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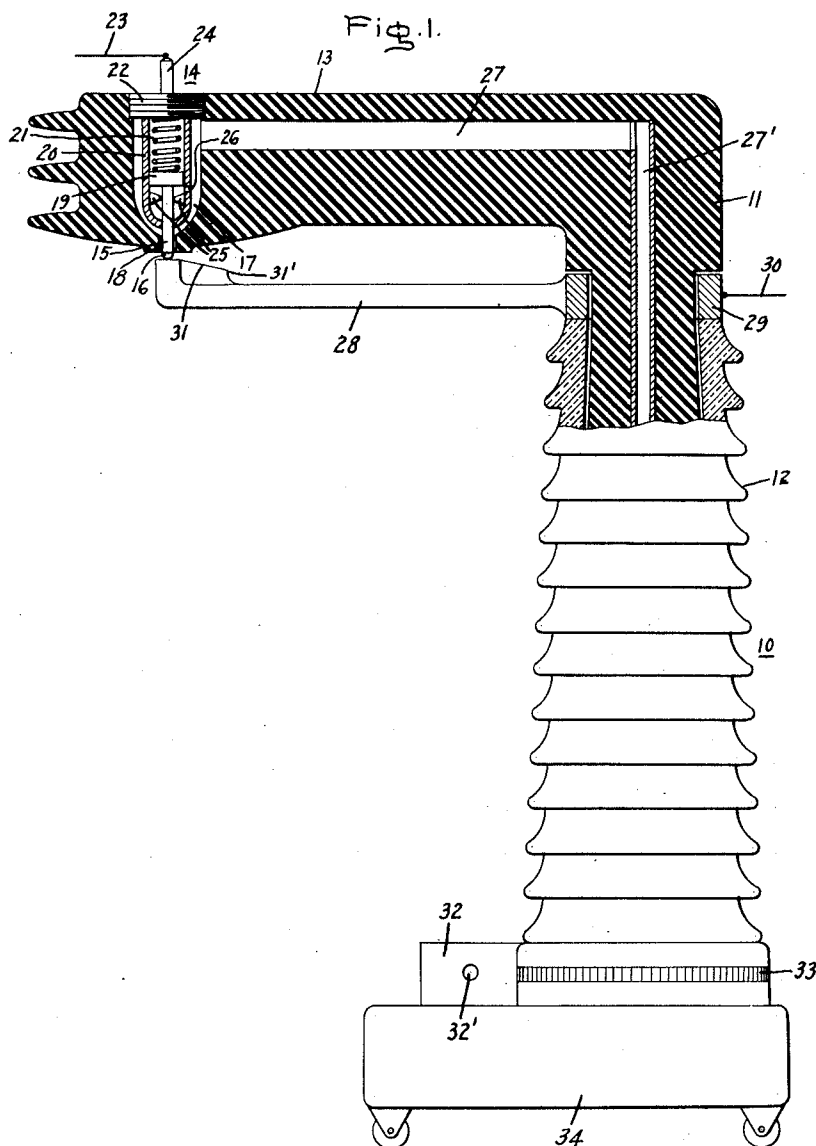
E. SCHULZ

