April 17, 1934. W. A. COATES 1,955,532

ELECTRIC CIRCUIT INTERRUPTER

Filed March 17, 1932

Fig. 1.

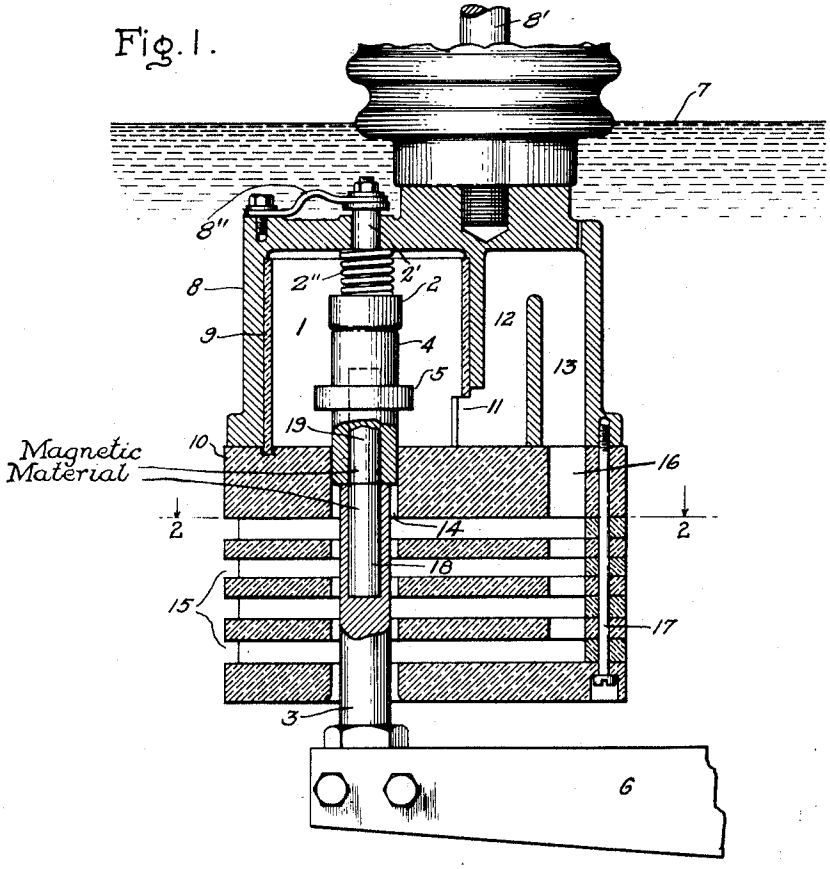
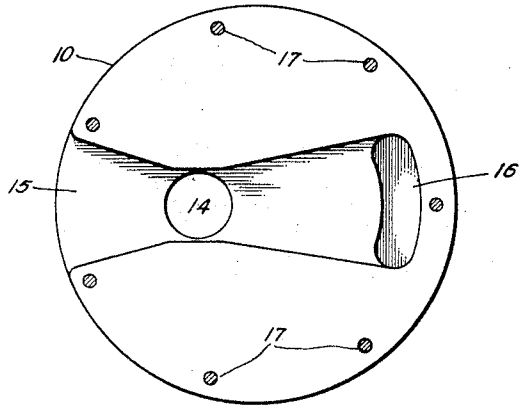


Fig. 2.



Inventor
William A. Coates,
by Charles S. Tulla
His Attorney.

Patented Apr. 17, 1934 1,955,532

UNITED STATES PATENT OFFICE

1,955,532

ELECTRIC CIRCUIT INTERRUPTER

William Anselm Coates, Hale, England, assignor to General Electric Company, a corporation of New York

Application March 17, 1932, Serial No. 599,579
In Great Britain March 30, 1931

3 Claims. (Cl. 200—150)

My invention relates to electric circuit interrupters, more particularly to the type in which the contact members are immersed in oil or other insulating fluid and in which the moving contact member is constructed in two or more portions, namely an actuable portion and one or more loose, or floating, portions detachably associated with the said actuable portion. The arrangement is such that when the interrupter is opened two or more arcs are formed in series, the first arc being arranged to take place during the initial stage of the opening of the circuit interrupter within a body of insulating fluid segregated from the remaining fluid in an inner chamber herein referred to as an explosion chamber.

