Dec. 13, 1938. J. D. HILLIARD 2,140,475

CIRCUIT BREAKER

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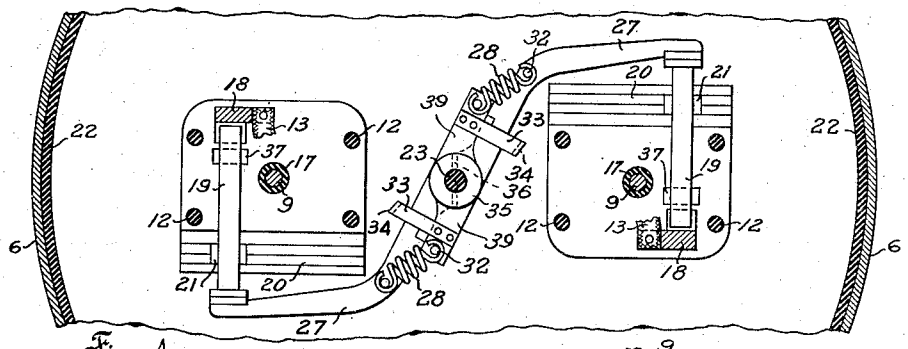


Fig. 1

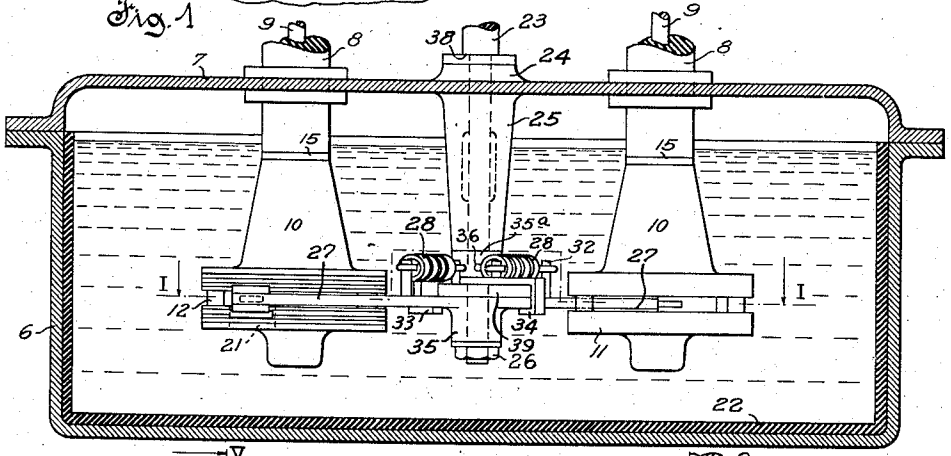


Fig. 2

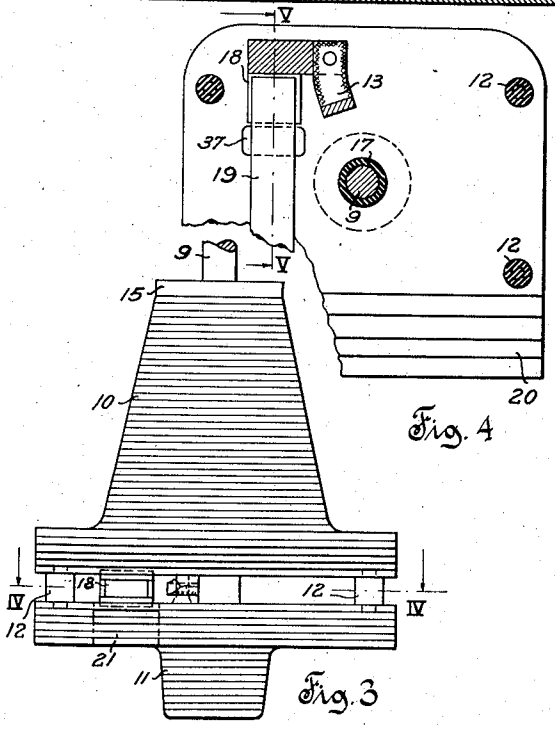


Fig. 3

Fig. 4

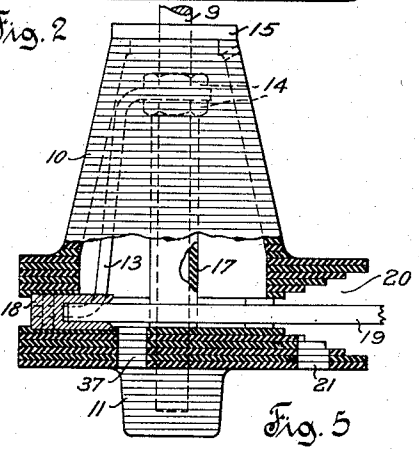


Fig. 5

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CIRCUIT BREAKER

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7 Claims. (Cl. 200—150)

This invention relates in general to circuit breakers and more particularly to circuit breakers of the fluid break type wherein the arc formed during interruption of the circuit is extinguished in oil or some similar insulating or arc extinguishing fluid.

It is an object of this invention to provide an improved circuit breaker of the above type wherein the arc is extinguished and the circuit is interrupted in an improved and more efficient manner.

A further object of this invention is to provide a circuit breaker of the above type with an arcing chamber having a throat opening extending radially from the arc.

It is further an object of the present invention to provide in a circuit breaker of the above type a pressure chamber supported from a current carrying stud member and provided with a throat opening extending radially from the stud in substantially all directions.

It is also an object of the present invention to provide in a circuit breaker of the above type a snap acting moving contact assembly having a rotary motion.

It is also an object of the present invention to provide a pressure chamber comprising a stack of laminations of insulating material with a means for spacing one part of the stack from another part thereof to thereby form a throat opening extending radially in a plane at substantially a right angle to the stack of laminations.

It is a further object of the present invention to provide a pressure chamber formed of a stack or stacks of insulating laminations held under compression by a stud passing through the chamber.

It is also an object of the present invention to provide in a circuit breaker of the above type a pressure chamber which is simply and easily formed of laminations of insulation but which is rugged in construction.

It is also an object of the present invention to provide a method of and means for forming a pressure chamber with side walls of insulating material, whereby a hoop tension is the only tensile stress applied to the said side walls during circuit interruption.

