

March 13, 1962

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3,025,375

ELECTRIC CIRCUIT BREAKER HAVING A SEALED INTERRUPTING UNIT

Filed April 4, 1960

2 Sheets-Sheet 1

Fig. 1.

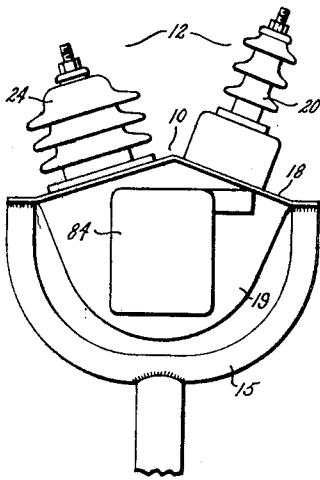


Fig. 2.

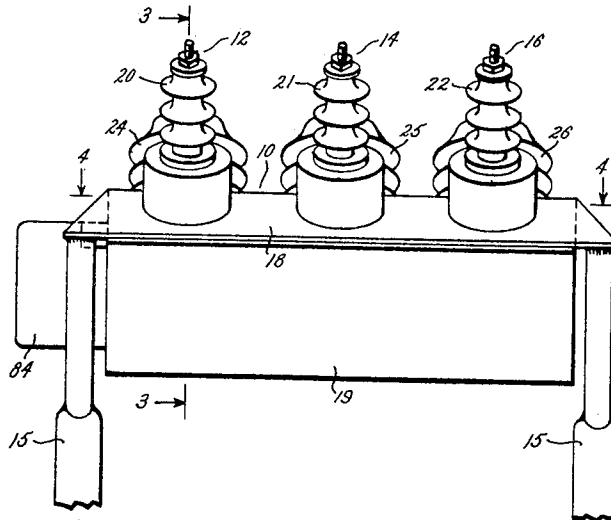


Fig. 4.

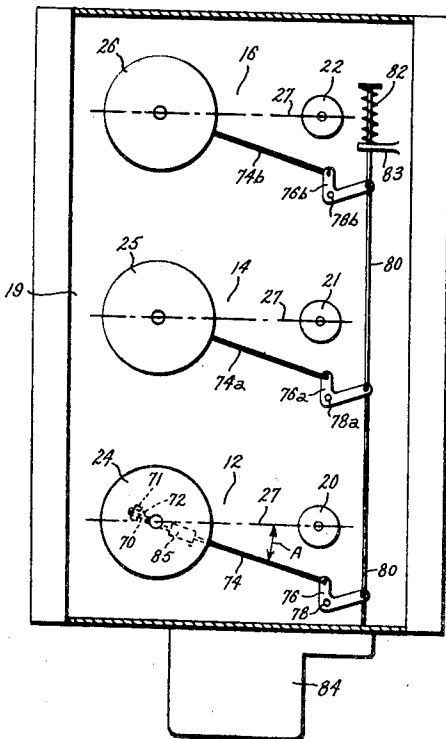
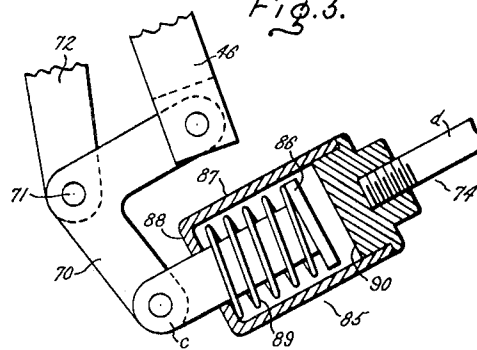


Fig. 5.



