

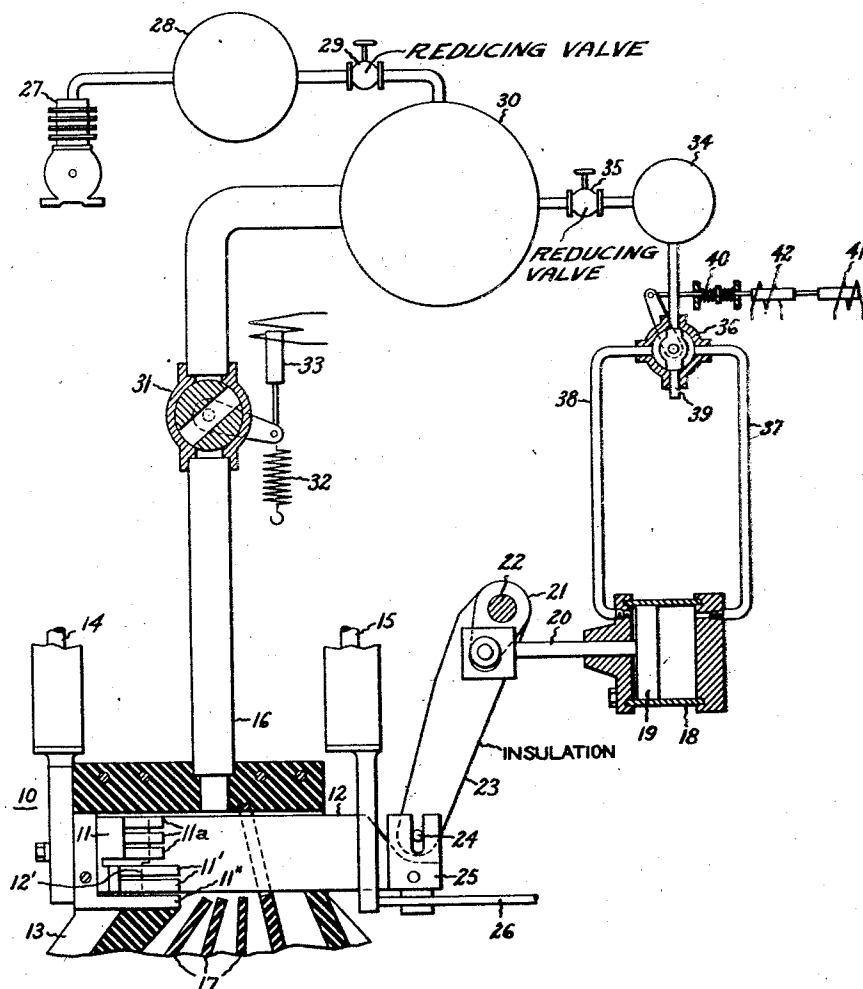
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ELECTRIC CIRCUIT BREAKER

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ELECTRIC CIRCUIT BREAKER

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3 Claims. (Cl. 200—148)

My invention relates to electric circuit breakers and more particularly to circuit breakers of the fluid-operated fluid-blast type.

In many installations, it is desirable to obtain higher speed of opening of circuit breakers than has heretofore been possible. Circuit breakers have been designed which operate by spring pressure but, where high speed tripping is desired, the mass of the springs becomes an important factor both in the amount of energy delivered to the moving parts and the rate of such delivery. In order to deliver sufficient energy, the springs must be heavy and, therefore, the inertia of the actual spring parts prevents any considerable amount of energy from being delivered by the spring in the very short interval of time of the order of which it is desirable to operate high-speed circuit breakers. Furthermore, mechanical complications arise where springs are used since means must be provided to charge the springs, latch them in place and finally release them at the proper instant. For this reason, the use of fluids under pressure, such as air, has been suggested to supply the operating force for causing relative movement between the contacts of circuit breakers since, in this manner, a large amount of energy with negligible inertia may be supplied.

Difficulties have been encountered in circuit breakers employing a blast of fluid for arc-extinguishing purposes when it is desirable to use this source of fluid pressure for producing relative movement between the contacts, particularly with respect to obtaining consistently similar performance therefrom. In the first place, a relatively high pressure is desirable to produce the desired fluid blast for arc-extinguishing purposes and fluid under the same pressure is normally used to produce relative movement between the contacts. In the second place, there is an optimum and comparatively narrow range of velocity and separation of contacts for interrupting the circuit efficiently. Since a very large amount of fluid must be suddenly released to obtain a satisfactory arc-extinguishing blast, a considerable and variable pressure reduction in the source necessarily occurs, which adversely affects particularly the opening operation of the circuit breaker by causing wide variations in the opening speed thereof in response to pressure changes so that, in most cases where it was essential to obtain uniform opening speeds of the circuit breaker under all conditions, it became necessary to sacrifice the high-speed operation obtainable when a source of fluid pressure supplied the

operating force by resorting to springs for providing the relatively invariable operating conditions. This, as has been mentioned above, however, due to increased inertia adversely affected the operating speed and in addition introduced mechanical complications. It would be desirable, therefore, to provide a fluid-operated circuit breaker of the fluid-blast type in which relatively invariable circuit-breaker opening operation is obtained.