It is also an object of the present invention to provide a method of and means for constructing a pressure chamber so that no stress beyond the elastic limit of the insulating material used will be applied to the structure in the process of manufacture.

It is also an object of this invention to provide a circuit breaker in which failure of the pressure chamber due to parts weakened by production operations in manufacture is avoided.

It is also an object of this invention to secure a throat opening of considerable width but of small thickness so as to decrease the time required for deionizing of the gas stream, and thus to increase the efficiency of interruption.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawing, in which:

Fig. 1 is a partial top section view of a circuit breaker embodying the present invention taken on the line I—I of Fig. 2;

Fig. 2 is a front elevation view of the circuit breaker shown in Fig. 1 with part of the tank removed;

Fig. 3 is a front elevation detailed view of one of the pressure pots of the circuit breaker shown in Figs. 1 and 2;

Fig. 4 is a top section view taken on the line IV—IV of Fig. 3; and

Fig. 5 is a side view partly in section taken on the line V—V of Fig. 4.

As shown in Figs. 1 and 2 the circuit breaker of the present invention is provided with a tank 6 and a cover 7 through which insulating bushings 8 extend and carry the circuit breaker stud 9. In order to fully utilize the advantages of a moving contact structure having a rotary motion rather than a rectilinear motion, a simple pressure chamber construction is provided which consists generally in a stack 10 of insulating laminations each of which has a substantial aperture therein, whereby the stack forms the walls of the pressure chamber. The chamber may be closed at the end by a plate of insulation or by a second stack of laminations 11 which is spaced from the stack 10 by means of spacers 12 to form another wall of the pressure chamber and to provide for a throat opening which may be any desired width from a narrow slot to substantially 360° in extent. In utilizing the rotary motion of the moving contact member, advantage is taken of the fact that the energy necessary to accelerate a given mass to a given speed in rotary motion is much less than that of a contact member of the same mass having rectilinear motion and therefore the time of arcing is correspondingly short. This decreased energy of acceleration is due to the small radius of gyration of the rotating mass as compared with the rectilinear motion of the mass of the ordinary

