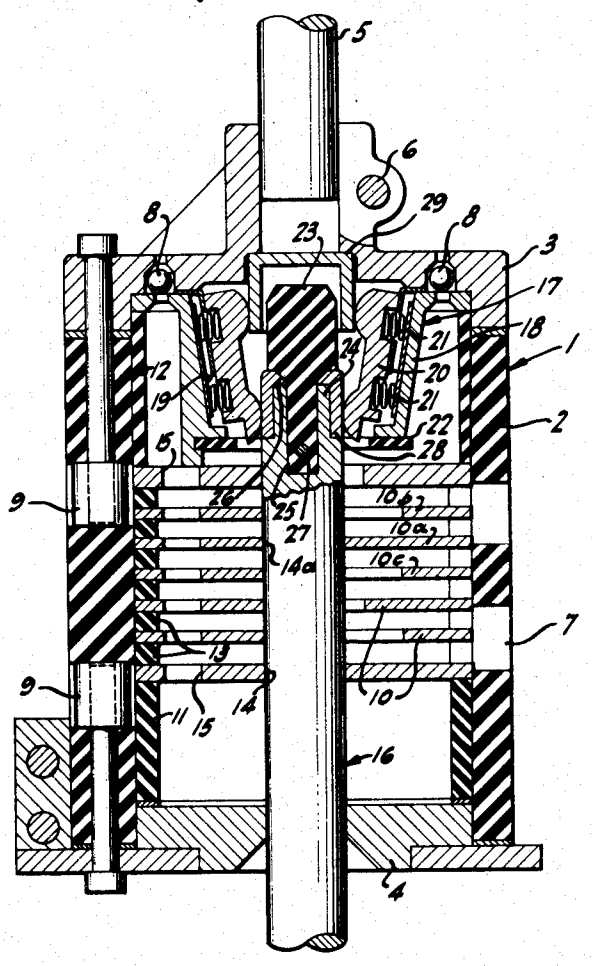
July 7, 1964 F. H. COLE 3,140,374

CIRCUIT BREAKER INTERRUPTER

Filed Sept. 20, 1962 2 Sheets-Sheet 1

FIG-1



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CIRCUIT BREAKER INTERRUPTER

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FIG-2

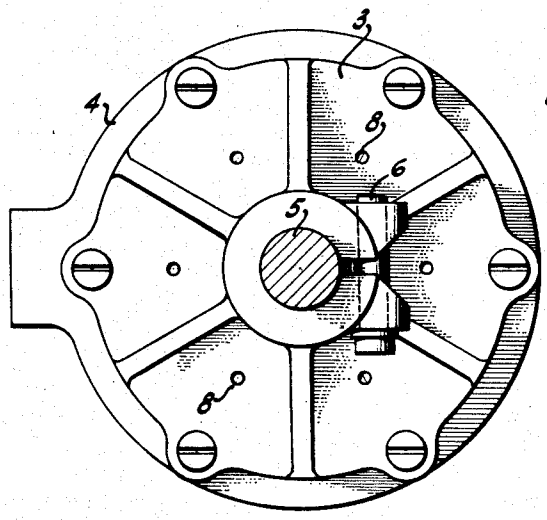
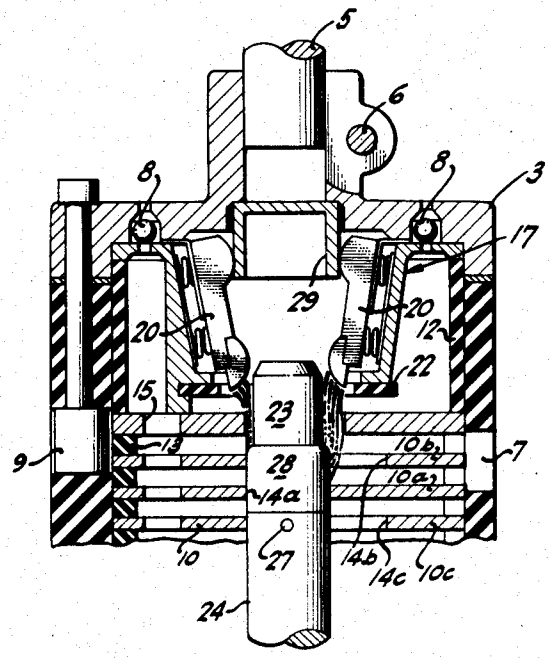


FIG-3



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CIRCUIT BREAKER INTERRUPTER

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3 Claims. (Cl. 200—150)

This invention relates to circuit breakers of the oil immersed type having a movable bayonet contact and a stationary tulip. More specifically, the invention provides a fiber pin mounted on the end of the movable bayonet contact for the purpose of squeezing an arc, which is formed between contact surfaces as they are separated.