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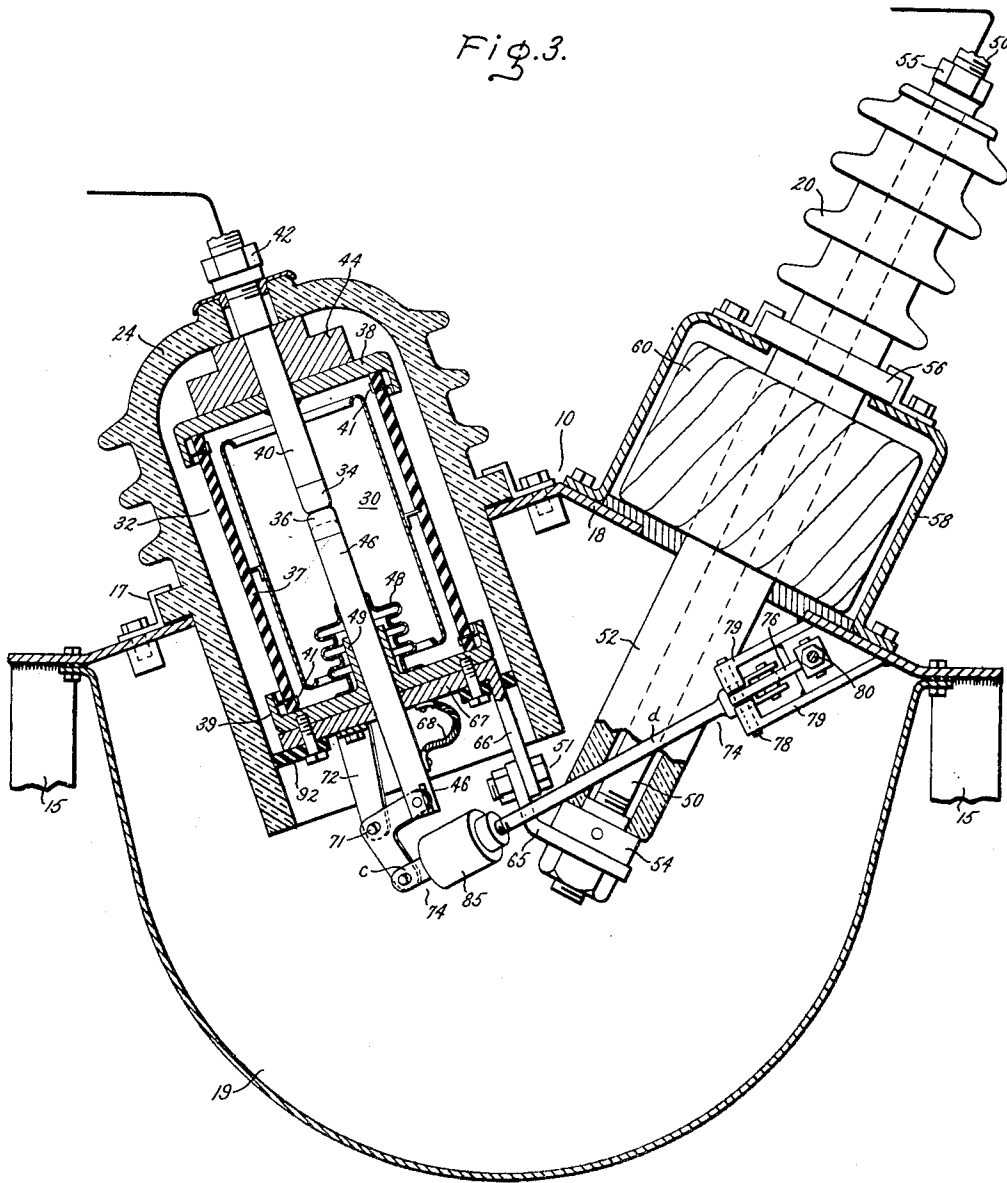
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2 Sheets-Sheet 2

Fig. 3.



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ELECTRIC CIRCUIT BREAKER HAVING A SEALED INTERRUPTING UNIT

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12 Claims. (Cl. 200-144)

This invention relates to an electric circuit breaker, and, more particularly, to a circuit breaker of a highly compact, exceptionally light-weight design that readily lends itself to high voltage circuit applications.

In the circuit breaker of the present invention, circuit interruption is effected by separating a set of contacts within an interrupting unit that is disposed within a protective enclosure. The contacts are actuated by means of a linkage also disposed within the enclosure. A high voltage terminal bushing projects into the enclosure and carries current to and from the interrupting unit.

An object of the present invention is to construct and arrange the interrupting unit, the contact actuating linkage, and the terminal bushing in such a manner that the required electrical clearances and creepage distances for high voltages can be provided within an enclosure of exceptionally small volume that consumes an exceptionally small amount of ground space.

Another object is to construct a circuit breaker in such a manner that the insulation provided by these electrical clearances and creepage distances will not be impaired by the arcing products generated during circuit interruption. Thus, insulation that is adequate for the breaker in its normal closed circuit position is adequate during circuit interruption and after repeated circuit interrupting operations, and there is no need to increase these clearances and dimensions beyond the values required under normal closed-circuit conditions.

