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ELECTRIC CIRCUIT INTERRUPTER

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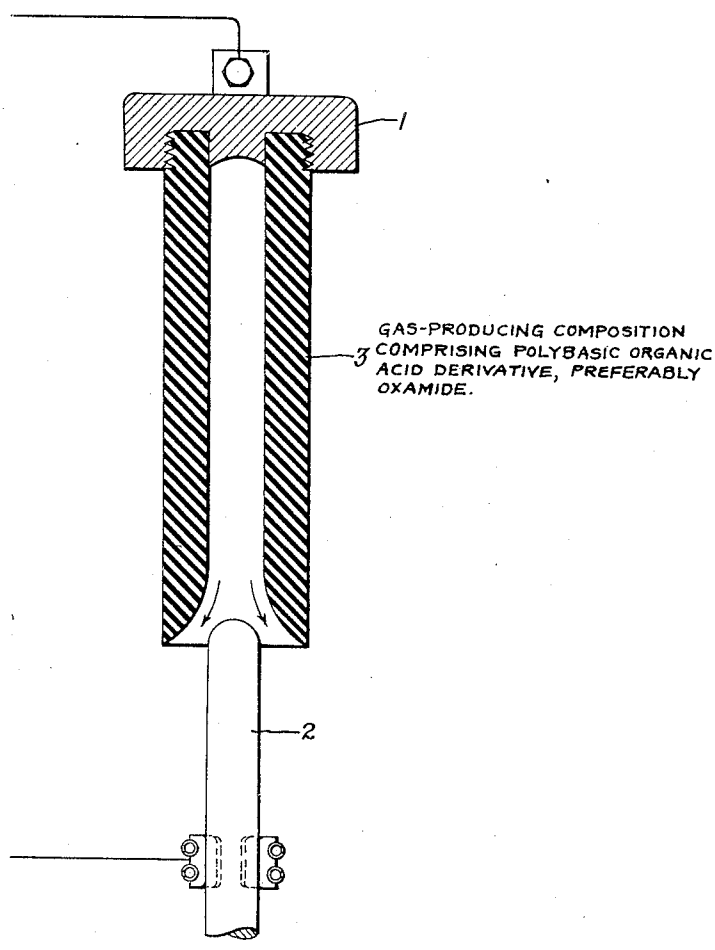

Inventor:
Paul Nowak,
by Harry E. Dunham
His Attorney.

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ELECTRIC CIRCUIT INTERRUPTER

Paul Nowak, Berlin-Charlottenburg, Germany, assignor to General Electric Company, a corporation of New York

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9 Claims. (Cl. 200—149)

This invention relates to electric circuit interrupters, and more particularly to circuit interrupters of the air-break expulsion type wherein a gas formed by decomposition of a material by the arc upon opening of the circuit is utilized to interrupt the arc.

In a well-known form of circuit interrupter of the aforesaid type, the arc is drawn in a confining insulating structure, such as a tube formed of material which under the influence of the arc emits gases or vapors tending to extinguish the arc. Inorganic materials such, for example, as boric acid, ammonium alum, etc., have been proposed as the gas-producing material. In these substances water is chemically combined so that, under the influence of the arc, vapors are released for the arc-extinguishing process. It has also been proposed to use aminoplasts (general term for synthetic resins from amido or amino compounds) in the construction of arc-confining structures. Aminoplasts contain nitrogen which is evolved under the arc heat and tends to extinguish the arc. More recently, other gas-producing materials or compositions containing the same have come into prominence for making arc-insulating members. For example, in Burmeister U. S. Patent 2,089,050 is disclosed and claimed an arc-confining structure composed of oxalic acid; and in Burmeister U. S. Patent 2,089,051, mechanically strong organic material, for instance hard rubber, impregnated with an inorganic material which upon decomposition yields an arc-interrupting gas and, specifically, with ammonium carbonate or bicarbonate, calcium carbonate, etc. Reference is also made to the copending applications of Rudolf Auerbach and Hermann Burmeister, Serial No. 200,770, filed April 7, 1938 of Hans Schuhmann, Serial No. 201,410, filed April 11, 1938 and of Vitaly Grosse, Serial No. 200,784, April 7, 1938, all of which applications are assigned to the same assignee as the present invention. In these co-pending applications other solutions to the same general problem of improving circuit interrupters of the air-break expulsion type are disclosed and claimed.

In accordance with the present invention, electric circuit interrupters having insulating structures disposed adjacent and in confining relation to an arc formed upon opening the circuit comprise a polybasic organic acid derivative which is normally solid (that is, solid at room temperature) and is capable of evolving an arc-interrupting gas in the heat of an arc. I prefer to use a dibasic carboxylic acid derivative which is capable of evolving nitrogen, preferably both carbon dioxide and nitrogen, under the arc heat. An example of such a substance is oxamide, which in the heat of the arc decomposes into gases and vapors, leaving practically no residue. This substance has the property of being less hygroscopic than oxalic acid, which is used in accordance with Burmeister U. S. Patent 2,089,050 in constructing arc-confining structures. Oxamide gives off sufficient carbon dioxide and nitrogen in the arc heat to quickly extinguish the arc.

My invention will be set forth more fully in the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Referring to the drawing the single figure thereof is an elevational view, partly in section, of an electric circuit breaker of the expulsion type to which the present invention is applicable.

