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Boersma et al.

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[54] **GAS BLAST CIRCUIT-BREAKERS HAVING COOPERATING TUBULAR CONTACT PIECES**

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[51] **Int. Cl.** **H01h 33/14**, H01h 33/80

[58] **Field of Search** ..... 200/148 BV, 148 A, 200/148 R, 145, 146

[56] **References Cited**

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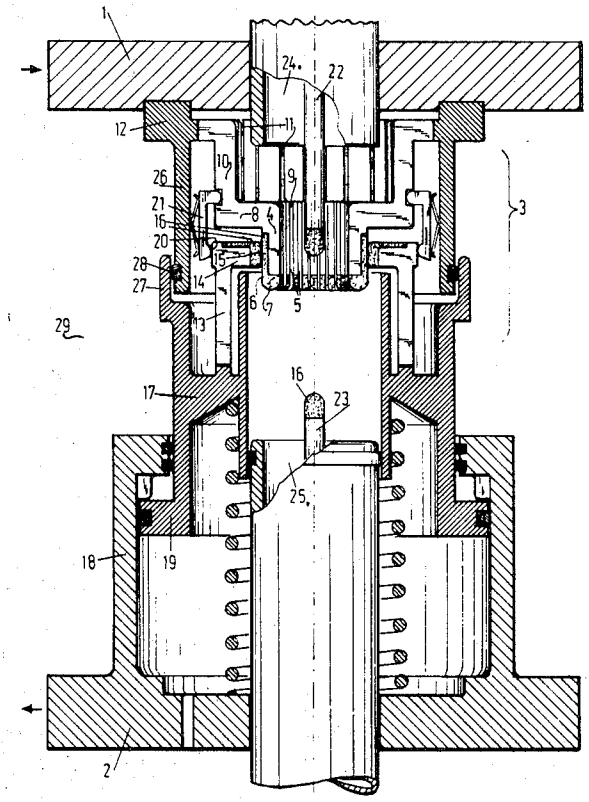
Primary Examiner—Robert S. Macon

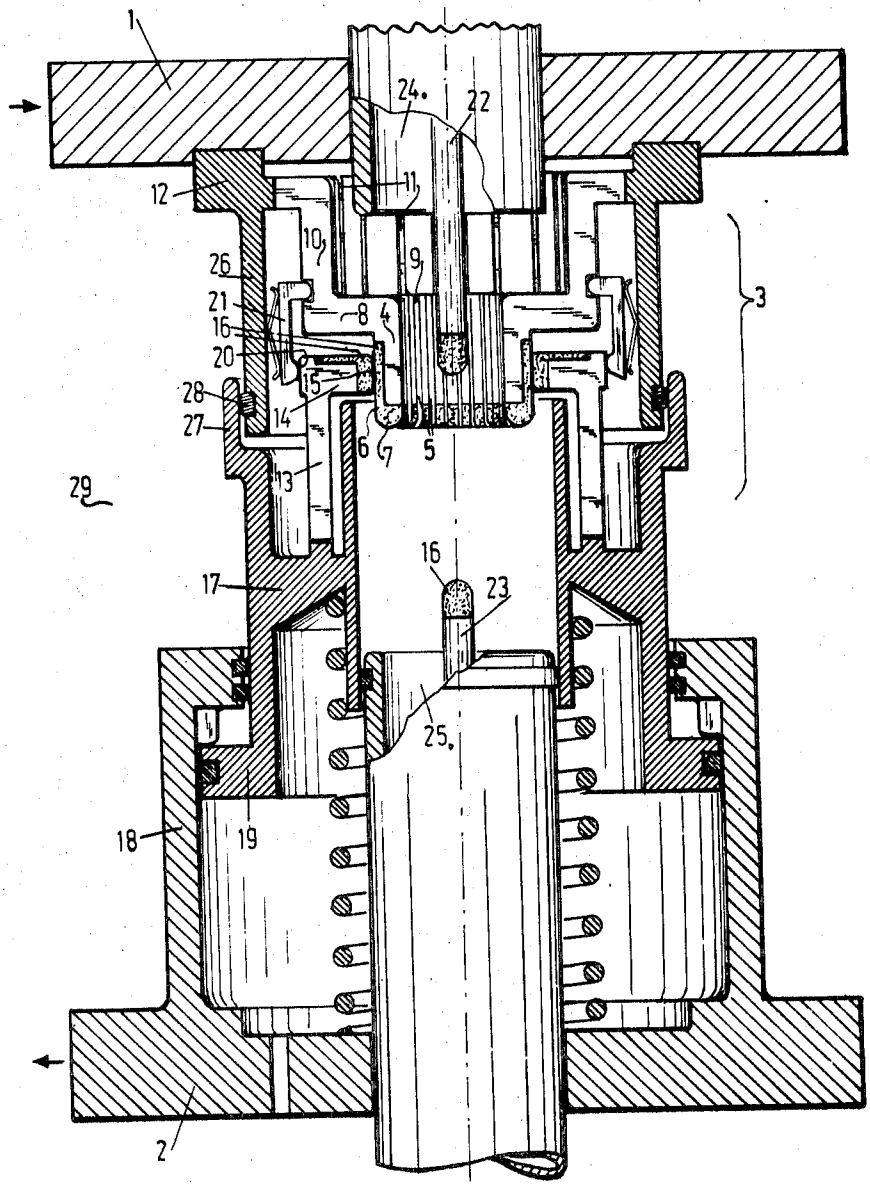
Attorney—John P. Snyder et al.

