July 28, 1936. W. F. SKEATS 2,049,328

ELECTRIC CIRCUIT INTERRUPTER

Filed June 21, 1934

Fig. 1.

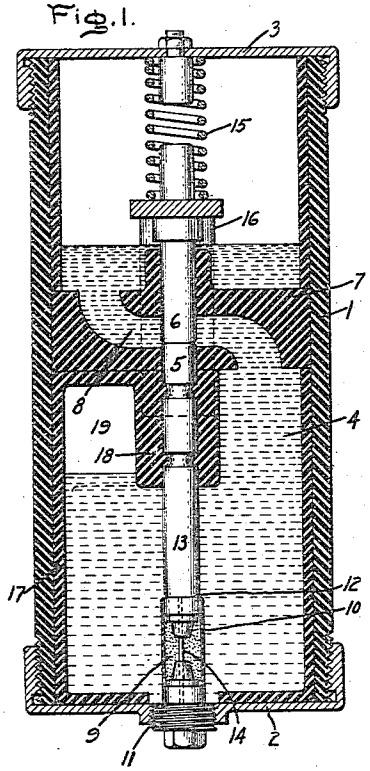


Fig. 3.

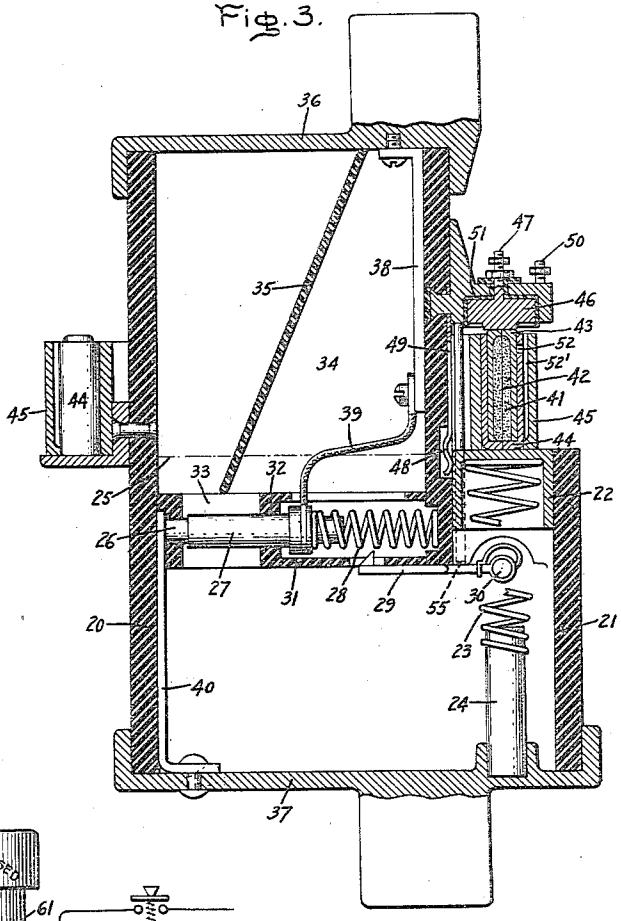


Fig. 4.