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ELECTRIC CIRCUIT BREAKER

Filed May 29, 1940

2 Sheets-Sheet 1



Inventor:
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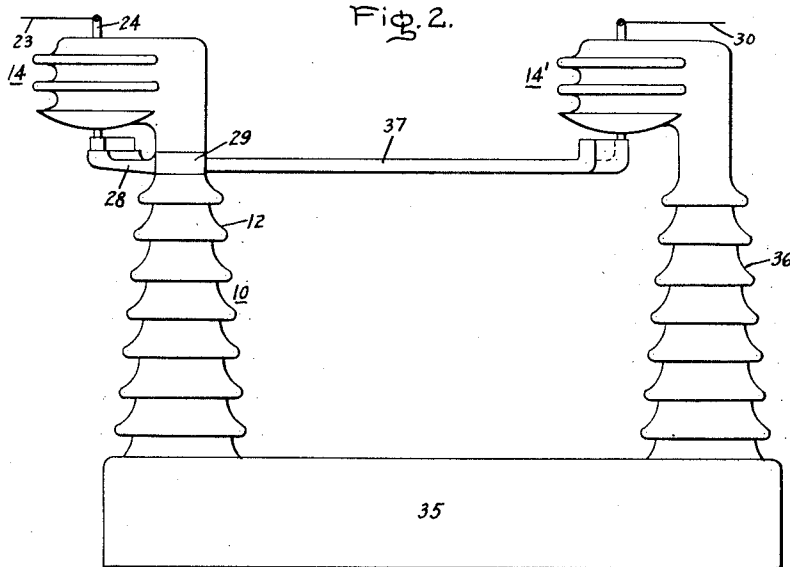
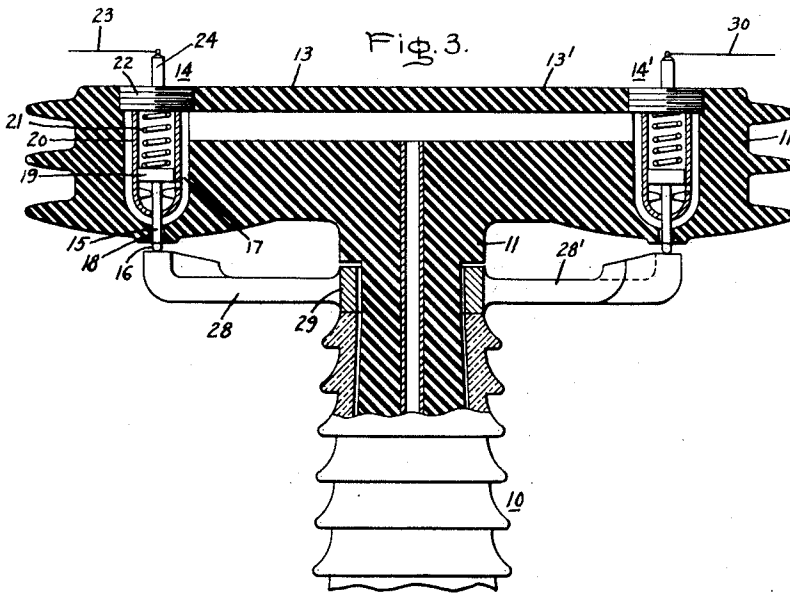
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UNITED STATES PATENT OFFICE

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ELECTRIC CIRCUIT BREAKER

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9 Claims. (Cl. 200—148)

My invention relates to electric circuit breakers and more particularly to those of the air-break type for high voltage circuits employing a pressure jet of suitable arc-extinguishing fluid as the interrupting means.

In electric circuit breakers of the air-break type for outdoor use, it would be very desirable to remove the contacts and interrupting structure to as large an extent as possible from the influence of the weather and, furthermore, it would be desirable to mount the entire circuit-interrupting structure on a single insulator. In the circuit breakers of the prior art, the construction is usually such that one portion of the circuit breaker is mounted on one insulator while another portion thereof is positioned on another insulator separate from the first. Furthermore, prior art devices for outdoor circuit breaker operation were not arranged so that the contacts and operating parts thereof were relatively free from the influence of the weather. According to my invention, therefore, I provide an electric circuit breaker of the fluid-blast type for outdoor use wherein the interrupting head and disconnecting arm thereof are mounted on a common supporting insulator and the entire structure is so arranged that the interrupting head specifically as well as the contacts are reasonably protected from the weather.

It is an object of my invention, therefore, to provide a new and improved high voltage circuit breaker of the air-blast type which overcomes the disadvantages above noted in connection with prior art gas-blast circuit breakers and which is efficient in operation and simple in construction.

Further objects and advantages of my invention will become apparent as the following description proceeds 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.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention, itself, however, will best be understood by reference to the following description taken in connection with the accompanying drawings in which Fig. 1 represents one embodiment of my invention while Figs. 2 and 3 represent certain modifications thereof.

In the arrangement of Fig. 1 of the drawings, I have illustrated my electric circuit breaker as comprising a single vertical supporting column 10 which includes an internal stationary or fixed

supporting insulator 11, which may be constructed of any suitable insulating material, and an external rotatable casing 12 also constructed of insulating material and preferably of porcelain.