Accordingly, it is an object of my invention to provide a fluid-operated circuit breaker of the fluid-blast type overcoming the difficulties set forth above.

It is another object of my invention to provide a fluid-operated circuit breaker of the fluid-blast type in which uniform opening operation of the circuit breaker is obtainable under all conditions.

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.

My invention will be better understood from the following description taken in connection with the accompanying drawing in which the single figure thereof is a schematic diagram partly in section of a fluid-operated circuit breaker of the fluid-blast type embodying my invention.

For explanatory purposes, I have illustrated my invention as applied to a circuit breaker of the cross fluid-blast type, such as is disclosed and claimed in the joint application of David C. Prince, William K. Rankin, and Wilfred F. Skeats, Serial No. 303,126, filed November 6, 1939, and assigned to the same assignee as the present application. It will, of course, be understood by those skilled in the art that my invention is equally applicable to other types of circuit breakers which employ a fluid blast for arc-extinguishing purposes.

Referring now to the drawing, I have illustrated my invention as applied to a fluid-blast circuit breaker 10 of the cross-blast type comprising a stationary contact 11 and a movable contact 12 arranged to be operated so as to draw an arc in an arc chute 13. The fixed contact 11 is connected to the line terminal 14 while the movable contact 12 is connected to the line terminal 15. Fixed contact 11 is provided with spring-pressed contact fingers 11a and longer arcing contact fingers 11' while movable contact 12 is provided with an arcing tip 12' so that,

when the contacts separate, an arc occurs between arcing tips 11' and 12'. Immediately after separation of the contacts, one terminal of the arc is transferred by a blast of fluid, preferably air, issuing out of conduit 16 from contact fingers 11' to the contact 11'' which is provided with a tip of arc-resistant metal. The fluid or gas blast from conduit 16 upon opening of the breaker drives the arc into the arc chute 13 against the edges of a plurality of partitions 17 in the arc chute, which partitions are transverse to the arc gap and the ends of which extend close to the path of movement of the arcing tip 12' of the movable contact 12. The circuit breaker 10, illustrated by way of example in order to describe my fluid-blast control means, is not my invention but is described and claimed in copending application, Serial No. 303,126, referred to above.

Any suitable means for producing relative movement between the contacts 11 and 12 of the circuit breaker 10 may be provided. In the single figure, I have disclosed an arrangement in which circuit breaker 10 is automatically operated by fluid pressure. Accordingly, I have shown a fluid motor comprising a cylinder 18 with a piston 19 connected through a rod 20 to operate a lever 21 secured to the shaft 22. The shaft 22 has attached thereto an arm of insulating material 23 for operating the movable contact 12 of the circuit breaker. Although circuit breaker 10 is described with respect to a single phase, it will, of course, be understood by those skilled in the art that it may just as well comprise a plurality of phases in which case a plurality of arms 23 would be provided for operating the movable contacts 12 of the various phases. The arm 23 is shown provided with a pin 24 operating the member 25 secured to the outer end of movable contact 12. Member 25 is arranged to slide on a pair of rods 26, only one of which is shown in the drawing since the other is obscured from view thereby. It will be apparent that, when the shaft 22 is rotated in a counterclockwise direction, the arm 23 will move the contact 12 to the open position of the circuit breaker 10 and that, when the shaft 22 is rotated in a clockwise direction, the arm 23 will move the contact 12 to the closed position. The member 25 and the rods 26 constitute a kind of cross-head arrangement by which the movable contact 12 is reciprocated. This type of operating mechanism is described in detail in United States Letters Patent 2,218,797, granted October 22, 1940, upon the joint application of Leonard J. Linde and Torild Andersen, and assigned to the same assignee as the present application.

Any suitable means for producing fluid under pressure for supplying the fluid blast for arc-extinguishing purposes as well as for operating the circuit-breaker mechanism may be provided. In the drawing, I have illustrated schematically a suitable compressor 27 for compressing the fluid which may be stored at a suitably high pressure in storage vessel 28. Storage vessel 28 is connected through a suitable reducing valve 29 to fluid-blast pressure reservoir 30 which is maintained at a relatively high pressure of the order of 150 pounds per square inch so as to supply the required fluid blast for arc-extinguishing purposes. Fluid-blast reservoir 30 is preferably connected through a suitable blast valve 31 to conduit 16 so as to supply a blast of fluid, preferably air, adjacent contacts 11 and 12 of circuit breaker 10 for arc-extinguishing purposes. Blast valve

31 is normally biased to the closed position by means of spring 32 and is operated by means of solenoid 33 which may be energized at the desired time by any suitable control circuit.