Circuit interrupters of this kind have been proposed in which the bottom of the explosion chamber is formed of insulating material, through a passage in which the movable member of the circuit interrupter is operable, said passage being intersected by one or more channels perpendicular thereto communicating with the interior of the explosion chamber. The movable member is formed in two portions, namely an actuable portion and a loose or floating portion. One end of the floating portion makes connection with a fixed contact of the circuit interrupter within the explosion chamber at which the first arc is formed when the interrupter is opened and the other end makes connection with the remaining or actuable portion of the movable member during the initial stage of the opening movement of the circuit interrupter. When the movable member has moved through a certain distance the floating part is prevented from following and breaks the connection with said remaining portion so that a second arc is formed in series with the first. The arrangement is such that the second arc is formed substantially opposite the first of the transverse channels in the bottom of the explosion chamber so that a body of insulating liquid from the explosion chamber will be caused to pass through said transverse channel extinguishing the second arc and interrupting the circuit at this point. An example of this type of circuit interrupter is shown in Hilliard Patent 1,548,799, granted August 4, 1925 for Electric switch.

A principal object of my invention is the provision of an improved circuit interrupter of the aforesaid type.

According to one form of my invention the floating portion, or portions, and what has been above referred to as the actuable or remaining portion of the movable contact member, are held in contact during the initial stage of the opening movement of the circuit interrupter by making them wholly or in part of magnetic material, one or more of said portions, or the magnetizable parts thereof being magnetized. By way of example, one or more of said portions may terminate in a permanent magnet and the other portion or portions include a piece of magnetic material so that the portions will be held together by magnetic attraction at the contact surfaces.

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 circuit interrupting apparatus embodying my invention, and Fig. 2 is a sectional view of structure shown along the line 2—2 of Fig. 1.

In practicing the invention the movable contact may be arranged to travel through a passage in an insulating wall of the explosion chamber, which wall has one or more channels intersecting said passage transversely and communicating with the explosion chamber. A loose, or floating, portion of the movable member which makes contact with a fixed contact within the explosion chamber, is provided with a stop, such as a projection or flange, which is adapted to engage with the said wall at the mouth of the channel thereby to limit the movement of the floating part. The arrangement is such that after the contact surfaces between which the first arc occurs, namely, those between the fixed contact and the loose, or floating, portion of the movable member of the interrupter have separated, said floating portion will be prevented from following the actuable portion of the movable contact member in its movement, and a second arc occurs between the floating portion and the actuable portion at the time when the contact surfaces of these portions are opposite the first of the transverse channels in the wall of the explosion chamber. The oil in the explosion chamber is expelled by the gas formed by the arc which occurs at the first break and when the break occurs between the second pair of contact surfaces as above described the oil is forced out of the explosion chamber through the transverse channel in the wall of the explosion chamber towards and over the said contact surfaces and thereby extinguishes the arc.

Referring more particularly to Fig. 1, there is

shown one pole of a circuit interrupter comprising a main arcing or explosion chamber 1 in which is disposed the fixed contact 2 of the circuit interrupter, which contact is shown as being of the butt type, although it may be of other types known to the art. The movable contact of the interrupter comprises a rod portion 3 which is moved towards and away from the fixed contact 2 for closing and opening the interrupter, and a floating portion 4, which is interposed between the actuable portion 3 of the movable contact member and the fixed contact 2. The floating contact portion 4 is shown as making, at one end, butt contact with the fixed contact 2 and at the other end butt contact with the moving contact 3 although the contacts may, as in the case of the fixed contact 2, be of other known forms. The floating contact 4 is formed with a collar 5, as shown, which serves as a stop to limit the movement of the floating portion 4, as will be indicated hereinafter. The contact 3 may be carried in the well known manner upon a bridge 6 at the other end of which may be a similar contact in another explosion chamber (not shown). The main oil tank (not shown) contains an insulating liquid as oil, indicated at 7, in which the contact structure is immersed.

The explosion chamber is preferably divided into two portions having free communication with each other whereby a reserve oil supply will be kept available to quench the arc. This is conveniently done by providing a partition extending within the explosion chamber from one wall nearly to the opposite wall thereof. A second partition may also be provided so as to form a tortuous passage through which the oil is forced from the interior of the explosion chamber to the inlet end of the transverse channel or channels.

As illustrated, the explosion chamber 1 comprises a metal casting having a cylindrical wall 8 preferably lined with a tube 9 of insulating material, said chamber being closed at its lower end by the insulating wall structure 10 hereinafter referred to. The casting 8 is suitably connected to the insulated main conductor stud 8' and is likewise connected to the contact 2 as by the conducting strip 8'' and the contact guide pin 2'. The explosion chamber 1 communicates, as by an opening 11, with an oil reservoir 12, which also communicates with another chamber 13.