On the stationary or fixed supporting insulator 11 of the vertically arranged supporting column 10, there is arranged a horizontal arm 13, also of insulating material, of the same construction as fixed supporting insulator 11. In the end of horizontal arm 13 is mounted interrupting head 14 arranged in a downwardly projecting direction in such a manner as to be to a large extent protected from the influence of the weather. Interrupting head 14 includes a retractable pin 15 having an arcing tip 16 composed of a suitable heat-resisting metal such as tungsten, for example. The retractable pin-type contact 15—16 is movable longitudinally of and within a fluid chamber 17 in the end of horizontal insulating arm 13. One end of this chamber 17 is provided with a restricted throat or nozzle 18 projecting from the under side of horizontal arm 13 into which retractable pin 15 extends in the circuit-closing position. This nozzle or throat 18 is located adjacent the point of separation of the relatively removable contacts making up the circuit breaker and including contact 16, as will be described in greater detail hereinafter.

For the purpose of initially operating retractable pin 15 and contact 16, a piston 19 connected directly to the retractable pin 15 is provided. This piston 19 is operable within a cylinder 20 against the bias of a suitable spring 21. The retractable pin 15, contact 16, piston 19, cylinder 20, and spring 21 are combined into one constructional unit fixedly attached to plug 22 which is provided with screw threads so as to cooperate with corresponding threads in horizontal arm 13. Interrupting head 14 comprises the single constructional unit just described. The power supply line 23 is connected to the plug 22 through suitable conducting means 24. In order to insure good electrical connections between retractable pin 15 and cylinder 20, a plurality of conducting lugs 25 are provided mounted on the interior surface of cylinder 20 so as to slidably engage retractable pin 15. Cylinder 20 is also provided with an opening 26 below piston 19 through which suitable fluid under pressure may be admitted for retracting pin 15 from nozzle 18 against the biasing force of spring 21. This opening 26 communicates with chamber 17 which, in turn, is connected to suitable fluid passage means 27 and 27' located within horizontal in-

insulating arm 13 and fixed supporting insulator 11, respectively.

In order to support another contact cooperating with contact 16 associated with retractable pin 15, I provide disconnecting arm 28 fixedly attached to rotatable casing 12 by means of a sleeve or collar 29 which surrounds stationary insulator 11 and is relatively rotatable with respect thereto. Power line 30 is electrically connected to disconnecting arm 28 through collar 29. Disconnecting arm 28 is arranged to pivot when rotatable insulator 12 rotates so as to move in a horizontal plane parallel with insulating arm 13. Upon the end of disconnecting arm 28 adjacent contact 16 is a contact 31 comprising an oblique surface. This oblique contact surface 31 is arranged so that the lower edge 31' thereof barely touches contact tip 16 of retractable pin 15 when disconnecting arm 28 is swung under retractable pin 15. Thereafter oblique contact 31 tends to push contact 16 and retractable pin 15 against the bias of spring 21, the force of which insures good electrical contact. Oblique contact surface 31, therefore, acts as a guide for the contact tip 16 of interrupting head 14.

The actuating means for rotating casing 12 of supporting column 10 comprises the driving device indicated at 32 in Fig. 1, which is operatively connected to a suitable source of gas pressure through the conduit 32'. The driving device 32, the details of which are immaterial as far as the present invention is concerned, coacts with the ring gear 33 carried by the lower end of rotatable casing 12. Admission of gas under pressure through the conduit 32' causes rotation of the rotatable casing 12 and the disconnecting arm 28 as well as retraction of retractable pin 15 as will be described in greater detail hereinafter. The single supporting column 10 of Fig. 1 is illustrated as being mounted on a transportable base 34 which houses other parts of the switch drive which are immaterial as far as this invention is concerned.

