March 15, 1932. E. G. KEES 1,849,875

OIL CIRCUIT BREAKER

Filed Feb. 2, 1931

Fig. 1.

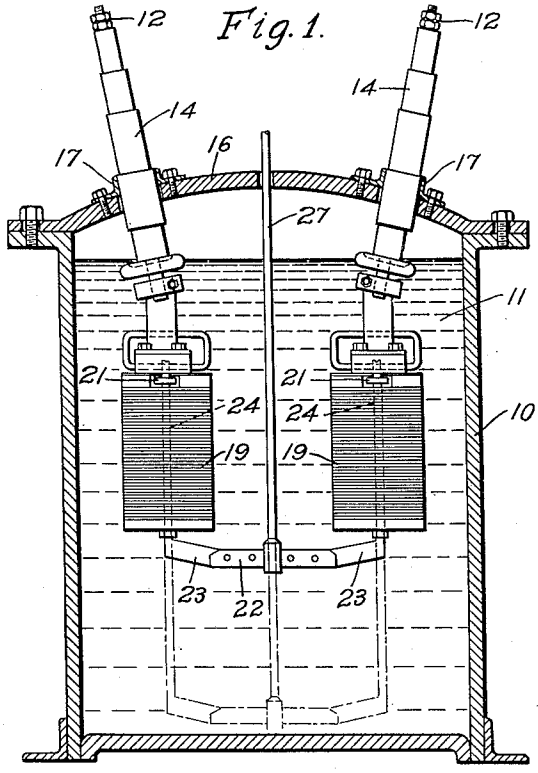


Fig. 2.

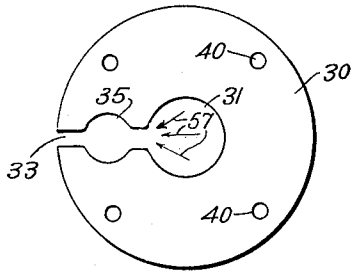


Fig. 3.

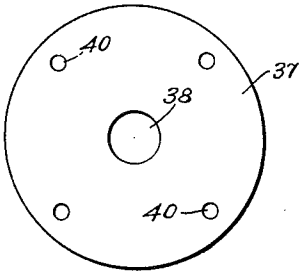


Fig. 4.

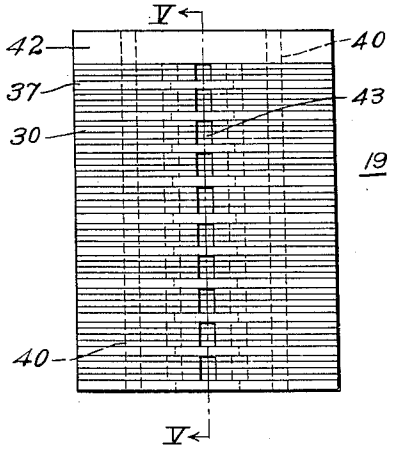
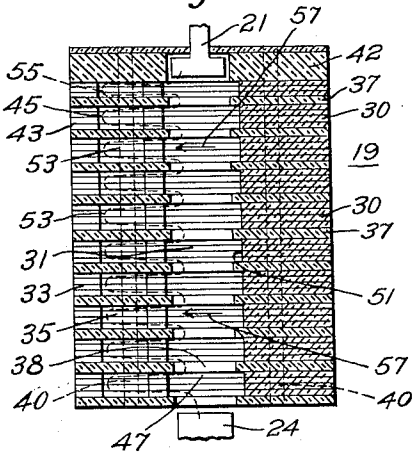


Fig. 5.



WITNESSES:

C. J. Weller,

Ralph N. Scoggle

INVENTOR

Ernest G. Kees.

BY Wesley G. Carr

ATTORNEY

Patented Mar. 15, 1932 1,849,875

UNITED STATES PATENT OFFICE

ERNEST G. KEES, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

OIL CIRCUIT BREAKER

Application filed February 2, 1931. Serial No. 512,936.

My invention relates to a circuit-interrupting device and more particularly to an arc-quenching structure for a circuit breaker of the oil-immersed type.

An object of my invention is to provide means for retaining the arc-quenching fluid in intimate contact with the arc until it is extinguished, so that a large amount of gas will formed for deionizing the arc.

A further object of my invention is to provide a structure having passages therein for directing the flow of the deionizing gas through the whole length of the arc.