In carrying out my invention in one form, I provide an enclosure having a metallic wall portion. Extending convergently through this wall portion into the interior of the enclosure, I provide a terminal bushing and a hollow insulating housing disposed in laterally-spaced relationship. The terminal bushing comprises a lead-in conductor terminating in an inner end disposed near the inner end of the insulating housing. Mounted within the insulating housing is a circuit interrupter comprising sealed envelope means containing separable interrupting contacts. First conductive structure electrically connected to one of the contacts projects through the envelope means and the outer end of the insulating housing to provide a terminal for the circuit breaker. Second conductive structure connected to another of the contacts projects from the envelope means in spaced-apart relationship to the first conductive structure. Conductive bridging means interconnects the inner end of the lead-in conductor and the second conductive structure both when the circuit breaker is opened and closed. Circuit-controlling relative movement of the contacts is effected by means including an operating part extending transversely of a reference plane containing the bushing and the hollow insulating housing. This operating part is located within the enclosure on a side of the terminal bushing opposite to the location of the insulating housing. This operating part and the contacts of the interrupter are interconnected by rod-like coupling structure primarily of insulating material extending from the general region of the interrupter to the general region of the operating part.

In one embodiment of the circuit breaker disclosed, the force for actuating the movable contact of the sealed interrupter has a component extending transversely of the path of movement of the movable contact. The seals of the envelope are relatively vulnerable to damage by

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such transversely-acting loads. It is therefore another object of the invention to protect these seals from being damaged by such transversely-acting loads.

This latter objective is achieved by providing between the sealed envelope and the hollow insulating housing force-transmitting structure that acts to transmit transversely-acting loads to the insulating housing by a path that effectively bypasses the envelope and thus relieves the envelope of stresses that could otherwise result from these transversely-acting forces.

For a better understanding of my invention, reference may be had to the following description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a front elevational view of a three-phase circuit breaker embodying one form of my invention.

FIG. 2 is a side elevational view of the circuit breaker of FIG. 1.

FIG. 3 is an enlarged sectional view taken along the line 3—3 of FIG. 2.

FIG. 4 is a schematic plan view taken along the line 4—4 of FIG. 3.

FIG. 5 is an enlarged sectional view of an operating component of the circuit breaker.

Referring now to FIGS. 1 and 2, the three-phase circuit breaker shown therein comprises an enclosure 10 in which major components of all three poles 12, 14, and 16 of the breaker are located. This enclosure 10 comprises a metallic top-wall portion 18 that extends between the three poles of the breaker and for a short distance beyond each of the outer two poles 12 and 16. This top-wall portion has a generally V-shaped cross-section as seen in FIG. 3 and serves as a supporting frame from which the basic components of the breaker are suspended, as will soon appear more clearly. The enclosure 10 further comprises a metallic body portion 19 of U-shaped cross-section that is suspended from the top-wall portion 18 to define bottom, side and end walls for the enclosure 10. The enclosure 10 is at ground potential and is supported at its opposite ends by suitable supports, such as the generally Y-shaped pedestals 15 shown welded to the top wall portion 18 of the enclosure.

Projecting through the top-wall portion 18 of the enclosure 10 are three spaced-apart high voltage terminal bushings 20, 21, and 22 and three spaced-apart insulating housing 24, 25, and 26. Each pole of the breaker includes one of these terminal bushings and the particular insulating housing that is shown in FIG. 2 aligned therewith. The insulating housing and the terminal bushing of the respective poles may be thought of as being disposed in generally parallel spaced-apart reference planes such as indicated at 27 in FIG. 4.

The specific manner in which each of these poles is constructed is best illustrated in FIG. 3, which is a sectional view along the line 3—3 of FIG. 2. Referring now to FIG. 3, it can be seen that the housing 24 is a hollow cylindrical member of suitable insulating material, such as porcelain, having an open lower end and a restricted upper end. This housing 24 projects through an opening provided in the top wall 18 and is secured within this opening by means 17 providing a sealed joint that holds the housing 24 firmly in place.

Mounted within the housing 24 is a circuit interrupting device in the form of a vacuum-type circuit interrupter 30. The internal details of this vacuum-type circuit interrupter form no part of the present invention and are therefore shown in schematic form only. For a more specific showing of interrupters suitable for use in the disclosed circuit breaker, reference may be had to Patent No. 2,892,911, Crouch, and application S.N. 730,413, Schneider, filed April 23, 1958, now Patent No. 2,949,520, both assigned to the assignee of the present invention. Generally speaking, the circuit interrupter 30 comprises

an evacuated and sealed envelope 32 in which a pair of separable contacts 34 and 36 are mounted. The envelope 32 is located in a region disposed on opposite sides of the metallic wall portion 18 and comprises a tubular housing 37 of insulating material and a pair of metallic end caps 38 and 39 closing off the ends of the tubular housing. The end caps 38 and 39 are joined to the housing 37 by means of suitable seals 41 forming vacuum-tight connections between the end caps and the housing. The upper contact 34 is a stationary contact that is supported on the lower end of a conductive rod 40. This conductive rod 40 projects through the upper end of the envelope 32 and through an opening in the upper end of the porcelain housing 24. Suitable fastening means are provided for clamping the rod 40 to the upper wall of the housing 24 to provide effective support for the circuit interrupter 30. In the embodiment of FIG. 3, this fastening means comprises a nut 42 that is threaded onto the rod 40. When this nut 42 is tightened it applies an upward force to the rod 40 and forces the end cap 38 of the envelope 32 against a suitable spacer 44 disposed between the end plate 38 and the housing 24.