In order to provide a fluid at a relatively low pressure which is maintained substantially constant at all times so that consistent circuit-breaker opening speeds may be obtained, I provide a fluid reservoir 34 connected to fluid-blast reservoir 30 through reducing valve 35. Valve 35 is arranged to maintain the pressure in fluid reservoir 34 far below that in reservoir 30 so that, when blast valve 31 is opened and a considerable pressure reduction occurs in reservoir 30, the pressure in reservoir 34 will be unaffected. By this arrangement consistent operation of the relatively movable contacts is obtained while using a single pressure producing means.

Fluid reservoir 34 is connected with the respective ends of cylinder 18 for operating circuit breaker 10 through a four-way control valve 36. This valve is arranged to control the closing of circuit breaker 10 by connecting reservoir 34 with the right-hand end of cylinder 18 through conduit 37. For opening the circuit breaker on the other hand, valve 36 is adapted to interconnect reservoir 34 with the left-hand end of cylinder 18 through conduit 38. Valve 36 is also constructed so as to vent one end of cylinder 18 to atmosphere through conduit 39 whenever the other end of cylinder 18 is subjected to pressure from low pressure reservoir 34. A suitable spring means 40 is provided to bias valve 36 to the closed position shown in the drawing. Valve 36 is arranged to be operated for opening circuit breaker 10 by means of an opening solenoid 41 which may be energized from any suitable control circuit. Similarly, valve 36 is arranged to be operated to control the closing of circuit breaker 10 by means of a closing solenoid 42 which may also be energized from any suitable control circuit. Blast valve solenoid 33, opening solenoid 41, and closing solenoid 42 are preferably controlled in the manner disclosed and claimed in copending application Serial No. 310,599 of Bryce W. Wyman, filed December 22, 1939, and assigned to the same assignee as the present application.

In view of the detailed description set forth above, the operation of my new and improved fluid-operated fluid-blast circuit breaker will be obvious to those skilled in the art. A single compressor 27 produces the necessary fluid pressure and, by virtue of the separate low pressure reservoir 34, the reduction of pressure in blast reservoir 30 upon opening of blast valve 31 will cause no effect in reservoir 34 since the pressure therein is considerably lower than the pressure to which reservoir 30 is reduced after blast valve 31 has been opened. By this arrangement, therefore, consistent opening speeds of the circuit breaker are obtained similar to those obtainable when using the spring arrangements mentioned above while, at the same time, dispensing with the high inertia factor tending to cause slower operating speeds.

It will be understood by those skilled in the art that reducing valve 35 could be connected directly to storage vessel 28 since the pressure therein is always at least as high as that in blast reservoir 30.

While I have shown and described a particular embodiment of my invention as applied to an electric circuit breaker, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from

my invention in its broader aspects and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

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

1. In an electric circuit breaker, a pair of relatively movable contacts separable to draw an arc therebetween, a fluid motor for producing relative movement between said contacts, a high pressure source of fluid, means for introducing a blast of said high pressure fluid adjacent said contacts for arc-extinguishing purposes, a low pressure source of fluid supplied from said high pressure source, said low pressure source being maintained at a sufficiently low pressure so as to be unaffected by pressure changes in said high pressure source upon operation of said first-mentioned means, and means for operating said fluid motor from said low pressure source to produce relative movement between said contacts.

2. In an electric circuit breaker, a pair of relatively movable contacts separable to draw an arc therebetween, a source of fluid under pressure, means for introducing a blast of fluid from said source adjacent said contacts for arc-extinguishing purposes, a fluid motor, a second source of

fluid under pressure connected to supply only said fluid motor, means for operating said motor from said second source to produce relative movement between said contacts, and means for maintaining the pressure of said second source independently of pressure changes in said first-mentioned source so that consistent operation of said motor may be obtained at all times.

3. In an electric circuit breaker, a pair of relatively movable contacts separable to draw an arc therebetween, a high pressure source of gas, means including a blast valve for controlling the introduction of a blast of gas from said source adjacent said contacts for arc-extinguishing purposes, a low pressure source of gas, means for maintaining the pressure of said low-pressure source independently of pressure changes in said high pressure source, a fluid motor, means for operating said motor from said low pressure source to produce relative movement between said contacts, said low pressure source being arranged to supply only said fluid motor so that consistent mechanical operation of said circuit breaker may be obtained independently of pressure variations caused by operation of said blast valve.

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