A further object of my invention is to provide a closed chamber in which the pressure of the gas, caused by the arc, forces the arc between a series of plates which elongate it by causing it to assume a wavy shape.

A further object of the invention is to provide recesses in the arc-extending structure, forming pockets in which oil is retained in intimate contact with the arc.

Studies made of the extinction of arcs in oil show that the extinction of the arc is due largely to gas formed by decomposition of the oil. This gas forms relatively cool centers upon which the ions recombine, thus so increasing the dielectric strength between the two arcing contacts that the arc is extinguished at the zero point on the alternating-current wave. In circuit breakers of the older types, gas bubbles are frequently formed about the arcing contacts which so hold the oil away from the arc that the generation of gas is not sufficiently rapid to deionize the arc at a rate greater than the increase in voltage between the contacts until an excessive time period after the opening of the contacts. I have, therefore, provided a structure for retaining the oil in intimate contact with the arc, and for causing the gas to most effectively cool and deionize the arc.

This is accomplished by providing a stack of plates, having holes therein forming a passage through which the arc is drawn. Spaced groups of these plates have slots therein, providing vents for the gas. The pressure of the gas, generated in the stack causes the gas to pass through the arc and causes it to be elongated by being looped into these vents. Recesses are provided, both in the arc passage and in the vents, to retain the oil in contact with the arc. This gives a maximum amount of deionizing gas and provides for its effective utilization in extinguishing the arc.

These objects and advantages of the invention will be more fully understood from the following description and the accompanying drawings, in which

Figure 1 is a sectional view, through a circuit breaker embodying my invention, showing the interior parts in elevation.

Figs. 2 and 3 are detail views of the plates, of which the arc-quenching structure is formed.

Fig. 4 is a view, in elevation, of the assembled stack forming the arc chamber.

Fig. 5 is a sectional view, on the line V—V of Fig. 4, showing the interior passages in the arc-extinguishing structure.

In Fig. 1, the circuit breaker is shown as having a tank 10, which is filled with an arc-extinguishing fluid 11. This fluid may be oil, carbon tetrachloride, or other fluid which it may be found desirable to use. Current conductors 12, protected by insulating bushings 14, extend through openings in the top 16 of the circuit-breaker tank. The bushings 14 are secured to the top of the tank, in the usual manner by bolted glands 17. The arc extinguishing structure 19 is supported from the ends of the conductors 12, which are provided with fixed contacts 21. Connection is made between the fixed contacts 21 by means of a conducting bar 22 which has removable contact members 23, having upwardly extending portions 24 to extend through the arc chamber to make contact with the fixed contacts 21. The conducting bar 22 is actuated through a rod 27, which is operated by a suitable mechanism (not shown). The conducting bar is shown in closed position in full lines and in the open position in broken and dotted lines.

The arc-extinguishing structure 19 is built up of a series of plates of insulating material. These plates are of the two types shown in Figs. 2 and 3. Plates 30, shown in Fig. 2, have holes 31 in the centers thereof, and have

slots 33 extending from the holes 31 to their outer edges. A recessed or enlarged portion 35 is provided in the slot, intermediate its ends. Plates 37, shown in Fig. 3, have single circular openings 38 in their centers which are of smaller diameters than those of the holes 31 in the plates 30. Both of the plates have holes 40 through which studs are inserted for securing the plurality of plates together to form a stack.

The structure 19 is formed by assembling a number of the plates 30, having inserted therebetween one or more plates 37, at spaced intervals. This forms a stack in which holes 31 in plates 30, and holes 38 in plates 37 are aligned to form a passage 47 through which the moving contacts 24 are operated to make contact with the fixed contacts 21 which are imbedded in a plate 42 at the top of the stack. The plates 30 are preferably made of insulating material of a porous character, such as Fullerboard, so that they readily retain the oil 11, which the plates 37 are made of fibre. The plates 30 and 37 may all be made from either fiber or Fuller board if desired.

As shown in Fig. 5, the stack of plates constitutes a closed structure, except for the vents 43, which are connected by passages 45 to the central arc passage 47 through which the arc is drawn. Insertion of the unslotted plates 37 between the groups of slotted plates 30, provides baffle means for dividing the groove formed by the aligned slots 33 into a plurality of sections. By making the holes 38 in the plates 37 of a smaller diameter than the holes 31 in plates 30, recesses 51 are formed along the sides of the arc passage 47. The recesses 51 retain oil in the passage in intimate contact with the arc when it is drawn. The recesses 35 in the slots 33 form pockets 53 in the passages 45 for retaining oil.