The lower contact 36 of the circuit interrupter is a movable contact brazed to the upper end of a conductive operating rod 46. This conductive operating rod 46 is mounted for movement along its longitudinal axis and projects through an opening in the lower end cap 39. A flexible metallic bellows 48 is interposed between the lower end cap 39 and the movable operating rod 46 to provide a seal about the operating rod that allows for longitudinal movement thereof without impairing the vacuum inside the envelope 32. As shown in FIG. 3, the bellows 48 is secured at its respective opposite ends to the operating rod 46 and the end cap 39 by means of suitable sealed joints. For guiding the operating rod 46 in a longitudinal direction, a bearing sleeve 49 is provided. This sleeve 49 is suitably secured to the end plate 39 and receives the operating rod 46 in sliding relationship.

Opening of the circuit interrupter 30 is effected by applying a downward force to the operating rod 46 to drive the lower contact 36 downwardly out of engagement with the upper contact 34. Initial separation of the contacts establishes a circuit-interrupting arc between the contacts, and this arc persists until about the time a natural current zero is reached. The arc will then vanish and be prevented from reigniting by the high dielectric strength of the vacuum, thus completing the circuit interrupting operation. Closing of the interrupter is effected by driving the lower contact 36 from its open position upwardly into engagement with the upper contact 34, thus re-establishing the power circuit through the interrupter.

The actuating means for effecting opening and closing motion of the conductive operating rod 46 will soon be described in detail, but first a description will be given of the structure that is relied upon for carrying current to and from the conductive operating rod 46. This structure comprises a conductive stud 50 forming a part of the high voltage terminal bushing 20 and conductive bridging means generally indicated at 51 connected between the lower end of the conductive stud 50 and the operating rod 46. The conductive stud 50 of the bushing is surrounded by a tubular porcelain housing 52 that is secured to the stud 50 by clamping nuts 54 and 55 threaded onto opposite ends of the stud. When these nuts 54 and 55 are suitably tightened, they clamp the porcelain housing 52 in compression and hold the conductive stud 50 in position therein. The porcelain bushing housing 52 is supported on the top wall 18 of the enclosure 10 by means of the radially extending mounting flange 56 that is suitably clamped to the top of a cup-shaped metallic member 58 through which the porcelain 52 extends. The cup-shaped member 58 is suitably secured at its lower end to the top-wall portion 18. This

cup-shaped member 58 is intended to serve as a housing for bushing type current transformers, such as 60 which are disposed about the bushing 52. These current transformers are ordinarily relied upon to provide the breaker with an operation-initiating signal when predetermined electrical conditions, such as overcurrent, occur in the power circuit extending through the breaker.

The conductive bridging means 51 interconnecting the lower end of the lead-in conductor 50 and the conductive operating rod 46 comprises an L-shaped strap 65 of conductive material clamped to the stud 50 and another strap of conductive material 66 clamped to a conductive disc 67 that is, in turn, suitably secured to the lower end cap 39 of the vacuum circuit interrupter 30. The two straps 65 and 66 are suitably bolted together so that they collectively form a conductive path between the stud 50 and the conductive disc 67. The conductive disc 67 and the conductive operating rod 46 are electrically interconnected by means of a flexible conductive braid 68 suitably secured at its respective opposite ends to the operating rod 46 and the plate 67. It will therefore be apparent that the circuit between the operating rod 46 and the lead-in conductor 50 extends through the flexible braid 68, the conductive disc 67, and the straps 65 and 66.

For transmitting actuating forces to the conductive rod 46, there is provided a bell crank 70 pivotally mounted on a stationary pivot 71 located at the bottom of the circuit interrupter 30. This pivot 71 is carried by a bifurcated bracket 72 suspended from the metallic disc 67. One arm of this bell crank 70 is pivotally connected to the conductive operating rod 46, and the other arm is pivotally connected to a rod-like coupling structure 74 constructed primarily of insulating material. The insulating coupling structure 74 is controlled by means of another bell crank 76 located at the upper end of the coupling structure 74. The upper bell crank 76 is pivotally mounted on a stationary shaft 78 that is supported in a bifurcated bracket 79 attached to the top-wall 18 of the enclosure 10. As will be apparent from FIGS. 3 and 4, one arm of the upper bell crank 76 is pivotally connected to the insulated coupling structure 74 and the other arm is pivotally connected to a metallic link 80 that extends between the three poles of the circuit breaker perpendicular to the plane in which FIG. 3 is taken.