This application is a continuation-in-part of application Serial Number 22,726, filed April 18, 1960.

The normal process of interrupting the arc in an oil circuit breaker is as follows: As the contacts are moved apart, the alternating current may be interrupted while passing through one of its zero values. But since the contacts will move only a short distance during the time when the current is near its zero value, the current continues to flow as the contacts move apart, forming an arc that consists of highly ionized gases. The voltage across the contacts reaches a peak shortly after the current passes through its zero value, and this voltage tends to maintain the current across the arc. Heat from the arc decomposes the oil into gases, which for the most part are non-ionized. Such non-ionized gases act to deionize the gases in the arc and thus convert them to a dielectric of sufficient strength to withstand the voltage across the contacts. The current may be reestablished for several cycles before the arc is finally deionized and the current interrupted; however, soon after an arc is formed, non-carbonized oil enters the space between the contacts, thereby establishing a dielectric strength that is ample to extinguish the arc.

It is desirable to destroy the arc as quickly as possible, for the longer the arc persists, the greater the erosion upon the contacting surfaces. Accordingly, circuit breakers have been provided with two sets of contacts per interrupter; one set strikes an arc to generate gas pressure that drives oil across a main arc, which is formed across the second set when the motion of the first set of contacts is arrested. This arrangement accelerates the flow of oil across the main arc, thereby enhancing the destruction of the main arc. However, the additional set of contacts adds materially to the cost of manufacture.

This invention operates in essentially the same manner as other oil breakers described above, but there is also provided a novel device which will hasten the destruction of the arc. Specifically, an insulating pin is mounted on the end of a movable mayonet contact; and as the bayonet contact is separated from its tulip contact, the pin is drawn through openings in a set of interrupter plates, thereby squeezing the arc and restricting the arc flow to the peripheral edge of the bayonet, thus increasing the dielectric strength of the gases which form the arc. One obvious advantage of this construction then, is to reduce erosion of the contact surfaces and increase the normal life of the circuit breaker.

It is realized that the broad principle of using an insulating pin member at the end of a movable bayonet contact for shifting the arc to the side of the contact is not new. While such structures are useful in connection with the invention, they alone do not provide an arc-snuffing action as now contemplated. More particularly, no known prior art teaching contemplates an oil type circuit breaker that provides structure for snuffing an arc at times soon after its formation.

Therefore, it is one object of this invention to provide an oil immersed circuit breaker interrupter comprising a plurality of interrupter plates supported in an axial spaced relation, each of said plates having an opening

aligned with the other openings of other interrupter plates and defining an axial path for receiving a movable electrode assembly therethrough, said interrupter plates also defining vertical ports for transmitting gases and oil therethrough in an upward direction from a lower region; a stationary contact assembly mounted axially of said plates and having one or more contact finger members disposed adjacent said axial path and biased inwardly to partially obstruct said path; a movable electrode assembly supported for axial movement through said openings in said plates, said assembly including an insulating pin member mounted axially at the end of an electrically conductive bayonet stud; one of said interrupter plates having an arc-restrictive opening approximately equal in cross section but slightly greater and complementary to the cross section of said bayonet stud, the one interrupter plate being disposed intermediate interrupter plates having openings substantially greater in cross section than said bayonet stud and capable of passing and extending a gaseous arc therethrough, whereby said insulating pin member is moved into said path upon withdrawal of said bayonet, thereby squeezing said arc between the edges of the one interrupter plate opening.

Other objects of this invention will become apparent in view of the following description and claims.

In the drawings forming a part of this application and in which like parts are designated by like reference numerals throughout the same,

FIG. 1 is an elevation in section of an interrupter having a construction which embodies the instant invention;

FIG. 2 is a top plan view of the interrupter shown in FIG. 1;

FIG. 3 is a fragmentary view of FIG. 1 showing the contacts in a partially open position.