[57] **ABSTRACT**

A gas blast circuit-breaker having cooperating axially slotted tubular contact pieces which are so formed that at the moment at which said contact pieces are separated from one another a current path is formed which consists of at least three axial portions interconnected by substantially radial portions, the middle one of said axial portions extending nearest the axis of the tubular contact pieces.

3 Claims, 1 Drawing Figure

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GAS BLAST CIRCUIT-BREAKERS HAVING COOPERATING TUBULAR CONTACT PIECES

The invention relates to a gas blast circuit-breaker comprising two relatively movable, cooperating, coaxial, tubular contact pieces supported each by a contact holder which is to be connected to the circuit to be closed and opened, the first one of said contact pieces being provided with an externally cylindrical rigid end portion pointing towards the second piece and provided with axial slots for dividing said end portion in parallel axial current paths and with contact surfaces lying in the cylindrical outer surface and separated from one another by said slots and the second one of said contact pieces being provided with a circular series of resilient contact fingers pointing toward the first contact piece and forming parallel axial current paths, said contact fingers having radially inwards facing contact surfaces which are adapted to slide on the contact surfaces of the first contact piece and to cooperate each with one single contact surface of the first contact piece only.

A gas blast circuit-breaker of this kind is disclosed in the Swiss Pat. No. 413.960. In this known circuit-breaker a switching arc is first produced between the contact surfaces of the main contacts forming parallel current paths, when during the separation of the cooperating contacts said contact surfaces slide away from one another. After the switching arc has a certain length it jumps, under the influence of the magnetic field of the outer circuit which is still closed by the circuit-breaker, from the contact surface of the movable main contact to a split ring which surrounds with ample clearance the fixed contact and is connected to the movable contact. The switching arc then extends substantially radially outwards from the contact surface of the fixed contact. The change of the current path caused thereby results in that a resulting magnetic field is produced which exerts on the switching arc a force which drives together with the flow of extinguishing gas said arc towards the axis of the tubular contacts, so that the switching arc will be set up between two spaced coaxial fixed contact portions and thereupon is quenched by the extinguishing gas. A disadvantage of this known circuit-breaker is that the switching arc is kept some time between the contact surface of the fixed contact and the movable contact piece before it is driven from said contact surface to the axis of the contact pieces by the combined action of the resulting magnetic field and the flow of extinguishing gas. Thereby the said contact surface could be damaged and it could damage in its turn the contact surface of the moving contact piece sliding thereon.