As will be apparent from FIG. 4, this link 80 mechanically couples together the circuit interrupters in all three poles of the breaker for substantially simultaneous operation. In this regard, an insulating coupling structure 74a and bell crank 76a connect the circuit interrupter of the center pole 14 of the breaker to the link 80, and a coupling structure 74b and a bell crank 76b connect the circuit interrupter of the end pole 16 to the link 80. These parts 74a, 74b, 76a, and 76b respectively correspond to parts designated by the same reference numerals without suffix in FIG. 3. An opening spring 82 of the compression type disposed between a stationary support 83 and a shoulder on the link 80 biases the link 80 upwardly in FIG. 4, but is restrained from moving the link 80 so long as the breaker is latched in its closed position by a suitable trip latch (not shown). When this trip latch is released, the opening spring 82 is free to expand, and, in expanding, drives the link 80 upwardly as depicted in FIG. 4. This action pivots the upper bell cranks 76, 76a, and 76b about their respective pivot 78, 78a, and 78b in a counterclockwise direction as shown in FIG. 4, and such counterclockwise motion drives the insulating coupling structures 74, 74a, and 74b simultaneously downward along their respective lengths, as viewed in FIG. 3. Such downward longitudinal movement of the insulating coupling structures results in substantially simultaneous opening of the three circuit interrupters. In the interrupter shown in FIG. 3, for example, downward longitudinal movement of the coupling structure 74 pivots the lower bell crank 70 in a clockwise direction, thereby driving the contact rod 46

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downward to separate the interrupting contacts 34, 36. The other poles of the breaker are substantially identical to that shown in FIG. 3 so that downward motion of their insulating coupling structures produces contact-opening movement in a corresponding manner. Closing of the three interrupters is effected substantially simultaneously by moving the connecting link 80 in an upward direction from its open position to the solid-line position shown in FIG. 4 against the bias of opening spring 82. This lifts the insulating coupling structures 74, 74a, and 74b, thereby transmitting simultaneous closing motion to the contacts of the three interrupters. The motive means for imparting closing motion to the connecting link 80 and the latch for holding the connecting link 80 in its closed position are located in a compartment 84 attached to the front of the enclosure 10. Since these components may be of any suitable conventional construction, they have not been shown in the drawings.

In the disclosed form of my circuit breaker, each of the coupling structures 74, 74a, and 74b comprises a joint 85 that is relied upon for sufficient contact wipe to enable each of the three interrupters to be driven into closed position without interference from any of the other interrupters. In this regard, each coupling structure comprises a pair of aligned rods *c* and *d* of insulating material connected together by means of the joint 85. The lower rod *c* carries at its upper end a piston-like member 86 that is telescopically received in a cup 87 carrying an internal shoulder 88 located behind the piston 86. A compression spring 89 disposed between the shoulder 88 and the piston 86 acts in a direction to hold the contacts closed when the circuit breaker is in its position of FIG. 3. Referring to FIG. 5, which is an enlarged sectional view showing the parts of the coupling 85 when the breaker is closed, it can be seen that the piston 86 under these conditions is spaced a short distance from the end wall 90 of the cup. When the upper rod *d* is moved downwardly during a contact opening operation, the end wall 90 strikes the piston 86, thus driving the lower rod *c* downwardly to impart clockwise contact-opening motion to the crank 70.

During a closing operation, the cup 87 is returned from its open position to the right toward its position of FIG. 5, and the forces developed by such motion act through the spring 86 to drive the rod *c* upwardly. When the contacts 34, 36 engage, the rod *c* is prevented from moving further upward, but the rod *d* continues to move a slight distance further, compressing the spring 89 and opening a space between the piston 86 and the end wall 90. This overtravel of the cup 87 assures that a mechanism closing stroke will drive the contacts 34, 36 firmly into engagement despite contact wear and without blocking the contacts of the other poles from engaging should the contacts 34, 36 engage slightly ahead of the contacts of the other poles. Likewise, the joints 85 in the other poles compensate for contact wear in these poles and permit the contacts 34, 36 to be driven into engagement should the contacts of either of these other poles engage before the contacts 34, 36.