circuit breaker operating member, that is, for a given mass, the movement of inertia is much less than the momentum. In other words, the rotating operation of the moving contact member and attached mechanism results in a given accelerating force producing a greater lineal acceleration of the moving arcing tip than if the same force is applied to the same mass but with rectilinear acceleration, and this provides a shorter arcing period, less gas generation, less oil dissociated, less carbon in the oil and therefore greater interrupting and maintenance efficiency. By using a rotary motion, the present construction provides a very simple method of forming a pressure chamber provided with a throat member of the extent desired, while at the same time due to the fact that the insulating laminations are held in compression the construction is very rugged.

The stack of laminations **10** is formed of disks having large apertures therein whereby the stack forms the walls of the pressure chamber. The bottom disks of the stack **10** may be cut shorter on one side thereof to form the throat opening 20, as shown more clearly in Fig. 5. The lower stack of laminations **11** are formed to include a screw threaded member so that by turning both stacks of laminations, the entire assembly may be tightened on the stud **9**. The stud **9** is insulated in the pressure chamber by the member **17**. The member in the stack **11** may be a nut or similar separate member or the stack itself may be threaded. The lower stack of laminations **11** is spaced from the upper stack as by means of insulating spacers **12**, thereby providing the radial throat opening extending in all directions at right angles to the stack. The upper laminations of the lower stack **11** are cut off on one side similar to the lower laminations of the stack **10** to form the throat **20**. Openings **21** and **37** are provided through the walls of the lower stack **11** to form shunt vents, the openings **37** providing an expulsion port action, which greatly decreases the chamber pressure for a given quantity of gas generated, thereby increasing the interrupting capacity of the breaker.

The term "throat" or "throat opening" as used herein comprises an opening in a wall of the pressure chamber extending in a given plane substantially the entire perimeter thereof, such opening including the path through which the movable contact is operable to draw an arc and through which such arc may be drawn by the movable contact substantially in the plane of the opening.

In the preferred form of the invention the laminations **11** are consolidated by heat and pressure to form a more stable and rugged construction. The laminations **11** are each impregnated with Bakelite or equivalent material and then stacked as desired and the stacks put under pressure while heat is applied. In this manner a solid body of great strength is obtained when the stack has cooled, voids in the material are eliminated and water absorbtion decreased. This method avoids stressing the material beyond its elastic limit during construction of the chamber, as is the case where material is rolled into cylindrical form and then pressed into special shapes and then again pressing and heat polymerizing the prepressed section. In the ring construction initial fracture due to the pressing is completely avoided, resulting in a structure that has a uniform strength. In the present invention, however, the rolled wall or the plastic molded construction may be used.

The snap acting moving contact assembly which operates with a rotary motion is supported from the cover member **7** which is provided with an upstanding boss **24** and a depending insulating member **25** serving as bearings for the operating rod **23** of insulating material which extends therethrough.

The bridging member **27** is loosely mounted on the rod **23**, the extension **35** providing a bearing whereby the member **27** may rotate on the rod **23** relative thereto. A member **39** is rigidly connected to the rod **23** for rotation therewith as by a pin **36** through the extension **35***a*. Member **39** is operably connected to the bridging member **27** through springs **28**, pins **32** and stop members **33** rigidly mounted on member **39** and provided with bent over portions **34**. Portions **34** engage bridging member **27** after a predetermined movement of member **39** against the biasing force of springs **28**. A nut **26**, acting in conjunction with the operating rod shoulder **38**, holds the operating assembly in position.