The invention has for its object to provide a circuit-breaker of this type, in which directly after the separation of the contact a resulting magnetic field is produced which forces the switching arc immediately after its occurrence from the contact surfaces of said contacts towards the axis of the tubular switching contacts, where said arc is quenched by the extinguishing gas. According to the invention this is achieved in that the slotted end portion of the first contact piece is formed on a disc-shaped portion of said contact piece, said disc-shaped portion extending radially outwards in respect of said end portion and having radial slots which connect to the axial slots of the end portion, said disc-shaped portion being electrically conductively connected near its outer edge to the respective contact holder through an axially extending tubular connecting piece having axial slots connecting to the slots of said disc-shaped portion and the contact fingers of the second contact piece having each at their free ends the shape of a radially inwards extending contact block, the arrangement being such, that at the moment, at which, during the opening process, the contacts of the circuit-breaker are separated from one another, a current path is produced which consists of at least three axial portions interconnected by substantially radial portions, the middle one of said axial portions extending nearest the axis of the tubular contact pieces. Due to this shape of the current path the switching arc is immediately forced to the axis of the circuit-breaker by the resulting magnetic field with a force which under all circumstances is great in respect of the force exerted on said arc by the flow of gas, so that for that purpose the extinguishing gas is relieved of its task.

A further amelioration is attained, when the circuit-breaker is so constructed that the contact fingers of the circuit-breaker contact piece also have near their free ends radially outwards facing contact surfaces and the first contact piece is provided with an additional circular series of resilient contact fingers connected permanently electrically conductively near their one ends with the first contact piece and cooperating near their other ends with said radially outwards facing contact surfaces of the contact fingers of the second contact piece, the axial dimensions of the contact fingers of both contact pieces and of the end portion of the first contact piece being so chosen, as to ensure that during the opening process first the cooperating contact fingers of both contact pieces and there after the contact fingers of the second contact piece and the end portion of the first contact piece are separated from one another. In that case the main current finds in the closed condition of the circuit-breaker a path through the contact fingers of both contact pieces and said path is interrupted almost under no-tension conditions during the opening process, so that the cooperating contact surfaces of said contact fingers remain undamaged. As in the known circuit-breaker the interruption of the circuit takes place between the slotted end portion of the first contact piece and the contact fingers of the second contact piece. Since the cooperating contact surfaces of said end portion and said contact fingers need not conduct the main current, when the circuit-breaker is in its closed condition, they only operate as arcing surfaces. Consequently, the contact surfaces of the end portion of the first contact piece and the contact surfaces of the contact fingers of the second contact piece cooperating therewith can be provided without any difficulty in regard to the normal conduction of current with material which is resistant to the switching arc.

The invention will be further elucidated with the aid of the drawing, which gives an axial sectional view of two cooperating contact pieces of a gas blast circuit-breaker according to the invention, when said circuit-breaker is in its closed condition.

Spaced apart contact holders are designated by 1 and 2 and they are each connected to an end of the circuit (not shown) which has to be closed and opened by the circuit-breaker. The contact holder 1 supports a fixed contact 3 which is provided with a rigid end portion 4 pointing towards the contact holder 2 and having axial slots 5 for dividing said end portion into parallel axial

current paths. The external cylindrical surface of said end portion 4 forms separated contact surfaces 6. In said contact surfaces the end portion 4 is provided with a layer 7 of material which is resistant to the switching arc.

The split end portion 4 is formed on a disc-shaped portion 8 one another and thereafter the fingers 13 are slid off with their contact surfaces 15 from the contact surfaces 6 of the end portion 4. Thus the interruption of the current path through the contact fingers 21 takes place substantially under no-tension conditions, so that the contact surfaces of the fingers 21 and the contact surfaces 20 of the fingers 13 will not be damaged by a switching arc.

Since each contact finger 13 cooperates with one axial lamination of the end portion 4 only, the current will follow at the moment, at which during the opening process the contact fingers 13 and the fixed end portion 4 are separated from one another, a path which is directed axially in a finger 13, radially inwards in the contact block 14 of said finger, again axially in the respective lamination of the end portion 4, radially outwards in the respective sector of the disc-shaped portion 8 and again axially in the respective lamination of the tubular connecting piece 10. This shape of the current path makes that the switching arc set up between a contact finger 13, 14 and the end portion 4 is forced by the produced magnetic field with great force towards the axis of the circuit-breaker, so that the switching arc comes to extend between the arcing rods 22 and 23 shortly after the the separation of the contacts, where after said arc is quenched by the extinguishing gas flowing from the outside inwards and escaping through the central passages 24 and 25.