The circuit breaker of the present invention is a highly compact device consuming considerably less space than conventional tank-type breakers of comparable voltage and current ratings. There are a number of features contributing to this high degree of compactness. One such feature is that the interrupter 30, instead of being suspended from the lower end of an insulated lead-in device, such as a terminal bushing, is, in effect, located within its insulated lead-in device (the porcelain housing 24). As compared to a conventional circuit breaker where the interrupter is suspended from the lower end of a bushing with its axis vertically disposed, the location within the housing 24 enables the body portion 19 of the enclosure 10 to be located much closer to the lower end of the interrupter 30 without diminishing the electrical

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clearance between the enclosure 10 and this lower end of the interrupter 30, thereby allowing substantial reductions to be made in the overall height of the enclosure. As compared to a circuit breaker where the interrupter extends horizontally between the lower ends of lead-in bushings, the location inside the insulating housing 24 enables the lower ends of the lead-in conductors to be located comparatively close together. This will be apparent from FIG. 3, where it can be seen that the lower end of stud 50 is only slightly separated from the conductive structure 66, 67 within the insulating housing 24 at its lower end. More particularly, the lower end of stud 50 is located in a region that is aligned with the insulating housing 24. With the lead-in conductors laterally close together at their lower ends instead of widely separated, an enclosure 10 of considerably reduced lateral dimensions can be utilized without diminishing the electrical clearance between the exposed parts disposed at the lower ends of the lead-in conductors and the walls of the enclosure 10.

Another feature contributing to compactness is the location of the envelope 30 in the housing 24 on opposite sides of the upper wall portion 18 of the enclosure 10. This enables both the lower and upper portions of the hollow porcelain 24 to serve the dual role of housing and insulator for the interrupter. Furthermore, locating the lower end of the envelope 30 inside of the enclosure and near the lower end of the housing 24 simplifies the mechanical problems involved in utilizing a linkage disposed within the enclosure for actuating the contacts of the interrupter.

With the enclosure 10 drastically reduced in size as pointed out in the two immediately preceding paragraphs, the problem arises as to how to obtain creepage paths of sufficient length along the usual insulating operating rods of the interrupter. Typically, these operating rods are actuated by a connecting link at ground potential located between the lead-in bushings of the breaker, but this is not feasible in the disclosed breaker because the reduced distance from the lower end of the interrupter to any region between the bushings would allow insufficient creepage distance to be obtained along the operating rod. This problem has been solved in the disclosed circuit breaker (1) by locating the connecting link 80 on a side of terminal bushings opposite to the side of the bushings on which the interrupters 30 are located, and (2) by locating all of the insulating operating rods, i.e., the coupling structures, 74, 74a, 74b so that they are disposed at an angle to the reference plane 27 in which the axes of their corresponding interrupters and terminal bushings are located. The first of these relationships is illustrated in FIGS. 3 and 4, where the interrupter 30 is shown to the left of the terminal bushing 20 and the connecting link 80 to the right of the terminal bushing. The second of these relationships is illustrated in FIG. 4, where the operating rod or coupling structure 74 is shown disposed at an angle *A* relative to the plane 27 that includes the axes of the lead-in bushing 20 and the interrupter 30. These two relationships in combination with the fact that the connecting link 80 is vertically spaced from the interrupter as much as possible enable me to obtain a creepage path of exceptional length in an enclosure of highly restricted size.

A feature of the disclosed breaker which enables an insulating operating rod, or coupling structure, such as 74, to be angularly disposed with respect to the plane of its pole, i.e., the plane 27 of FIG. 4, is that the bell crank 70 for converting longitudinal motion of the insulating operating rod 74 into longitudinal motion of the contact rod 46 is mounted on structure (67) at the bottom of the interrupter. With the bell crank means 70 mounted in such location, it is a simple matter to position the pivot 71 of the bell crank in a position generally perpendicular to the longitudinal axis of the operating rod 74, as viewed in FIG. 4, thus enabling the bell

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crank to be smoothly operated without imposing any significant thrust thereon along the axis of its pivot 71. It will be apparent from FIGS. 3 and 4 that the bell crank 70 operates in a plane that is generally perpendicular to the plane in which the upper bell crank 76 operates.

To insure that sufficient creepage distance is available between the conductive structure 67 at the lower end of the interrupter and the grounded metallic enclosure 10, the insulating housing 24 has been extended for a substantial distance below the lower or inner end of the interrupter 30. Thus, the creepage paths interposed between this structure 67 and the top-wall of the enclosure extends along the inside surface of the porcelain housing 24 from the region of conductive structure 67 to the bottom end of the housing 24 and then upwardly along the outer surface of housing 24 to the metallic enclosure. It is to be noted that the conductive strap 66 at the bottom of the interrupter and all other conductive structure at the bottom of the interrupter is radially spaced from the internal surface of the housing 24. This spacing insures that the effectiveness of the inner insulating surface of the housing 24 is not impaired by being bypassed by the conductive structure 66.