After the movable contacts 24 are separated from the fixed contacts 21, an arc is drawn therebetween. The heat of the arc decomposes the oil in the arc passage 47 which retains oil, due to the provision of the recesses 51, and the gases generated by this decomposition of oil creates a pressure in the closed chamber which forces the arc into the passages 45 leading to the vents 43. The arc, therefore, is elongated by taking a sinuous path, as indicated by the dotted line 55, in Fig. 5. The gas generated in the passage 47 can escape only through the passages 45 to the vents 43, and, therefore, it is necessary that it pass through the arc in the direction indicated by the arrows 57. Oil is retained in intimate contact with the portion of the arc, which is looped into the passages 45, due to the provision of the pockets 53 in the passages 45 so that there is a continuous supply of fresh and relatively cool and unionized gas which passes through the arc and most effectively deionizes it. This action continues until the zero point on the alternating-current wave is reached, when the arc is being deionized at a rate greater than the increase in voltage between the arcing contacts and the arc extinguished.

It is thus seen that I have provided a structure which is most effective in providing gas for deionizing the arc and for directing its flow in a most desirable manner to accomplish the extinction of the arc.

While the invention has been described as being for an oil-immersed circuit breaker, it should be understood that it is not limited thereto, but may be utilized in a circuit breaker in which only a small amount of oil is held about the contacts, or in which the plates themselves are decomposable to furnish the deionizing gas.

While a particular embodiment of the invention has been shown, the invention is not to be limited, except as defined by the following claims.

I claim as my invention:

1. In a circuit-interrupting device, means for forming an arc, means adjacent to the arc and decomposable thereby to supply a deionizing gas, means for directing said gas to pass transversely through said arc and move it laterally, means in said path of motion of the arc to cause the arc to be elongated by assuming a sinuous shape, and means adjacent to said elongated arc to further cool and deionize the arc.

2. In a circuit-interrupting device, means for forming an arc, means for retaining a fluid decomposable by the arc adjacent thereto to supply a deionizing gas, means for causing said gas to pass transversely through the arc and to move it laterally, means in said path of motion of the arc to elongate the arc by arresting the motion of spaced portions thereof, and means for retaining some of said fluid in intimate contact with said elongated arc.

3. An arc-quenching device comprising a chamber having a passage for an arc therethrough, said chamber being closed except for vents in the side thereof, a groove extending from said passage to said vents, spaced members in said groove serving to divide it into a plurality of parts, means adjacent said arc path which causes a flow of fluid through the arc, and said chamber causing said fluid to move the arc into said spaced members and elongate the arc.

4. An arc-quenching device comprising a chamber having a passage through which an arc is initially drawn, said passage having projections therein forming pockets for retaining an arc-quenching fluid, vents in one side of the chamber, a groove of less width than said passage extending from said passage to said vents, and spaced members in said groove serving to divide it into a plurality of sections.

5. An arc-quenching device comprising a chamber having a passage for an arc therethrough, separable contacts movable through said passage, aligned vents in one side of the chamber, a groove extending from said passage to said vents, pockets in said groove for retaining an arc-quenching fluid, and baffle means in said groove for elongating and deionizing the arc.

6. An arc-quenching device comprising a chamber having a passage through which an arc is initially drawn, said passage having projections therein forming pockets for retaining an arc-quenching fluid, vents in one side of the chamber, a groove of less width than said passage extending from said passage to said vents, pockets in said groove for retaining an arc-quenching fluid, and baffle means in said groove for elongating and deionizing the arc.

7. In a fluid circuit-interrupting device, an arc chamber comprising a stack of plates having holes therein forming a passage, means for drawing the arc in said passage, a number of said plates having slots, and the remainder of said plates being unslotted and interposed between said slotted plates at spaced intervals throughout the stack, said stack of plates causing said fluid to move the arc into the space between said unslotted plates and elongate the arc.

8. In a circuit-interrupting device, an arc chamber comprising a stack of plates having holes therein forming a passage, means for drawing the arc in said passage, a number of said plates having slots of less width than said holes, and a recessed portion in said slot, and the remainder of said plates being unslotted and interposed between said slotted plates at spaced intervals throughout the stack.