Referring more particularly to FIG. 1, there is shown one embodiment of an interrupter assembly which has incorporated therein the various features of this invention. A stationary interrupter housing, generally indicated by reference numeral **1** and including a cylindrical casing **2** of high-dielectric strength material, a top closure plate **3** and bottom plate **4**, is suspended from a fixed electrode **5** through a conventional clamping means **6**. Being similar to other oil type interrupters, the housing is adapted to be immersed in an oil bath and will readily fill with oil through circumferentially spaced ports **7** and a plurality of check valves **8** which are provided in the top closure plate, as shown. The operation of the check valves is in all respects similar to prior art devices which operate closed upon a sudden increase in the internal fluid pressure which results when the heat of arcing decomposes the oil into gases. Top closure plate **3** and bottom plate **4** are secured to casing **2** by means of through bolts that thread into tapped steel inserts **9**.

A plurality of parallel interrupter plates **10** of insulating material are supported in the housing in an axial spaced relation between a bottom fiber liner **11**, a top fiber liner **12**, and a plurality of fiber spacer discs **13**. Each plate **10** is provided with a ecntrally located opening **14** and a plurality of interrupter ports **15**. Openings **14** are in substantial alignment and define an axial path for receiving a movable electrode assembly **16** therethrough.

It will be noted that the openings **14** of the interrupter plates **10** are of different sizes. Importantly, one interrupter plate **10***a* having an opening **14** approximately equal in cross section but slightly greater and complementary to the cross section of movable electrode **16**, is disposed intermediate interrupter plates **10***b* and **10***c* having openings **14***b* and **14***c*, respectively, substantially greater in cross section than electrode **16**. The size of openings **14**, and especially openings **14***a*, **14***b*, and **14***c*,

it will be seen, controls the action of arc interruption as electrode **16** is being retracted. This cooperative action will be described hereinafter.

Above the interrupter plates and suspended beneath the top closure plate is a stationary contact assembly, generally indicated by reference numeral **17**, and comprising a contact housing **18**, a housing liner **19**, six contact finger members **20**, twelve contact finger springs **21**, and a fiber insulating disc **22**. The contact fingers are circumferentially spaced adjacent the axial path through which the movable electrode assembly passes, and each finger is biased inwardly by two finger springs to partially obstruct the path. Accordingly, as the electrode assembly moves into the interrupter housing along the axial path, it will make contact with each of the contact fingers, urging them against their respective finger springs and out of the axial path as shown in FIG. 1. Fiber disc **22** shields the lower lip of the contact housing, thereby eliminating the chance of arcing between the lip and the movable electrode. (See FIG. 3.)

Movable electrode assembly **16** is supported in a conventional manner, not shown, for moving through the openings **14** of the plates and along the axial path defined thereby. Either manual or electrically operated tripping devices may be utilized for actuating the electrode, and the kind of device employed is not a material part of this invention. However, the electrode itself is comprised of an insulating pin member **23** mounted axially at the end of an electrically conductive bayonet stud **24**, and such an electrode as shown cooperates with other parts of the interrupter to produce an improvement in interrupter assemblies. The insulating pin has a protuberance **25** which projects into a recess **26** formed in the end of said stud and is held therein by a transverse locking pin **27**. As indicated, pin **23** is made of high-dielectric strength material, such as those fiber products conventionally employed for other parts where an electric insulating property is required. And the end of bayonet stud **24**, from which pin **23** projects, is provided with a cylindrical contact casing **28** made of a substance highly resistant to arc erosion, such as a sintered silver-tungsten-molybdenum alloy.

A contact spacer cup **29** is supported from top plate **3** above contact fingers **20** and in the axial path through which electrode assembly **16** moves. It will be apparent in view of the drawings that as the bayonet stud **24** moves into engagement with the contact fingers the insulating pin **23** is received into cup **29**, thereby limiting the axial movement of the electrode into the interrupter housing.

The operation of this interrupter assembly is essentially as follows: As indicated, the movable electrode assembly **16** may be selectively actuated through the openings **14** in the interrupter plates **10** and into a position of contact with said contact finger members **20**, the upward movement being limited by abutting contact of the insulating pin **23** with the spacer cup **29**. If electrode assembly **16** is then actuated downward, thereby breaking contact while the outer surface of casing **28** engages the finger members, an arc will be formed between the breaking contacts **20** and **28**, as shown in FIG. 3. As in other oil type interrupters, the heat of this arc will decompose the surrounding oil medium into gases, which for the most part are non-ionized; and these gases act to de-ionize those ionized gases which maintain the arc. The gases (which are thus initially formed in the ambient regions of contact assembly **17**) develop pressure within housing **1**, causing check valves **8** to close and driving the oil from that upper region out one of the exhaust ports **7**. If the arc persists as contact **28** moves downwardly, the arc will be initially drawn between intermediate interrupter plates **10***a* and **10***b*. The surfaces of pin **23** and opening **14***b* will tend to move the arc off to one side of the electrode, in a manner previously known, and permitting a side wash of oil to be directed against the crater of the arc root. However, further movement of the