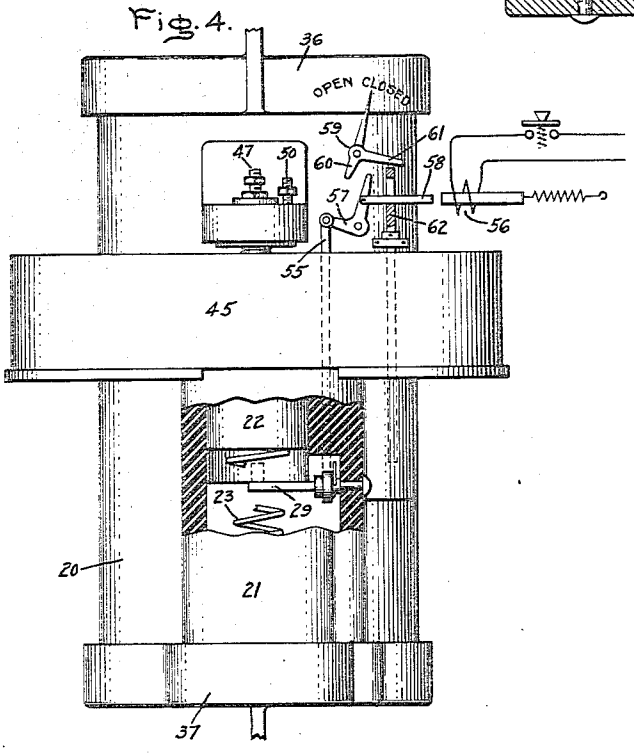
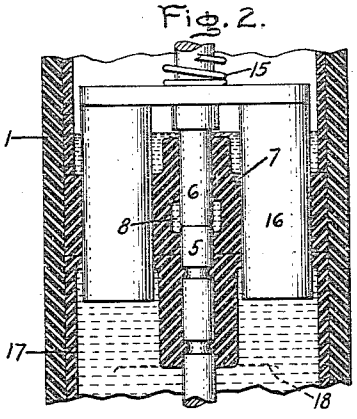


Fig. 2.



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ELECTRIC CIRCUIT INTERRUPTER

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11 Claims. (Cl. 200—150)

My invention relates to electric circuit interrupters, more particularly to those of the fluid-blast type wherein a source of pressure is utilized to effect a blast of arc-extinguishing liquid through a break in the circuit to be interrupted, and has for its principal object the provision of an improved circuit interrupter of the aforesaid type which shall have high interrupting capacity and be efficient and positive in operation, and simple and compact in structure.

In accordance with my invention, an explosive charge arranged to be ignited in response to a predetermined circuit condition comprises a source of pressure for separating the circuit controlling contacts and for driving a jet of insulating or arc-extinguishing liquid through the arc formed at said contacts.

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 circuit interrupter embodying my invention; Fig. 2 is a similar view showing at an angle of 90° a portion of the device shown by Fig. 1; Fig. 3 is an elevational view, partly in section, of another form of fluid-blast circuit interrupter embodying my invention; and Fig. 4 is an elevational and exterior side view, partly in section, of the device shown by Fig. 3.

The circuit interrupter illustrated by Fig. 1 comprises a cylindrical casing 1 of suitable insulating material closed at its opposite ends, as by caps 2 and 3, and containing an arc-extinguishing liquid 4, as insulating oil for example. Immersed in the insulating liquid are circuit controlling means adapted to form a break in the circuit to be controlled, as a stationary contact 5 and a movable contact 6. An insulating baffle 7, likewise immersed in the liquid 4, has formed therein a passage 8 extending transversely of the break at the contacts 5 and 6 and communicating with opposite sides of the baffle. As illustrated, the separation of the contacts 5 and 6 takes place within the passage 8 so that pressure within the liquid 4 beneath the baffle is effective to cause an arc-extinguishing blast of liquid transversely through the arc and into the exhaust region above the baffle.

For the purpose of effecting separation of said contacts coincident with said liquid blast, an explosive charge 9, which may comprise a suitable slow burning powder, is arranged to transmit pressure to the liquid 4 in response to a predetermined circuit condition. To this end a removable cartridge 10 is connected, as at 11, to the end cap 3 so as to be immersed in the insulating liquid and to make butt contact at 12 with the lower end of the conductor stud 13 connected to the contact 5. The opposite ends of the cartridge 10 are electrically interconnected by a fusible element or link 14 which is illustrated as being in series with the contacts 5 and 6 and surrounded by the explosive charge 9.

The movable contact 6 is normally biased as by a spring 15 into engagement with the contact 5 and is operatively connected to a pair of pistons 16 (Fig. 2) extending through the baffle 7 at opposite sides of the contacts into the pressure chamber beneath the baffle. The casing 1 is provided with a protective insulating lining 17 and a depending baffle 18 serving both to mount the conductor stud 13 and to form a gas pocket at 19 beneath the baffle 7.