The fixed contacts **18** are provided with pigtails **13** connected to the conducting stud **9** by nuts **14**. The movable contacts **19** are held in the closed position shown in Fig. 1 by the friction of the fixed contacts **18**. In the operation of the circuit breaker, a rotating movement is applied to the operating rod **23** and thereby to member **39**, which movement tends to stretch springs **28** until the bent over ends **34** contact the bridging member. At such point the moving contacts **19** are forceably pulled from the fixed contacts **18** with a snap action due to release of energy stored in springs **28**. An arc is thereby drawn which, due to the pressure in the pressure chamber, the short term of arcing, the deionizing action of the throat **20** and due to the fact that the throat extends in all directions from the arc, is easily and rapidly extinguished.

The provision of a throat member extending radially in all directions has a function other than that of aiding in extinguishing the arc. Due to the construction disclosed the blast from the pressure chamber is substantially a balanced blast, that is, one in which there is no resultant bending moment applied to the bushing supporting the pressure chamber. In prior art construction especially where the natural period of vibration of the chamber may synchronize with the period of the circuit, the bending moment due to the vibration is the cause of many bushing failures. Due to the balanced construction shown this disadvantage is avoided.

Although but one embodiment of the present invention has been illustrated and described it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In combination, a casing containing arc extinguishing fluid, an insulating bushing extending through said casing, a pressure chamber supported by said bushing in said fluid and provided with an opening in the wall thereof extending substantially the entire perimeter of said wall in a given plane, a first contact supported in said pressure chamber, and a second contact movable in substantially said given plane through said opening and cooperable with said first contact to draw an arc.

2. In a circuit breaker, a tank containing arc extinguishing fluid, a conducting stud extending through said tank in insulated relation thereto,

a stack of disks surrounding said stud in said fluid and provided with substantial apertures therein forming walls of a pressure chamber, a second stack of disks substantially without apertures therein and supported on said stud to form another wall of said pressure chamber, means for spacing said second stack from said first stack to provide a throat opening therebetween substantially 360° in extent and at an angle to said stud, a first contact in said pressure chamber, and a second contact movable parallel to said disks through said throat opening to draw an arc with said first contact.

3. In combination, a casing containing arc extinguishing fluid, a current conducting stud extending through said casing in insulated relation thereto, and a pressure chamber supported by said stud in said fluid comprising laminations of insulation held under compression by said stud.

4. In combination, a casing containing arc extinguishing fluid, a current conducting stud extending through said casing in insulated relation thereto, a pressure chamber supported by said stud in said liquid comprising a plurality of stacks of insulation members spaced apart to form a throat opening substantially perpendicular to said stud, a fixed contact in said pressure chamber, a contact movable through said throat opening in a plane parallel to said insulation members and cooperable with said fixed contact to draw an arc in said chamber, and means including said fixed contact for imparting a snap action to said movable contact.

5. In combination, a casing containing arc extinguishing fluid, a current conducting stud extending through said casing in insulated relation thereto, a pressure chamber supported by said stud in said fluid and provided with a throat opening extending radially from said stud in a plane substantially perpendicular to said stud, and means for insulating said stud adjacent said throat opening.

6. In combination, a casing containing arc extinguishing fluid, an insulating bushing extending through said casing, a pressure chamber supported by said bushing in said fluid and provided with an opening in the wall thereof extending substantially the entire perimeter of said wall in a given plane, a first contact supported in said pressure chamber, a second contact movable in substantially said given plane through said opening and cooperable with said first contact to draw an arc, and an expulsion port in said pressure chamber adjacent said fixed contact.

7. In combination, a casing containing arc extinguishing fluid, a current conducting stud extending through said casing in insulating relation thereto, a pressure chamber built up of rings of insulating material spaced apart to form a throat opening and said rings held under compression by said stud, a stationary contact member in said chamber, a movable cooperating contact member, means for supporting said chamber and contact in electrical connection with said current conducting stud, means for separating said contact members to interrupt the electrical circuit.

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