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POLE UNIT MECHANISM

2,945,110

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2 Sheets-Sheet 1

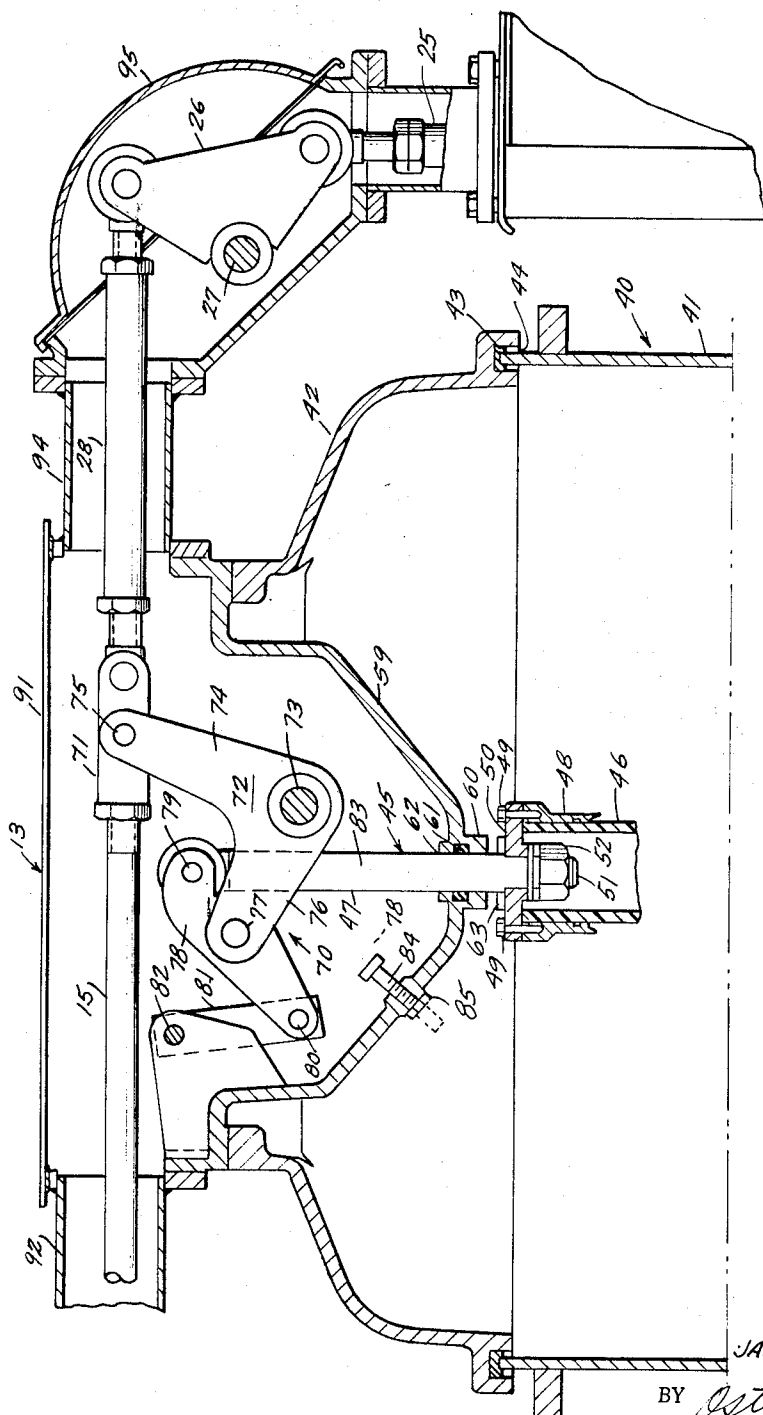


FIG. 1

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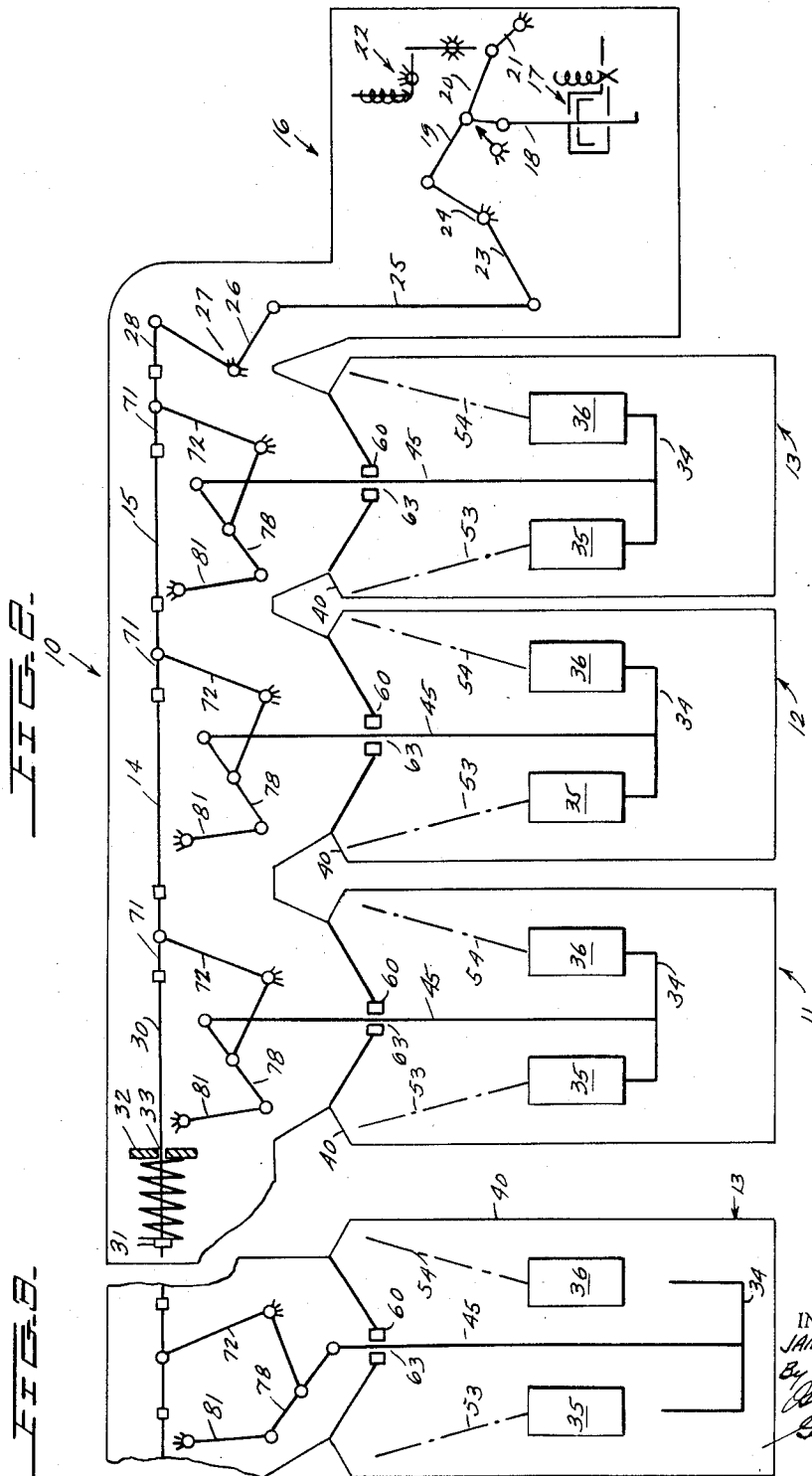
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POLE UNIT MECHANISM

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7 Claims. (Cl. 200—150)

The instant invention relates to oil circuit breakers and more particularly to a novel construction which places the pole unit operating mechanism externally of the oil filled tank and connects the operating mechanism to the end of the contact operating rod positioned externally of the tank.

In oil circuit breakers a pair of stationary contacts are usually bridged by a movable contact member which is carried by a reciprocative operating rod. The stationary contacts as well as the movable contact member are immersed in oil confined by the circuit breaker tank-like housing.