There is shown merely by way of example an electric circuit interrupter, more particularly a circuit breaker having means such as the stationary contact 1 and the movable rod contact 2, for opening the circuit so as to form an arc, and an insulating structure 3 forming an arc chamber for closely confining the arc between the contacts. The insulating structure 3 consists of a tubular member closed at the fixed contact end and open at the other end for receiving the rod contact. Upon opening of the circuit, separation of the contacts 1 and 2 causes formation of an arc which decomposes some of the material of the arc chamber walls 3. The gas so formed is under considerable pressure by reason of the comparatively close fit of the rod contact 2 and the tube 3, with the result that when the rod leaves the tube a blast of gas is released as indicated for interrupting the arc.

The beneficial effects of amides as arc-interrupting materials may be obtained in a variety of ways. In accordance with a preferred embodiment of the invention an amide or a diamide of a polybasic carboxylic acid, more particularly an amide of a saturated dibasic carboxylic acid, for example oxamide, succinamide or the like, is employed as a filling material for artificial resins, particularly aminoplasts such, for example, as urea- or thio-urea-formaldehyde condensation products. The insulating structure 3 is formed of, or has its inner portion surfaced with a composition comprising such filled resinous mass. By using such filling material the mechanical properties, for example the tensile and impact strengths, of the shaped, hardened mass are improved.

Further, since the amide gives off nitrogen under the arc heat, as does also an aminoplast, the improvement in strength of the structure is accompanied by an improvement in arc-extinguishing properties. Thus, effective arc-quenching tubes of a size and strength to meet a wide variety of service conditions may be made.

Besides aminoplasts, other artificial resins may be used as the basic material for constructing the walls of the arc-extinguishing chamber. For example, I may suitably combine oxamide or the like with a modified or an unmodified alkyd resin as, for example, a modified or unmodified glyceryl-phthalate alkyd resin. An electric circuit interrupter comprising an insulating structure having walls comprising alkyd resin is disclosed and broadly claimed in the aforesaid co-pending application of Hans Schuhmann, Serial No. 201,410, and I make no broad claims to such insulating structures.

In addition to a normally solid amide or diamide, other filling materials may be incorporated in the artificial resin as desired or as conditions may require. For instance, in certain cases it is advantageous to incorporate in the resin a material capable of giving off oxygen under the arc heat, for example an inorganic peroxide as, for instance, magnesium peroxide, barium peroxide, and the like.

It is also possible to use an amide or a diamide of a polybasic carboxylic acid, for example oxamide, as the sole or main component of the walls of the arc-confining member. The powdered amide, with or without suitable binding or other additional materials, is shaped under high pressure. As examples of binding agents which may be used, I mention inorganic binders such as plaster of Paris, clay, etc., and organic binders such as highly oxidized oils, for instance linseed and China-wood oils, or prepolymerized artificial resin as, for example, an aminoplast.

A mechanically strong reinforcing tube composed, for instance, of a suitable fibrous material such as hard fiber, wool, paper, linen, etc., may be provided with an inner liner comprising oxamide or the like. Reinforcing materials of this kind also may be impregnated, in any suitable manner, with such amides or with compositions containing the same. Thus, the amide may be dispersed in, or emulsified with aminoplasts dissolved or colloidally suspended in water or other solvent, and the resulting composition used as an impregnant for the fibrous or other base material of which the insulating structure is formed. Thereafter the solvent is removed.

If the arc-quenching chamber is provided with a coaxially-arranged insulating filling member or pin, then the walls of such member exposed to the arc heat also may be made of materials such as hereinbefore described with reference to a main arc chamber or insulating tube.

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

1. An electric circuit interrupter comprising means for forming an arc, and an insulating structure disposed adjacent and in confining relation to said arc, the walls of said structure in proximity to said arc being surfaced with a composition comprising an amide of a saturated dibasic carboxylic acid.

2. An electric circuit interrupter comprising means for forming an arc, and an insulating tubular structure within which said arc is drawn, said tubular structure being in confining relation to said arc and having walls in proximity to said arc surfaced with a composition comprising oxamide.

3. An electric circuit interrupter including an arc-confining structure, the walls of said structure in proximity to said arc being surfaced with a composition comprising mechanically strong artificial resin filled with an amide of a saturated dibasic carboxylic acid.

4. An electric circuit interrupter including an arc-confining structure, the walls of said structure in proximity to said arc being formed of a composition comprising a mechanically strong artificial resin, oxamide and a material capable of giving off oxygen under the arc heat.

5. An electric circuit interrupter comprising means for forming an arc, and an insulating structure disposed adjacent and in confining relation to said arc, the walls of said structure in proximity to said arc comprising an aminoplast and oxamide.

6. An electric circuit interrupter including an arc-confining structure, said structure consisting of a composition comprising an aminoplast filled with oxamide and an inorganic peroxide.

7. An electric circuit interrupter comprising means for forming an arc, and an insulating structure disposed adjacent and in confining relation to said arc, said structure consisting of a composition comprising an alkyd resin and oxamide.

8. An electric circuit interrupter including an arc-confining structure, said structure consisting of a composition comprising a glyceryl-phthalate alkyd resin filled with oxamide and magnesium peroxide.

9. An electric circuit interrupter comprising means for forming an arc, and an insulating structure disposed adjacent and in confining relation to said arc, the walls of said structure in proximity to said arc being surfaced with a composition comprising an amide of a saturated dibasic carboxylic acid and a material capable of giving off oxygen under the arc heat.

PAUL NOWAK.