In the operation of the device melting or heating of the fusible element 14 in response to excess current causes instantaneous ignition of the explosive charge 9 and a consequent rapid rise in fluid pressure beneath the baffle 7. As a result, the pressure acting on the pistons 16 causes immediate separation of contacts 5 and 6 coincident with a blast of the insulating liquid through the passage 8 and across the arc therein. The gas cushion within the pocket 19 serves to prevent excessive bursting pressures within the casing.

It will be apparent that the contact 6 may be held open by a simple manually or electrically controlled latch if desired, although this is not necessary in view of the fact that a break in the circuit is formed by the explosion of cartridge 10. The insulating liquid 4 serves to prevent re-ignition of arcing at this break, thereby maintaining the circuit open.

The explosive charge 9 may obviously be ignited in response to any predetermined circuit condition as, for example, by current in the usual current transformer or by a conventional relay. The pressure generated by the explosive charge is independent of the current to be interrupted and may be so proportioned that the most effective liquid blast is obtained for a given rating of circuit interrupter.

Fig. 3 illustrates a form of circuit interrupter embodying my invention wherein separation of the contacts and the oil blast are effected by an explosive charge arranged so that the products of combustion do not mingle with the oil or insu-

lating liquid. With this arrangement an insulating casing 20 is partly filled with oil, as indicated, and comprises a lateral extension 21 forming a cylinder within which a piston 22 is mounted for reciprocal movement. As illustrated, the piston 22 is resiliently biased as by a spring 23 bearing on a stud 24 upwardly and in opposition to the force for creating pressure in the oil body the level of which is indicated at 25.

The contact structure is immersed in the oil body and comprises a stationary contact 26, a relatively movable contact 27 resiliently biased as by spring 28 towards closed circuit position. The contact 27 is maintained in open circuit position as by a spring biased latch 29 pivoted, as at 30, with respect to the casing 20. The contacts are suitably mounted within insulating baffle structure 31 which provides a guide at 32 for the movable contact and is provided with an aperture at 33 forming an exhaust passage into the upper low pressure space 34 of the casing. An arc-splitting baffle 35 of suitable insulating material is mounted within the casing so that exhaust of oil from the lower part of the casing blows the arc between the contacts 26 and 27 transversely thereof.

The contacts 26 and 27 are arranged so that when in the closed circuit position they substantially close the exhaust passage 33. Since the baffle structure 31 otherwise substantially closes off the lower part of the casing, it will be apparent that the sudden pressure created within the oil body 25 beneath the baffle is effective to move the piston-like contact 27 quickly to the latched open circuit position illustrated and to force a free blast of oil upwardly through the passage 33 and transversely of the arc formed between the separating contacts. As used herein the term "free blast" means an unobstructed arc-extinguishing liquid blast subject to inappreciable back pressure in the pressure relief or low pressure chamber.

The circuit controlled by the contacts 26 and 27 includes the conducting end caps 36 and 37 forming the circuit interrupter terminals, the terminal 36 being connected to the movable contact as by rigid and flexible conductors 38 and 39, respectively, and the terminal 37 to the stationary contact 26 as by the rigid conductor 40.

For the purpose of driving the piston 22 into the oil body for creating the aforesaid pressure in response to a predetermined circuit condition there is provided an explosive charge 41 which surrounds a fusible element or the like 42. The element 42 need not necessarily be fusible. A light wire of high melting point metal might be in some cases preferable. It shall therefore be understood that the term "fusible" as hereinafter used is intended to comprehend means as above described. The explosive charge is in the present instance disposed within expansible enclosing means as telescopic structure including relatively movable telescopic members 43 and 44, each closing one end of the other as illustrated. The aforesaid telescopic structure is mounted within a suitable revolver 45 adapted to surround the casing 20, as illustrated, for supplying a plurality of charges to the piston 22.

The revolver per se forms no part of the present invention and any suitable arrangement, such as that shown for example by Read U. S. Patent 723,183 of March 17, 1903, may be provided for bringing into position above the piston 22 a new charge in response to a circuit opening operation.