In the disclosed circuit breaker, there is no problem that the insulating properties of the above-described creepage paths or of the air within the enclosure 20 will be impaired by arcing products resulted from interrupter operation. This follows from the fact that the interrupter 30 is a sealed device in which the arcing products are totally confined. Thus, these arcing products cannot escape into regions external to the interrupter to impair the available insulation. Assurance that there will be no such impairment obviates the necessity of increasing the insulating level beyond that required under normal closed circuit conditions.

Because the arcing products are confined within the sealed envelope 32, it will be apparent that generation of these arcing products will not significantly increase the pressure of the air within the main enclosure 10. Thus, the walls of this enclosure 10 need withstand no significant fluid pressure forces. This is highly advantageous in that it enables these walls to be constructed from relatively light gauge inexpensive material. This is particularly true of the lower wall portion 19, which is required to withstand neither significant fluid pressure forces nor significant mechanically applied forces.

Since the fluid within the enclosure 10 outside of the sealed envelope performs no arc-extinguishing function, it may be air, rather than the oil that is used in conventional tank-type breakers. This substantially lightens the breaker, contributes to lower cost, and simplifies maintenance procedures.

For relieving the seals 41 of the vacuum interrupter 30 from cantilever loads tending to result from operating forces applied to the interrupter, an annular insulating plate 92 is disposed between the conductive plate 67 at the bottom of the interrupter and the internal cylindrical surface of the porcelain housing 24. This insulating plate 92 is bolted to the conductive plate 67 and is tightly received within the bore of porcelain housing 24. Thus, the forces applied through the insulating operating rod 74 in a direction transverse to the contact rod 46 are transmitted through the insulating plate 92 directly to the housing 24 rather than being applied to the seals 41 of the vacuum interrupter. Since these seals are relatively vulnerable to damage by cantilever or transversely applied loads, it will be apparent that the insulating plate 92 performs an important protective function.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects, and I, therefore, intend in the appended

claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric circuit breaker comprising an enclosure including a metallic wall portion, a terminal bushing and a hollow housing of insulating material disposed in spaced-apart relationship and projecting convergently through said wall portion into the interior of said enclosure, said terminal bushing comprising a lead-in conductor terminating in an inner end disposed near the inner end of said hollow insulating housing, a circuit interrupter disposed within said insulating housing and comprising sealed envelope means containing separable interrupting contacts, first conductive structure electrically connected to one of said contacts and projecting through said envelope means and the outer end of said insulating housing to provide a terminal for said circuit breaker, second conductive structure connected to another of said contacts and projecting from said envelope means in spaced-apart relationship to said first conductive structure, conductive bridging means interconnecting the inner end of said lead-in conductor and said second conductive structure both when the circuit breaker is open and closed, and means for producing circuit-controlling relative movement of said contacts comprising an operating part extending transversely of a reference plane containing said bushing and said housing, said operating part being located within said enclosure on a side of said terminal bushing opposite the location of said hollow insulating housing, and means for interconnecting said operating part and said contacts comprising rod-like coupling structure primarily of insulating material extending from the general region of said interrupter to the general region of said operating part.

2. The circuit breaker of claim 1 in which contact-controlling motion of said rod-like coupling structure produces forces at one end of said envelope acting transversely to the path of movement of a movable one of said contacts, and which further comprises means for transmitting said transversely-acting forces directly to said insulating housing by a path that effectively bypasses said envelope, whereby to relieve said envelope of stresses that would otherwise result from said transversely-acting forces.

3. The interrupter of claim 1 in which said terminal bushing and said hollow housing of insulating material are disposed in a predetermined reference plane intersecting said wall portion and in which said insulating rod-like coupling structure is disposed at an acute angle to said reference plane.

4. The circuit breaker of claim 3 in which the means for interconnecting said operating part and said contacts further comprises crank means mounted at the inner end of said interrupter for converting motion of said insulating coupling structure into circuit-controlling motion of one of said contacts.

5. The circuit breaker of claim 3 in which the means for interconnecting said operating part and said contacts further comprises first crank means mounted at the inner end of said interrupter and coupled to one end of said rod-like coupling structure for converting longitudinal motion of said coupling structure into circuit-controlling motion of one of said contacts, and second crank means interconnecting the other end of said rod-like coupling structure and said operating part for converting motion of said operating part into longitudinal motion of said coupling structure, said first and second crank means being mounted for pivotal motion in planes that are substantially perpendicular to each other.