electrode **16** will bring the pin **23** into proximate relationship with opening **14***a* of plate **10***a*, and because of the size of this opening the arc will be squeezed and in most instances completely snuffed out.

It is important to realize that it would be impossible to employ the arc restrictive principle as derived by the use of interrupter plate **10***a* in an oil breaker circuit interrupter without providing means for initially stretching the arc out of the chamber within which contact assembly **17** is housed. This will be apparent if it is understood that by restricting the arc the gases forming said arc are also confined. Accordingly, care must be taken to insure that the gas pressures created by decomposition of the oil do not become excessive. It has been discovered that by the time the arc has been drawn through a first interrupter plate such as **10***b* over which the arc may be stretched, it is then possible to restrict the arc as by using an interrupter plate **10***a* having an opening **14***a*. But it is also important that the interrupter plate **10***c* be provided with an enlarged opening **14***c* to permit a rapid relief of gas pressures in the event of a high pressure build-up during the arc snuffing operation. Additional interrupter plates are useful in providing further insurance that the arc will be eliminated in the shortest time possible, and preferably the size of their openings **14** are substantially greater than the electrode.

The above described operation is also predicated on the fact that gases are generated in those lower ambient regions, building up a pressure which propels the surrounding oil upward through internal interrupter ports **15** and across those openings **14** through which the casing contact **28** has been retracted. By this action the arc is normally stretched across the interrupter plates and the gases are expelled through ports **7** and into the oil tank. But most importantly, as the electrode is withdrawn from the housing **1** along the axial path, the insulating pin member **23** is moved into said axial path, squeezing the ionized gases between the opening **14***a* of plate **10***a*, restricting the arc flow from the contact finger members to the edge of the receding electrode assembly and effectively snuffing the arc. The enlarged openings **14***b* and **14***c* of interrupter plates **10***b* and **10***c* permit the use of the "snuffer" plate **14***a* in the oil type circuit breaker shown.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example thereof, and that various changes in the shape, size and arrangement of certain parts may be made without departing from the spirit of the invention or the scope of the attached claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. An oil immersed circuit breaker interrupter comprising a plurality of interrupter plates of insulating material supported in an axial spaced relation, each of said plates having an opening aligned with the other openings of other interrupter plates and defining an axial path for receiving a movable electrode assembly therethrough, said interrupter plates also defining vertical ports for transmitting gases and oil therethrough in an upward direction from a lower region; a stationary contact assembly mounted axially of said plates and having one or more contact finger members disposed adjacent said axial path and biased inwardly to partially obstruct said path; a movable electrode assembly supported for axial movement through said openings in said plates, said assembly including an insulating pin member mounted axially at the end of an electrically conductive electrode; one of said interrupter plates having an arc-restrictive opening approximately equal in cross section but slightly greater and complementary to the cross section of said electrode, the one interrupter plate being disposed intermediate interrupter plates having openings substantially greater in cross section than said electrode and capable of passing and extending a gaseous arc therethrough; whereby said electrode may be selectively actuated through said interrupter plate

openings into a position of contact with said contact finger members or withdrawn through said openings, thereby breaking contact with said finger members and forming an arc, said insulating pin member being moved into said path upon withdrawal of said electrode, squeezing said arc between the edges of the one interrupter plate opening; and whereby gases and oil are propelled upwardly through said ports and across the path vacated by said insulating pin member to extinguish the extended and restricted arc.

2. The oil immersed circuit breaker interrupter of claim 1 wherein the end of said electrode is formed with a recess, said insulating pin member having a protuberance projecting into said recess and being secured to said electrode by a transverse locking pin.

3. The oil immersed circuit breaker interrupter of claim 1 and further including a spacer cup supported a spaced axial distance from the endmost interrupter plate and

extending across said axial path; said insulating pin member being engageable with said spacer cup for limiting movement of said movable electrode assembly.

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