Formed on the annular part 12 of the contact piece 3 is a piece of tubing 26 and the contact piece 17 is provided with a piece of tubing 27. In the closed condition of the circuit-breaker the piece of tubing 27 is moved on the piece of tubing 26 and then forms together with a packing ring 28 inserted between said pieces of tubing a closed valve which separates the space 29, in which extinguishing gas under high pressure is present or to which extinguishing gas under high pressure can be supplied, from the switching chamber 26 connecting to the discharge passages 24, 25.

What we claim is:

1. A gas blast circuit-breaker comprising two relatively axially movable, cooperating, coaxial, tubular contact pieces, two contact holders for connection to the ends of the circuit to be closed and opened, said contact holders each supporting a contact piece, an externally cylindrical rigid end portion formed on one (the first) contact piece, said end portion pointing towards the other (the second) contact piece, axial slots provided in said cylindrical end portion for dividing said end portion into parallel axial current paths, contact surfaces lying in the outer surface of said end portion and separated from one another by said slots, a circular series of separated axially extending, resilient contact fingers forming part of said second contact piece and pointing towards said first contact piece, radially inwards facing contact surfaces formed on said contact fingers and adapted to slide on and off the contact surfaces of the end portion of said first contact piece, each contact surface of one contact piece cooperating with one contact surface of the other contact piece only, a disc-shaped portion forming part of said first contact piece and connecting to said cylindrical end portion at the end of the latter remote from said second contact piece, said disc-shaped portion extending radially outwards from said end portion, radial slots provided in said disc-shaped portion and connecting to the axial slots of said end portion, an axially extending tubular connecting piece extending between the outer circumference of said disc-shaped portion and the respective contact holder and electrically conductively connecting said end portion and said disc-shaped portion with said contact holder, axial slots provided in said tubular connecting piece and connecting to the radial slots of said disc-shaped portion and radially inwards extending contact blocks, each block formed on a contact finger of said second contact piece at the end thereof facing said first contact piece and the contact surfaces of said contact fingers formed on the radially inwards facing surfaces of said contact blocks, the arrangement being such, that at the moment, at which, during the switching-off operation of the circuit breaker, the contact pieces thereof are separated from one another and a switching arc is set up between the contact surface of a contact finger of said second contact piece and a contact surface of the end portion of said first contact piece, a current path is produced which consists of at leat three axial portions interconnected by substantially radial portions, the middle one of said axial portions extending nearest the axis of the tubular contact pieces.

2. A gas blast circuit-breaker as claimed in claim 1, comprising in addition radially outwards facing contact surfaces provided on the contact fingers of said second contact piece at the ends of said fingers facing said first contact piece, an additional circular series of axial resilient contact fingers forming part of said first contact piece and pointing towards said second contact piece, and radially inwards facing contact surfaces provided on the contact fingers of said additional circular series and cooperating with said outwards facing contact surfaces of the contact fingers of said second contact piece, the axial dimension of the contact fingers of said second contact piece and the axial dimensions of the contact fingers and the end portion of said first contact piece being such, that during the switching-off operation first the cooperating contact fingers of both contact pieces are separated from one another and thereafter the contact fingers of said second contact piece are separated from the end portion of said first contact piece.

3. A gas blast circuit-breaker according to claim 2, in which the contact surfaces of the end portion of said first contact piece and the contact surfaces cooperating therewith of the contact fingers of said second contact piece are made of material which is resistant to the switching arc.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,761,661 Dated September 25, 1973

Inventor(s) Rintje Boersma & Gijsbert W. Irik

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

---[30] Foreign Application Priority Data

Sept. 7, 1971 Netherlands.....12281/71 --

Signed and sealed this 26th day of February 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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