In designing oil circuit breakers the following problems must be considered:

(1) A positive seal must be provided to prevent the gases generated upon arc extinguishing from passing between pole units and also to prevent the gas from entering the operating mechanism. In the event this gas should enter the operating mechanism an explosion may result since the control switches or relay contacts generate small arcs which may ignite the gas.

(2) A guide means must be provided for the reciprocative operating rod to prevent rotation thereof so that the movable contact member will always engage the stationary contacts. Mechanical shocks caused by the formation of the arc will cause a misalignment between the movable contact and stationary contacts if adequate guidance is not provided for the operating rod.

(3) Stop means must be provided to limit overtravel of the operating rod during circuit breaker closing since circuit breakers are closed at very high speeds to limit pre-arcing.

(4) The pole units must be of a rigid construction since closing under high current conditions sets up tremendous forces which tend to separate the movable contact member from the stationary contacts.

One prior art oil circuit breaker design utilizes a seal constructed of a series of sliding plates or baffles to seal the operating rods as they exited from the tanks of the pole unit. This type of seal has proven extremely inefficient for oil circuit breaker applications. In this design the operating mechanism is positioned within the circuit breaker tank thereby exposing the bearing points to contamination caused by the arcing products.

Another prior art oil breaker design, while segregating most of the operating mechanism from the contact area introduced points of mechanical weakness. That is, this design utilized a crank disposed within the circuit breaker tank to drive the operating rod. The crank was driven by an oscillatable shaft extending externally of the tank and driven by another crank also disposed externally of the tank. Therefore, it was necessary to key both cranks to the shaft. Since the pole unit mechanism is subjected to extreme shocks and closing tremendous forces, points of mechanical weakness developed at the keys and keyways therefor often resulting in mechanical break-downs.

Even with this arrangement, the bearing connecting the

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crank disposed within the tank, to the operating rod is exposed to contaminating gases. Further, with this arrangement means for preventing rotation and lateral motion of the operating rod must necessarily be positioned within the tank. It is undesirable to place additional parts in areas of high electrical potential.

The instant invention provides a construction wherein the pole unit operating mechanism is completely segregated from the contact area. This is accomplished by extending a reciprocative operating rod through an opening in the tank with a simple ring member providing a seal. The housing for the ring member also serves as a positive stop to limit the overtravel during closing of the breaker. The operating mechanism is secured to the operating rod in a manner such that all keys and keyways have been eliminated. Also, operating mechanism includes a three member linkage which provides a guide to prevent rotation and lateral motion of the operating rod.

Accordingly, a primary object of the instant invention is to provide a novel construction for an oil circuit breaker which is mechanically superior to the oil circuit breakers of the prior art.

Another object is to provide an oil circuit breaker wherein the operating mechanism is segregated from the contact area.

Still another object is to provide an oil circuit breaker wherein a simple ring member is utilized as the sealing means of the opening in the tank through which the reciprocative operating rod extends.

A further object is to provide a housing seal which also functions as a positive stop to prevent overtravel of the operating rod during closing of the circuit breaker.

A still further object is to provide an operating mechanism for an oil circuit breaker which includes a simple linkage which prevents rotation and lateral motion of the operating rod thereby preventing misalignment between the movable bridging member and the stationary contacts.

These as well as other objects of the instant invention shall become readily apparent after reading the following description of the accompanying drawings in which:

Figure 1 is a fragmentary view of the pole unit of the operating mechanism therefor.

Figure 2 is a schematic illustrating a three pole circuit breaker in the closed position.

Figure 3 is a schematic illustrating one of the pole units of Figure 2 in the open position.

Now referring to the figures, oil circuit breaker 10 comprises three pole units 11, 12 and 13 which are interconnected by rods 14, 15 and are operable to the closed position by means of an actuating mechanism 16, which forms no part of this instant invention. Mechanism 16 may be of the type fully described in copending application Serial No. 767,383, filed October 15, 1958, and assigned to the assignee of the instant invention.

