating contact 29 by the force of the blast which too exhaust axially in opposite directions from the region of arcing by flowing upwardly through the orifice 25 and the spider electrode 26, and the exhaust chamber 12 to atmosphere and also by flowing downwardly in the direction of the arrows 43 through the ports 33, the radial passageways 34, muffling chamber comprising the mesh means 35 to atmosphere.

As is well understood, extinction of the arc drawn between the fingers 21 of the main interrupting contact 15 and the fixed tubular member 23 will place the resistor R in series with the contacts comprising the movable tubular member 29 and the fingers 21 of the secondary interrupting contact assembly 10. Thus

5

these gas-blown secondary contacts, in moving from the movable isolator contact, must effectively interrupt the residual resistor current.

Immediately after the arcs at both of the series interrupting contacts have been extinguished, the operating rod 30 is drawn downwardly for isolating by suitable operating mechanism not shown. Such sequential operation of gas-blown interrupting contacts and isolating contacts is well-known in the art and might assume various forms; that described in U. S. Patent 2,418,739 to Thumim et al., which is assigned to the assignee of the present application, being illustrative of one embodiment thereof. This downward movement of operating rod 30 causes the movable isolating member 29 to move downwardly with respect to the now opened fingers 21 of secondary interrupting contact 10. In this way, the initial gap opened by the fingers 21 is extended to form a widening safe isolating gap within the weather protection afforded by the enclosing cylinder 8. The phantom-lined open position 44' of the isolator operating rod coupling 44 indicates the desirable extent of this safe gap. In this position, the tip of the isolator tube 29 would be somewhat above the metallic structure 6.

During this isolating movement, when a safe gap is assured, the blast of pressure fluid supplied through a blast valve from a source not shown through the openings 33 and 39 to the interrupter is shut off. When the fluid blast is cut off, the fingers 21 will then move back to the positions shown in the drawing due to the action of their biasing springs 24.

It will be observed that, after a certain downward movement of operating rod 30 with isolator tube 29, the ports 33 disposed in the lower portion of tubular member 29 will have moved out of registry with the exhaust passages 34 and into the region of blast supply as indicated by the arrows 42. Accordingly, continued flow within isolating tube 29 will cease with the downward flow indicated by the arrows 43 being bucked by the upward flow indicated by the arrows 42. Thus, automatic cut-off of part of the blast is effected anticipatory to the mechanical cut-off of the blast valve which is about to take place, and until this moment a scavenging stream will flow only upwardly through the orifice 25. Such a reduction in the continued use of pressure fluid at the isolating contacts is advantageous because the magnitude of blast required to prevent the re-establishment of an arc between the rapidly widening gap is much less than that required earlier to motivate the contact fingers 21 of assembly 10 to their open position and also to extinguish the arcs.

Conversely, for a closing operation, this arrangement automatically provides a diminished blast which is all that is needed for the closing operation when the blast is for the purpose of limiting prestriking of an arc across the gap as the contacts approach one another.

While I have shown and described a particular embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from the invention in its broader aspects and I, therefore, intend in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

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

6

ducting structure constructed of at least two relatively movable parts, first contact means normally biased into engagement with one of said parts of said conducting structure, second contact means normally biased into engagement with another of said parts of said conducting structure, said conducting being located in a position which is intermediate said first and second contact means, means for supplying a blast of pressure fluid to said first and said second contact means to cause predetermined separation thereof from the associated parts of said conducting structure, and means for moving one of said parts of said conducting structure relative to its associated contact means after movement of said contact means by said fluid blast to establish an isolating gap.

2. An electric circuit breaker comprising housing structure, conducting structure disposed in said housing structure and constructed of at least two relatively movable parts, first contact means normally biased into engagement with one of said parts of said conducting structure, second contact means normally biased into engagement with another of said parts of said conducting structure, said conducting structure being located in a position which is intermediate said first and second contact means, means for supplying a blast of pressure fluid to said first and said second contact means to cause predetermined separation thereof from their associated parts of said conducting structure, and means for subsequently moving one of said parts of said conducting structure relative to its associated contact means to establish an isolating gap after movement of said contact means by said fluid blast has established a predetermined arc extinguishing gap thereat.