The insulating wall 10 closes the lower ends of the chambers 1 and 12 and is provided with a main vertical passage 14 which receives the shank of the floating portion 4 and through which the moving contact member 3 travels for closing and opening the circuit interrupter. Preferably, that part of the floating portion of the movable contact member which is received in the wall of the explosion chamber has a sliding fit in the passage in order that oil will normally be retained in the explosion chamber and substantially the whole of the oil which leaves the explosion chamber after the first break will do so through the aforesaid chamber 13. Accordingly, the passage 14 provides a reasonable clearance for the moving contact member 3, but is made a sliding fit for the shank of the floating contact 4.

For the purpose of directing oil across the arc the insulating wall structure 10 is provided with a plurality of transverse channels indicated at 15. The channels 15, referring now to Fig. 2, extend across the passage 14 and open at their left hand ends into the main oil body 7 and at their right hand ends into the vertical duct 16 which communicates with the oil chamber 13. In construction the insulating wall structure 10 with the passage 14, the channels 15 and duct 16 is conveniently formed from a plurality of stacked insulating plates, each plate having a perforation through which the movable contact member travels and another perforation for forming the ducts 16. The several plates are suitably secured together as by bolts, indicated at 17 in Figs. 1 and 2.

For the purpose of maintaining the portions 3 and 4 in following engagement during the initial circuit opening movement, the actuable portion 3 of the moving contact is provided with an inset 18 of magnetic material and the floating contact portion 4 is provided with an inset 19 also of magnetic material. At least one of these inset parts is magnetized.

In operation, the circuit interrupter is opened by withdrawal of the actuable portion 3 of the moving contact. Due to the magnetic attraction of the inset parts 18 and 19, the floating contact portion 4 will move with the actuable portion 3 of the moving contact during the initial stage of the opening operation of the circuit interrupter, the break taking place at the surfaces of the fixed contact 2 and the floating contact 4. A spring 2'' provides a resilient mounting for the contact 2 permitting a limited amount of over-travel of the movable rod contact 3. Upon engagement of the collar or stop 5 of the floating contact portion 4 with the wall 10, the floating contact portion 4 is prevented from following the actuable portion 3 so that at this stage the second break takes place.

The circuit interrupter is preferably so designed that the contact surfaces between the actuable contact portion 3 and the floating contact portion 4 are opposite the first of the transverse channels 15 when the break at these surfaces occurs. The gas bubble which is formed in the explosion chamber due to the separation of the contacts 2 and 4 forces at considerable pressure oil from the reservoir 12 into the chamber 13 and through the duct 16 and the channels 15 so that, when the contacts 3 and 4 separate, a relatively large body of oil at high velocity is forced across their contact surfaces.

A desirable feature of the invention lies in that the floating contact portion 4 never actually leaves the passage 14, and it is for this reason that the passage 14 can be made a sliding fit for the shank of said contact portion, so that the oil will be normally retained in the explosion chamber 1 and substantially the whole of the oil which leaves the explosion chamber after the first break will do so through the duct 16.

In constructing the circuit interrupter, it is desirable to arrange that the first break, that is to say, the break between the contacts 2 and 4, should take place as high up in the explosion chamber as possible. By this means and also by employing a reserve oil reservoir, as is shown at 12, maximum quantity of oil will be forced towards the contact surfaces which function at the second break.

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. In a circuit interrupter of the oil-blast type, switch contact structure comprising a relatively

fixed contact portion, an actuable contact portion and an intermediate contact portion in floating relation with respect to said other contact portions, magnetic means normally attracting said floating and actuable portions into engagement so as to move as a unit, and means arranged to abut said floating portion during the circuit opening operation causing separation of said floating and actuable portions after separation of said floating and fixed portions.

2. In a circuit interrupter of the oil-blast type, switch contact structure comprising an explosion chamber casing, a relatively fixed contact portion mounted within said casing, an actuable portion, a floating portion disposed between and interconnecting said fixed and actuable portions, said casing having a lower insulating wall structure including a passage through which said actuable portion extends and a passage transverse thereto communicating with the interior of the explosion chamber, magnetic means attracting said actuable and floating portions into following engagement after separation of said floating and fixed portions during the circuit opening operation, and means overcoming the aforesaid magnetic attraction causing separation of the contact surfaces of said floating and actuable portions substantially opposite said transverse passage.

3. A circuit interrupter of the oil-blast type comprising a relatively fixed contact, an actuable movable contact, an intermediate contact interconnecting and in floating relation to said fixed and movable contacts, means including magnetic inserts mounted in the coacting contact faces of said intermediate and movable contacts arranged to attract and hold the aforesaid contacts in following engagement subsequent to separation of said intermediate and fixed contacts during the circuit opening operation, and means arranged to abut said intermediate contact causing separation of said intermediate and movable contacts.

WILLIAM ANSELM COATES.