The operation of my invention as applied to Fig. 1 will be well understood by those skilled in the art but will be briefly described hereinafter, first with reference to an opening operation of the circuit breaker. Through suitable means, fluid under pressure is admitted to conduit 32' when it is desired to open the circuit breaker. This initiates a rotation of rotatable casing 12 and disconnecting arm 28 through driving device 32 and ring gear 33. At the same time, this fluid under pressure passes through fluid passage means 27' and 27 to chamber 17. Since retractable pin 15 extends into throat or nozzle 18, the fluid under pressure does not readily escape therethrough but enters cylinder 20 through opening 26 against the under surface of piston 19, thereby forcing retractable pin 15 to be withdrawn from nozzle or throat 18 and causing an arc to be drawn between oblique contact surface 31 on disconnecting arm 28 and contact 16 of interrupting head 14. With the withdrawal of retractable pin 15 from nozzle 18, a fluid blast is released through this nozzle so as to extinguish the arc drawn between contact 16 and oblique contact surface 31 of disconnecting arm 28. By this time also, disconnecting arm 28 has pivoted sufficiently so as to greatly increase the arc discharge path, thereby insuring circuit interruption. The fluid pressure applied to conduit 32' is cut off when the circuit breaker is fully open, whereby retractable pin

15 under the force of spring 21 is again forced into throat or nozzle 18 so as to be ready when the circuit breaker is operated to the closed position. In the closed position of the circuit breaker, current flows from line 23 through the interrupting head 14 and disconnecting arm 28 to line 30.

For the closing operation, disconnecting arm 28 is pivoted by rotating casing 12 so that the oblique contact surface 31 engages contact tip 16 first at the narrowest portion 31' thereof and thereafter the oblique contact surface 31 acts as a guide forcing retractable pin 15 to be withdrawn slightly within interrupting head 14 against the force of spring 21, thereby producing a wiping action for good electrical contact. It will be observed that, with the interrupting head 14 mounted as shown so as to project downwardly, the contact 16 and associated operating parts are relatively free from weather as is also the oblique contact surface 31 of disconnecting arm 28 due to the protection offered by horizontal arm 13.

Occasionally it is desirable to provide series interruption of the circuit and, accordingly, in Fig. 2, I have illustrated my invention as applied to such an arrangement. The corresponding parts of Fig. 2 are characterized by the same reference numerals as in Fig. 1. I have illustrated supporting column 10 as including a rotatable casing 12 mounted on a suitable base 35 which contains the driving apparatus, not shown, for rotating insulator 12. Also mounted on base 35 is a second conventional supporting column 36 of insulating material supporting an interrupting head 14' similar to the interrupting head 14 mounted on supporting column 10, which is identical with the arrangement described in connection with Fig. 1. Disconnecting arm 28 and collar 29 fixedly attached to rotatable insulator 12 are similar to the arrangement disclosed in Fig. 1. Also attached to collar 29, however, is disconnecting arm 37 which cooperates with interrupting head 14'. By this arrangement, a series of interruptions of the circuit are provided while, at the same time, providing a large isolation path between the respective contacts in the open-circuit condition.

In Fig. 3, I have illustrated a modification of the arrangement shown in Fig. 2 in which simultaneous interruption of the circuit at two points is obtained utilizing only a single supporting column 10. The corresponding parts of Fig. 3 are designated by the same reference numerals as in Fig. 1. Fixed supporting insulator 11 is, therefore, provided with two horizontal arms 13 and 13' carrying identical interrupting heads 14 and 14'. Collar 29 supporting disconnecting arm 28 is provided with a second disconnecting arm 28' cooperating with interrupting head 14'. The operation of the apparatus illustrated in Fig. 3 will be understood by those skilled in the art.

Although I have illustrated my invention as applied to a single-phase power line, it will be understood that it is particularly adaptable to three-phase construction, in which case, the horizontal arm 13 of the two outside phases will be mounted in the same plane but the horizontal arm of the middle phase will be supported in a higher or lower horizontal plane so that the disconnecting arms will not interfere with one another.

It will be understood by those skilled in the art that it may be advantageous to provide an

arrangement for the lateral deflection of the gases during circuit interruption in order not to prejudice the effectiveness of the insulation path between the interrupting head and ground.

While I have shown a particular embodiment of my invention in connection with an electric circuit breaker, I do not desire my invention to be limited to the construction shown and described and I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

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

1. An electric circuit breaker of the fluid blast type for high voltage power circuits comprising a main supporting insulating means, an arc interrupting unit including contact structure comprising a movable contact supported by said means, a movable contact structure mounted for rotative movement with respect to said means for engaging said movable contact of said interrupting unit, and means for directing fluid under pressure to said unit for interrupting arcing upon separation of said contact structure.