3. An electric circuit breaker comprising housing structure, conducting structure disposed in said housing structure and constructed of at least two relatively movable parts, means for maintaining an electrical connection between said parts, first contact means normally biased into engagement with one of said parts of said conducting structure, second contact means normally biased into engagement with another of said parts of said conducting structure, said conducting structure being located in a position which is intermediate said first and second contact means, means for supplying a blast of pressure fluid to said first and said second contact means to cause predetermined separation thereof from their associated parts of said conducting structure, and means for subsequently moving one of said parts of said conducting structure relative to its associated contact means to establish an isolating gap after movement of said contact means by said fluid blast has resulted in the establishment of a predetermined arc extinguishing gap thereat.

4. An electric circuit breaker comprising hollow conducting structure constructed of at least two relatively movable parts, means forming an electrical connection between said parts, first contact means normally biased into engagement with one of said parts of said conducting structure, second contact means normally biased into engagement with another of said parts of said conducting structure, said conducting structure being located in a position which is intermediate said first and second contact means, means for supplying a blast of pressure fluid substantially simultaneously to said first and said second contact structures to cause predetermined sep-

1. An electric circuit breaker comprising con-

7

aration thereof from their associated parts of said conducting structure, and means for subsequently moving one of said parts of said conducting structure relative to its associated contact means to establish an isolating gap after movement of said contact means by said fluid blast has established a predetermined arc extinguishing gap thereat.

5. An electric circuit breaker comprising housing structure, intermediate hollow conducting structure disposed within said housing structure and constructed of at least two relatively movable electrically connected parts, first contact means normally biased into engagement with one of said parts of said conducting structure and forming secondary interrupting and isolating contacts for the breaker, second contact means normally biased into engagement with another of said parts of said conducting structure and forming main interrupting contacts for the breaker, an exhaust opening in said housing structure adjacent said first and second contact means, means for supplying a blast of pressure fluid into said housing structure and to said first and said second contact means to cause predetermined separation thereof from their associated parts of said conducting structure, a portion of said blast being exhausted through said exhaust openings, and means for subsequently moving said one of said parts of said conducting structure relative to its associated contact means to establish an isolating gap after movement of said contact means by said fluid blast has established a predetermined arc extinguishing gap thereat.

6. An electric circuit breaker comprising housing structure, intermediate hollow conducting structure disposed within said housing structure and constructed of at least two relatively movable electrically connected parts, first contact means normally biased into engagement with one of said parts of said conducting structure and forming secondary interrupting and isolating contacts for the breaker, second contact means normally biased into engagement with another of said parts of said conducting structure and forming main interrupting contacts for the breaker, an exhaust opening in said housing structure adjacent said first and second contact means, means for supplying a blast of pressure fluid into said housing structure and to said first and said second contact means to cause predetermined separation thereof from their associated parts of said conducting structure, a portion of said blast being exhausted through said exhaust openings, and a portion of said blast being exhausted through said hollow structure to atmosphere, means for moving said one of said parts of said conducting structure relative to its

8

associated contact means to establish an isolating gap after movement of said contact means by said fluid blast has established an arcing gap, and resistance means in shunt with the main interrupting contacts of the breaker.

7. An electric circuit breaker comprising intermediate conducting structure constructed of at least two relatively movable parts, first contact means normally biased into engagement with one of said parts of said conducting structure, said first contact means and said one of said parts forming secondary interrupting and isolating contacts for the breaker, second contact means normally biased into engagement with another of said parts of said conducting structure, said second contact means and said another of said parts forming main interrupting contacts for the breaker, means for supplying a blast of pressure fluid to said first and said second contact means to cause predetermined separation thereof from the associated parts of said conducting structure to establish series arcing gaps thereat, means for subsequently moving one of said parts of said conducting structure relative to its associated interrupting contact means after movement of said contact means by said fluid blast to establish an isolating gap, and resistance means in shunt with said interrupting contacts.

8. An electric circuit breaker comprising a housing having two apertured extremities, hollow conducting structure supported within said housing the two ends thereof normally disposed adjacent said apertured extremities respectively, a first set of blast-responsive movable contacts for drawing an arc of predetermined gap length adjacent one end of said hollow structure, a second set of blast-responsive movable contacts for drawing another arc adjacent the other end of said hollow structure in series with said first-mentioned arc, means for supplying a blast of pressure gas to both sets of contacts for extinguishing the arcs drawn thereat, and means for extending the gap length at one of said sets of contacts for establishing thereat a subsequent isolating gap.

JOHN W. BEATTY.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,445,529	Leeds	July 20, 1948
2,454,586	Amer	Nov. 23, 1948
2,531,617	Forwald	Nov. 28, 1950
2,588,933	Latour	Mar. 11, 1952

FOREIGN PATENTS

Number	Country	Date
619,243	Great Britain	Mar. 7, 1949