9. In a fluid circuit-interrupting device, an arc chamber comprising a stack of plates having holes therein forming a passage, means for drawing the arc in said passage, the holes in some of said plates being of different dimensions than in others of said plates to form pockets in said stack, a number of said plates having slots and the remainder of said plates being unslotted and interposed between said slotted plates at spaced intervals, said stack of plates causing said fluid to move the arc into the spaces between said unslotted plates and elongate the arc.

10. In a circuit-interrupting device, an arc chamber comprising a stack of plates having holes therein forming a passage through which an arc may be drawn, the holes in some of said plates being of different dimensions than in others of said plates to form pockets in said stack, a number of said plates having slots, and recessed portions in said slots, and the remainder of said plates being unslotted and interposed between said slotted plates at spaced intervals.

11. In an oil circuit breaker, an arc-quenching chamber, means for drawing an arc in said chamber, said chamber comprising a stack of plates having holes therein, the edges of which define a passage for the arc and retain oil in close proximity thereto, some of said plates having slots extending from said holes to form a groove, and others of said plates being unslotted and interposed between said slotted plates at spaced intervals throughout said stack and dividing said groove into a plurality of vents into which said arc is looped by the flow of the gas formed by the decomposition of oil by the arc.

12. In an oil circuit breaker, an arc-quenching chamber, means for drawing an arc in said chamber, said chamber comprising a stack of plates having holes therein, the dimensions of said holes in some of said plates being different from those in others of said plates so as to form pockets for the retention of oil in the arc passage formed by said holes, some of said plates having slots extending from said holes to form a groove, and others of said plates being unslotted and interposed between said slotted plates at spaced intervals and dividing said groove into a plurality of vents into which said arc is looped by the flow of the gas formed by the decomposition of oil by the arc.

13. In an oil circuit breaker, an arc-quenching chamber, means for drawing an arc in said chamber, said chamber comprising a stack of plates having holes therein, the edges of which define a passage for the arc and retain oil in close proximity thereto, some of said plates having slots extending from said holes to form a groove, and others of said plates being unslotted and interposed between said slotted plates at spaced intervals and dividing said groove into a plurality of vents into which said arc is looped by the flow of the gas formed by the decomposition of oil by the arc, and some of said slotted plates having recesses in the sides of the slot for retaining oil in proximity to the loops of said arc.

14. In an oil circuit breaker, an arc-quenching chamber, means for drawing an arc in said chamber, said chamber comprising a stack of plates having holes therein, the dimensions of said holes in some of said plates being different from those in others of said plates so as to form pockets for the retention of oil in the arc passage formed by said holes, some of said plates having slots extending from said holes to form a groove, and others of said plates being unslotted and interposed between said slotted plates at spaced intervals and dividing said groove into a plurality of vents into which said arc is looped by the flow of the gas formed by the decomposition of oil by the arc, and some of said slotted places having recesses in the sides of the slot

for retaining oil in proximity to the loops of said arc.

15. In an oil circuit breaker, an arc-quenching chamber, means for drawing an arc in said chamber, said chamber comprising a stack of plates some of which are of porous insulating material and have holes therein, the edges of which define a passage for the arc and retain oil in close proximity thereto, some of said plates having slots extending from said holes to form a groove, and others of said plates being unslotted and interposed between said slotted plates at spaced intervals throughout said stack and dividing said groove into a plurality of vents into which said arc is looped by the flow of the gas formed by the decomposition of oil by the arc.

16. In an oil circuit breaker, an arc-quenching chamber, means for drawing an arc in said chamber, said chamber comprising a stack of plates some of which are of porous insulating material and have holes therein, the dimensions of said holes in some of said plates being different from those in others of said plates so as to form pockets for the retention of oil in the arc passage formed by said holes, some of said plates having slots extending from said holes forming a groove, and others of said plates being unslotted and interposed between said slotted plates at spaced intervals throughout said stack and dividing said groove into a plurality of vents into which said arc is looped by the flow of the gas formed by the decomposition of oil by the arc, and some of said slotted plates having recesses in the sides of the slot for retaining oil in proximity to the loops of said arc.

In testimony whereof, I have hereunto subscribed my name this 26th day of January, 1931.

ERNEST G. KEES.