Mounted directly above the explosive charge is a stationary breach block 46 adapted to engage and electrically contact with the closed end of the telescopic member 43.

The electric circuit including the fusible or heating element 42 for firing the explosive charge 41 includes a terminal member 47, breech block 46, telescopic members 43 and 44, piston 22, wiping contact 48, conductor 49 and terminal structure 50. The terminal structure 50 is suitably insulated as at 51 with respect to the breech block 46 so that in the position illustrated a complete circuit, including the fusible element 42, exists between the terminals 47 and 50.

The element 42 may be blown or heated in response to a predetermined circuit condition as, for example, by connecting terminals 47 and 50 to a current transformer or to a relay circuit which is in turn responsive to a predetermined circuit condition.

With the contacts 26 and 27 in the closed circuit position blowing of the fusible element 42 and ignition of the explosive charge 41, which preferably comprises a slow burning powder, results in downward movement of the telescopic member 44 since the member 43 is maintained stationary by the breech block 46. The piston 22 is accordingly driven into the oil body effecting the above-described contact separation and oil blast until the telescopic member 43 clears the exhaust port 52 of the member 44 permitting the products of combustion to exhaust through passage 52' into atmosphere. There is, therefore, no opportunity for the explosive charge to mingle with the oil or insulating liquid and affect the insulating characteristics of the same.

After the circuit opening operation, the spring 23 returns the piston 22 to the initial position illustrated and another explosive charge is rotated by the revolver 45 into position. The latch 29 which holds the contact 27 in open circuit position may be suitably released as by a plunger 55 extending within the casing, as illustrated in Figs. 3 and 4.

The latch releasing mechanism for closing the circuit interrupter may be controlled in any suitable manner as by a remotely controlled solenoid 56 coacting with a bellcrank 57 through attached link 58. Upon energization of the solenoid 56 the plunger thereof engages the link 58 causing counter-clockwise rotation of the bellcrank 57 and depression of the plunger 55 to release the latch 29.

Additional controlling and indicating means may comprise a pivoted member 59 having one arm 60 in the path of the bellcrank 57 and another arm 61 in the path of a plunger 62 extending through the casing 1 into the oil body 25. The plunger 62 is provided with a slot 62' through which the link 58 is loosely guided for a purpose hereinafter described.

During the circuit closing operation initiated by energization of solenoid 56, the bellcrank 57 engages the arm 60 to cause clockwise rotation thereof to the position illustrated so that the arm 61 is practically in engagement with the plunger 62. Return of the bellcrank 57, as under the influence of the latch spring, to its initial position therefore need not affect the position of the member 59. When, however, the circuit is opened the fluid pressure created within the casing projects the plunger 62 upwardly to engage the arm 61 and cause counter-clockwise rotation to the opposite position. The link 58 is likewise lifted by the plunger 62 so as to be out of the path of the closing solenoid plunger, thereby permitting

latching of the movable contact in closed circuit position. In order to effect another reclosing operation, deenergization and subsequent energization of the solenoid 56 are necessary. This will be apparent since the plunger 62 drops back to its initial position after decrease of pressure within the casing, thereby permitting the link 58 to drop into position in alinement with the solenoid plunger.

It will be apparent that the member 59 may actuate suitable indicators as illustrated or signal controlling contacts in a well known manner, the latter apparatus being omitted from the drawing in the interest of simplicity and clearness.

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 circuit interrupter of the fluid-blast type comprising a casing containing an arc-extinguishing liquid, an explosive charge for transmitting pressure to said liquid, circuit controlling means immersed in said liquid adapted to form a break in the circuit to be interrupted, and means for igniting said charge and for forming said break in response to a predetermined circuit condition, the pressure generated by said explosive charge directing a free blast of said liquid through said break and beyond the same.

2. A circuit interrupter of the fluid-blast type comprising a casing containing an arc-extinguishing liquid, an explosive charge for transmitting pressure to said liquid, circuit controlling contacts immersed in said liquid, and means for igniting said charge and for separating said contacts in response to a predetermined circuit condition, the pressure generated by said charge likewise directing a free blast of said liquid between and beyond said contacts.