Briefly, mechanism 16 comprises a compressed air operated means 17 which provides an upward movement to closing ram 18 which is effective to straighten out the toggle comprising links 19, 20 when latchable link 21 is latched by stripping mechanism 22. When toggle 19, 20 is extended, crank 23 is pivoted counterclockwise about stationary pivot 24 to the position illustrated in Figure 2. In this position of crank 23, rod 25 is moved downward thereby rotating crank 26 clockwise about fixed pivot 27 moving connecting rod 28 to the position illustrated in Figure 2 against the force of biasing spring 29.

Spring 29 is a compression spring positioned about connecting rod 30, seated against member 31 secured to the end of connecting rod 30 and also seated against a stationary member 32 having opening 33 through which connecting rod 30 extends. With toggle 19, 20

extended as in Figure 2, spring 29 is compressed and the movable bridging members 34 of each of the pole units 11-13 are in engagement with the stationary contacts (not shown), of their respective pole units 11-13, which are disposed within arc quenchers 35, 36. When mechanism 22 is tripped, the force of spring 29 is transmitted to actuating mechanism 16 causing toggle 19, 20 to collapse, permitting connecting rods 14, 15 and 28 to move to the right with respect to Figure 2 thereby moving each of the pole units to the open position as illustrated in Figure 3.

Since each of the pole units 11-13 is of an identical construction, for the sake of brevity only pole unit 13 will be described, it being understood that the other two pole units 11 and 12 are of an identical construction. Pole unit 13 includes tank 40, containing oil (not shown), comprised of a lower barrel shaped section 41 capped by a cover section 42. Ring seal 44 is disposed within an annular groove 44 of cover section 42 to provide a seal between barrel 41 and cover 42 when these parts are clamped together in any suitable manner.

Movable contact member 34 is secured to the lower end of operating rod 45 which is comprised of a lower insulating section 46 and an upper section 47. Annular member 48 is rigidly secured to the upper end of rod section 46 and screws 49 rigidly secure ring member 50 to annular member 48. The lower end 51 of rod section 47 is threaded and extends through an opening in ring member 50 to be engaged by nut 52 thereby sectioning upper section 47 to lower section 46.

The connection between handle member 48 and lower section 46 is such that relative rotation between the two members is prevented. Similarly, the connection between upper rod section 47 and ring member 50 is such as to prevent relative rotation between these two members. Thus, as operating rod 45 is moved to the downward position of Figure 3 and bridging member 34 is disengaged from the stationary contacts. Conversely, when operating rod 45 is raised, bridging contact 34 is in engagement with the stationary contacts.

Suitable studs and bushings (not shown) concentric with center lines 53, 54 provide means for extending the stationary contacts beyond tank 41. In the true physical embodiment of oil circuit breaker 10, operating rod 45, bridging contact 34, the stationary contacts, arc quenchers 35, 36, the bushings, and contact studs are each rotated 90° about the longitudinal axes 183 of rod 45 from their positions illustrated in Figure 2.

Cover section 42 includes a depressed central portion 59 having a central opening 62 through which operating rod 45 extends. Central portion 59 is formed to provide a housing 60 for ring seal 61 which is in engagement with the outer surface of upper section 47 of operating rod 45. Seal 61 prevents the gases formed during arc extinction from leaving tank 40.

Seal housing 60 also serves as a positive stop to limit the upward travel of operating rod 45 during the closing operation of the circuit breaker 10. Ring 63, comprised of a resilient material, is secured to the top of member 50 and is engageable with housing 60 upon opening of circuit breaker 10 to provide a cushion.

Pole unit 13 further comprises an operating mechanism 70, including rod 71, interposed between connection rods 15 and 28 in axial alignment therewith. Crank 72, mounted to stationary pivot 73 has one arm 74 thereof pivotally secured at 75 to rod 71. The other arm 76 of crank 72 is pivotally secured at 77 to link 78. One end of link 78 is pivotally secured at 79 to the upper end of operating rod 45 while the other end of link 78 is pivotally secured at 80 to one end of link 81. The other end of link 81 is mounted to stationary pivot 82.