2. An electric circuit breaker comprising a stationary supporting column of insulating material including a horizontally projecting arm, a pair of relatively movable contacts one of which is a retractable pin-type contact, fluid passage means in said supporting column and projecting arm having a restricted exhaust portion within which said retractable pin contact is operable, fluid pressure actuated means connected to said retractable pin contact for withdrawing the same from said restricted exhaust portion when fluid is admitted to said fluid passage means, means tending to maintain said retractable pin in said restricted exhaust portion, said restricted exhaust portion and said retractable pin-type contact being located at the under side of said projecting arm so as to be protected from the weather, and a rotatable insulating casing surrounding said supporting column and rigidly attached to said other contact, said other contact being so constructed and arranged as to engage said retractable pin-type contact when said circuit breaker is in the closed position.

3. An electric circuit breaker comprising a pair of relatively movable contacts, a stationary supporting insulator having a horizontally projecting arm, fluid passage means in said projecting arm having a restricted exhaust portion at the lower side of said projecting arm so as to be protected from the weather, one of said contacts being operable within said restricted exhaust portion, fluid pressure actuated means connected to said contact for withdrawing the same from said restricted exhaust portion when fluid is admitted to said fluid passage means, a rotatable insulating casing surrounding said first-mentioned insulator supporting said other movable contact which is rotatable therewith, and an oblique contacting surface on said other contact for engaging with said contact operable in said restricted exhaust portion of said fluid passage means.

4. In an electric circuit breaker of the fluid-blast type, an interrupting head including a contact movable in a vertical plane, a disconnecting arm cooperating with said contact in said interrupting head and movable in a horizontal plane, and a supporting means for said interrupting head, said disconnecting arm be-

ing pivotally mounted with respect to said supporting means.

5. In an electric circuit breaker of the fluid-blast type, a stationary supporting column of insulating material including a plurality of horizontally projecting arms, an interrupting head mounted in the end of each of said horizontally projecting arms, a rotatable casing including a plurality of disconnecting arms rigidly attached thereto surrounding said supporting column, each of said disconnecting arms arranged to cooperate with one of said interrupting heads, and means for operating said circuit breaker so as to obtain a plurality of breaks in the electrical circuit associated therewith.

6. In an electric circuit breaker of the fluid-blast type, a stationary supporting column of insulating material including a horizontally projecting arm, an interrupting head mounted in the end of said arm, a rotatable casing including a plurality of disconnecting arms rigidly attached thereto surrounding said supporting column, one of said disconnecting arms arranged to cooperate with said interrupting head, and means for operating said circuit breaker so as to obtain relative movement between said interrupting head and one of said disconnecting arms.

7. An electric circuit breaker of the gas blast type comprising a supporting means, relatively movable contact structure including a fixed arc interrupting unit comprising a movable interrupting contact supported by said means and a coacting movable disconnecting contact member supported for rotative movement with respect to said means for engaging said interrupting contact, said unit having a gas exhaust opening in which the arc is interrupted upon separation of said contact structure, and means for mounting said interrupting unit with respect to said supporting means so that said exhaust opening is substantially beneath said unit whereby said contact structure is shielded with respect to rain and sleet.

8. An electric circuit breaker of the fluid blast type comprising a pair of relatively movable contacts, one of said relatively movable contacts being mounted in an interrupting head, a supporting means for said interrupting head, the other of said contacts being carried by a disconnecting arm pivotally mounted with respect to said means, means for mounting said interrupting head with respect to said supporting means so that said contacts are located as to be relatively free from the weather, and means for obtaining relative motion between said contacts during the circuit-interrupting operation.

9. An electric circuit breaker comprising a pair of relatively movable contacts, one of said relatively movable contacts being mounted in an interrupting head including a retractable pin-type contact, a cylinder, and piston, all mounted as a single constructional unit, the other of said contacts being mounted on a pivoted disconnecting arm, said interrupting head being supported by insulating means and said disconnecting arm being pivotally mounted with respect to said insulating means, and means for obtaining relative motion between said contacts during operation of said electric circuit breaker.

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