3. A circuit interrupter of the fluid-blast type comprising a casing containing an arc-extinguishing liquid, an explosive charge and circuit controlling contacts immersed in said liquid, a fusible element for igniting said charge in response to a predetermined circuit condition, and pressure-actuated means operatively connected to said contacts, igniting of said explosive charge causing separation of said contacts and a free blast of said liquid between and beyond the same.

4. A circuit interrupted of the fluid-blast type comprising a casing containing an insulating liquid, a fusible element surrounded by an explosive charge immersed in said liquid, circuit controlling means adapted to form a break in the circuit to be interrupted in series with said fusible element, and means for directing pressure generated in said liquid by blowing of said fusible element and igniting of said explosive charge for creating the aforesaid break and for directing a free blast of said liquid through the same.

5. A circuit interrupted of the fluid-blast type comprising a casing containing an insulating liquid, an explosive charge for transmitting pressure to said liquid, circuit controlling contacts immersed in said liquid insulating baffle structure forming a passage disposed transversely of said contacts and piston structure associated with said contacts, pressure generated by said explosive charge actuating said piston structure to separate said contacts and effect a free blast of insulating liquid through said passage transversely of the arc between said contacts..

6. A circuit interrupter of the fluid-blast type comprising a casing containing an arc-extinguishing liquid, and means for transmitting pressure to said liquid for effecting a circuit interrupting operation including expansible enclosing means containing an explosive charge, means for igniting said charge in response to a predetermined circuit condition, ignition of said charge effecting expansion of said enclosing means for transmitting pressure to said liquid while maintaining the products of combustion out of contact with said liquid.

7. A circuit interrupter of the fluid-blast type comprising a casing containing an insulating liquid, circuit controlling contacts immersed in said liquid, pressure generating means for transmitting pressure to said liquid for separating said contacts and effecting a blast of said liquid between the same for extinguishing arcing including a pair of relatively movable enclosing members and an explosive charge within one of them.

8. A circuit interrupter of the fluid-blast type comprising a casing containing an arc-extinguishing liquid, means for transmitting pressure to said liquid for effecting a circuit interrupting operation including a pair of relatively movable telescopic members containing an explosive charge, a piston communicating with said liquid connected to one of said members, and means for igniting said explosive charge in response to a predetermined condition so that relative movement of said telescopic members causes said piston to create a circuit interrupting blast of said liquid.

9. A circuit interrupter of the fluid-blast type comprising a casing containing an arc-extinguishing liquid, circuit controlling contacts immersed in said liquid, insulating baffle structure associated with said contacts arranged so that pressure created within said liquid causes separation of said contacts and a blast of said liquid transversely of the gap between the same, means for creating pressure in said liquid including a pair of relatively movable telescopic members containing an explosive charge, a piston immersed in said liquid connected to one of said members, means for igniting said explosive charge in response to a predetermined circuit condition, whereby relative movement of said telescopic members is effected together with a circuit interrupting stroke of said piston, latching means for maintaining said contacts in open circuit position, means causing closing of said contacts in response to release of said latching means, and means returning said piston to its initial position.

10. In a circuit interrupter of the fluid-blast type comprising a casing containing an arc-extinguishing liquid, circuit controlling contacts separable in response to pressure created in said liquid, means controlling said contacts including resilient means tending to close said contacts, a latch for maintaining said contacts in open circuit position, a remotely controlled member for releasing said latch and a pivoted member including a pair of arms, one of which is adapted to be actuated by said remote controlled member for indicating the closed position of said circuit interrupter, and a member actuated by pressure within said casing adapted to engage the other arm of said member for indicating the open circuit position.

11. A circuit interrupter of the fluid-blast type comprising a casing, circuit controlling contacts in said casing, a latch for maintaining said contacts in open circuit position, means for releasing said latch thereby causing closing of said contacts, means actuated by fluid-blast pressure during a circuit opening operation, and a movable member arranged operatively to connect said latch and said releasing means, said pressure actuated means arranged to move said member into inoperative position with respect to said releasing means.

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