The arrangement of links 78 and 81 together with crank 72 prevent rotational and lateral movement of operating rod 45 thereby preventing misalignment between movable bridging member 34 and the stationary

contacts. The links 78, 81 and crank 72 also journal movement of operating rod 45 along the longitudinal axis thereof so as to prevent binding the upper section 47 and seal housing 60. Threaded member 84, locked in position by nut 85, extends upwardly from the central portion 69 of cover section 42 and is operatively positioned to be engaged by link 78 thereby limiting the low position of operating rod 45 during operation of oil circuit breaker 10 to the open position.

It is noted that operating mechanism 13 is completely disposed externally of tank 40 so that mechanism 13 will never be exposed to the contamination of arcing products. Further, operating mechanism 13, as well as its connection to operating rod 83, are free of all keys and keyways.

Plate 91 serves as a cover for the central depressed portion 69 of tank cover section 42 to form a housing within which operating mechanism 13 is disposed. The operating mechanism housings of adjacent pole units are connected by means of tubes 92 through which connecting rods 14 and 15 extend, while connecting rod 28 extends through tube 94 into housing 95 within which crank member 26 is disposed.

Thus, I have provided a novel construction for the mechanism of an oil circuit breaker. This construction provides a more rugged breaker which is less likely to be damaged by the shocks accompanying arcing as well as the pounding of the circuit breaker actuating mechanism. Further, this construction enables a simple ring seal to be utilized as a sealing means which prevents the escape of gas from the circuit breaker tank. The seal is so positioned that the housing therefor also serves as a positive stop to limit over travel of the operating mechanism when the circuit breaker is moved to the closed position.

Although I have here described preferred embodiment of my novel invention, many variations and modifications will now be apparent to those skilled in the art, and I therefore prefer to be limited, not by the specific disclosure herein, but only by the appending claims.

I claim:

1. A pole unit of an oil circuit breaker comprising a stationary and a movable contact, a tank wherein said contacts are disposed, a reciprocative rod extending through an opening in said tank and having said movable contact secured thereto, and operating means disposed externally of said tank for imparting reciprocating motion to said rod; said contacts being immersed in a dielectric liquid; a ring seal mounted to said tank at said opening and in engagement with said rod; said tank including a housing for said seal, said housing defining said opening; said housing also providing a positive stop limiting travel of said rod when bringing said movable contact into engagement with said stationary contact.

2. A pole unit of an oil circuit breaker comprising a stationary and a movable contact, a tank wherein said contacts are disposed, a reciprocative rod extending through an opening in said tank and having said movable contact secured thereto, and operating means disposed externally of said tank and operatively connected to a portion of said rod disposed externally of said tank for imparting reciprocating motion to said rod; said contacts being immersed in a dielectric liquid; first means comprising a portion of said operating means, disposed externally of said tank and operatively connected to said rod for preventing rotation thereof; said first means comprising a first, a second, and a third member; said first member being pivotally secured to a first stationary pivot and said second member; said second member also being pivotally secured to said rod; said third member being pivotally secured to a second stationary pivot and said second member at a point between the pivotal connections joining said second member to said first member and said rod.

3. A pole unit of an oil circuit breaker comprising a

stationary and a movable contact, a tank wherein said contacts are disposed, a reciprocative rod extending through an opening in said tank and having said movable contact secured thereto, and operating means disposed externally of said tank and operatively connected to a portion of said rod disposed externally of said tank for imparting reciprocating motion to said rod; said contacts being immersed in a dielectric liquid; first means comprising a portion of said operating means, disposed externally of said tank and operatively connected to said rod for preventing rotation thereof; said first means comprising a first, a second, and a third member; said first member being pivotally secured to a first stationary pivot and said second member; said second member also being pivotally secured to said rod; said third member being pivotally secured to a second stationary pivot and said second member at a point between the pivotal connections joining said second member to said first member and said rod; said operating means also including a second reciprocative rod; said third member comprising a crank mounted intermediate the ends thereof to said second stationary pivot and at one end thereof to said second member; said third member being pivotally secured at the other end thereof to said second rod.