6. An electric circuit breaker comprising an enclosure including a metallic wall portion, a terminal bushing and a hollow housing of insulating material disposed in spaced-apart relationship and projecting convergently through said wall portion into the interior of said enclosure, said terminal

nal bushing comprising a lead-in conductor terminating in an inner end disposed near the inner end of said hollow insulating housing, a circuit interrupter comprising sealed envelope means disposed within said hollow insulating housing in a region disposed on opposite sides of said metallic wall portion, separable interrupting contacts within said envelope means, first conductive structure electrically connected to one of said contacts and projecting through said envelope means and the outer end of said insulating housing to provide a terminal for said circuit breaker, second conductive structure connected to another of said contacts and projecting from said envelope means in spaced-apart relationship to said first conductive structure, conductive bridging means interconnecting the inner end of said lead-in conductor and said second conductive structure both when the circuit breaker is opened and closed, and contact-operating means comprising a linkage located within said enclosure and coupled to one of said contacts for producing circuit-controlling relative movement of said contacts.

7. The circuit breaker of claim 6 in which the inner end of said hollow insulating housing projects into said enclosure beyond the inner end of said sealed envelope, said inner end of said insulating housing being spaced from any conductive structure at said inner end that is electrically connected to said bridging means so that the internal wall of said insulating housing at said inner end provides creepage distance between said latter conductive structure and said metallic top-wall portion.

8. The circuit breaker of claim 6 in which operation of said contact-operating means produces forces at one end of said envelope acting transversely to the path of movement of a movable one of said contacts, and in which means is provided for transmitting said transversely-acting forces directly to said hollow insulating housing by a path that effectively bypasses said envelope, whereby to relieve said envelope of stresses that would otherwise result from said transversely-acting forces.

9. The circuit breaker of claim 6 in which the inner end of said lead-in conductor is disposed within a region aligned with said hollow insulating housing.

10. A multiple pole circuit breaker comprising a metallic enclosure having a top-wall intersected by a plurality of spaced-apart generally parallel reference planes, each pole of said circuit breaker comprising a terminal bushing and a hollow insulating housing disposed generally in one of said reference planes and projecting convergently through said top-wall into the interior of said enclosure, the terminal bushing of each pole comprising a lead-in conductor extending therethrough and terminating near the lower end of the hollow insulating housing of the corresponding pole, each pole further comprising a circuit interrupter disposed within the hollow insulating housing of said pole, each circuit interrupter comprising a sealed envelope containing separable interrupting contacts, conductive structure electrically connected to one of said contacts and projecting through said envelope and the top of said insulating housing to provide a terminal for the corresponding pole, second conductive structure connect-

ed to the other of said contacts and projecting from said envelope in spaced-apart relationship to said first conductive structure, conductive bridging means for each pole interconnecting the lower end of the pole's lead-in conductor and said second conductive structure both when the breaker is opened and closed, means for operating the contacts of said interrupters substantially simultaneously comprising an operating part extending transversely to said reference planes on a side of said terminal bushings opposite to the location of said insulating housings, and means for interconnecting said operating part and the contacts of each of said interrupters comprising rod-like coupling structures primarily of insulating material respectively extending from the general region of an associated interrupter to the general region of said operating part.

11. The circuit breaker of claim 10 in which the rod-like coupling structure for each pole is disposed at an acute angle to the reference plane of that particular pole.

12. An electric circuit breaker comprising a metallic enclosure, lead-in conductors projecting into said enclosure in spaced-apart relationship to each other, insulating means for insulating said lead-in conductors from said enclosure, a circuit interrupter within said enclosure located mechanically and electrically between said lead-in conductors, said circuit interrupter comprising a sealed envelope and separable contacts within said envelope, means for producing circuit-controlling relative motion of said contacts comprising an operating part extending transversely of a reference plane containing said lead-in conductors, said operating part being located within said enclosure on a side of one of said lead-in conductors opposite the location of said other lead-in conductor, and means for interconnecting said operating part and said contacts comprising rod-like coupling structure primarily of insulating material extending from the general region of said interrupter to the general region of said operating part, first crank means mounted at an end of said interrupter and coupled to one end of said rod-like coupling structure for converting longitudinal motion of said coupling structure into circuit-controlling motion of one of said contacts, and second crank means interconnecting the other end of said rod-like coupling structure and said operating part for converting motion of said operating part into longitudinal motion of said coupling structure, said first and second crank means being mounted for pivotal motion in planes that are substantially perpendicular to each other.

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