4. A pole unit of an oil circuit breaker comprising a stationary and a movable contact, a tank wherein said contacts are disposed, a reciprocative rod extending through an opening in said tank and having said movable contact secured thereto, and operating means disposed externally of said tank for imparting reciprocating motion to said rod; said contacts being immersed in a dielectric liquid; a ring seal mounted to said tank at said opening and in engagement with said rod; said tank including a housing for said seal, said housing defining said opening; said housing also providing a positive stop limiting travel of said rod when bringing said movable contact into engagement with said stationary contact; first means comprising a portion of said operating means, disposed externally of said tank and operatively connected to said rod for preventing rotation thereof; said first means comprising a first, a second, and a third member; said first member being pivotally secured to a first stationary pivot and said second member; said second member also being pivotally secured to said rod; said third member being pivotally secured to a second stationary pivot and said second member at a point between the pivotal connections joining said second member to said first member and said rod.

5. An oil circuit breaker comprising a plurality of pole units; each of said pole units including a stationary and a movable contact, a tank wherein said contacts are disposed, a reciprocative rod extending through an opening in said tank and having said movable contact secured thereto, and operating means disposed externally of said tank and operatively connected to a portion of said rod disposed externally of said tank for imparting reciprocating motion to said rod; said contacts being immersed in a dielectric liquid; means interconnecting the operating means of each of said pole units for simultaneously operating the contacts of each of said pole units; a ring seal for each of said tanks at said opening thereof and in engagement with said rod extending through the respective opening; each of said tanks including a housing, for its associated seal, defining the opening thereof; each of said housings also providing a positive stop to limit travel of its associated rod when said contacts are being operated into engagement.

6. An oil circuit breaker comprising a plurality of pole units; each of said pole units including a stationary and a movable contact, a tank wherein said contacts are disposed, a reciprocative rod extending through an opening in said tank and having said movable contact secured

thereto, and operating means disposed externally of said tank and operatively connected to a portion of said rod disposed externally of said tank for imparting reciprocating motion to said rod; said contacts being immersed in a dielectric liquid; a first means for each of said pole units comprising a portion of its associated said operating mechanism, disposed externally of said tank and operatively connected to said rod for preventing rotation thereof; each of said first means comprising a first, a second, and a third member; said first member being pivotally secured to a first stationary pivot and said second member; said second member also being pivotally secured to said rod; said third member being pivotally secured to a second stationary pivot and said second member at a point between the pivotal connections joining said second member to said first member and said rod; each of said operating means also including a second reciprocative rod; said third member comprising a crank mounted intermediate the ends thereof to said second stationary pivot and at one end thereof to said second member; said third member being pivotally secured at the other end thereof to said second rod; means interconnecting the second rods of each pole unit whereby the contacts of all the pole units are operated simultaneously.

7. An oil circuit breaker comprising a plurality of pole units; each of said pole units including a stationary and a movable contact, a tank wherein said contacts are disposed, a reciprocative rod extending through an opening in said tank and having said movable contact secured thereto, and operating means disposed externally of said tank and operatively connected to a portion of said rod disposed externally of said tank for imparting reciprocating motion to said rod; said contacts being immersed in a dielectric liquid; means interconnecting the operating means of each of said pole units for simultaneously operating the contacts of each of said pole units; a ring seal for each of said tanks at said opening thereof and in engagement with said rod extending through the respective opening; each of said tanks including a housing, for its associated seal, defining the opening thereof; each of said housings also providing a positive stop to limit travel of its associated rod when said contacts are being operated into engagement; a first means for each of said pole units comprising a portion of its associated said operating mechanism, disposed externally of said tank and operatively connected to said rod for preventing rotation and lateral movement thereof; each of said first means comprising a first, a second, and a third member; said first member being pivotally secured to a first stationary pivot and said second member; said second member also being pivotally secured to said rod; said third member being pivotally secured to a second stationary pivot and said second member at a point between the pivotal connections joining said second member to said first member and said rod; each of said operating means also including a second reciprocative rod; said third member comprising a crank mounted intermediate the ends thereof to said second stationary pivot and at one end thereof to said second member; said third member being pivotally secured at the other end thereof to said second rod; means interconnecting the second rods of each pole unit whereby the contacts of all the pole units are operated simultaneously.

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