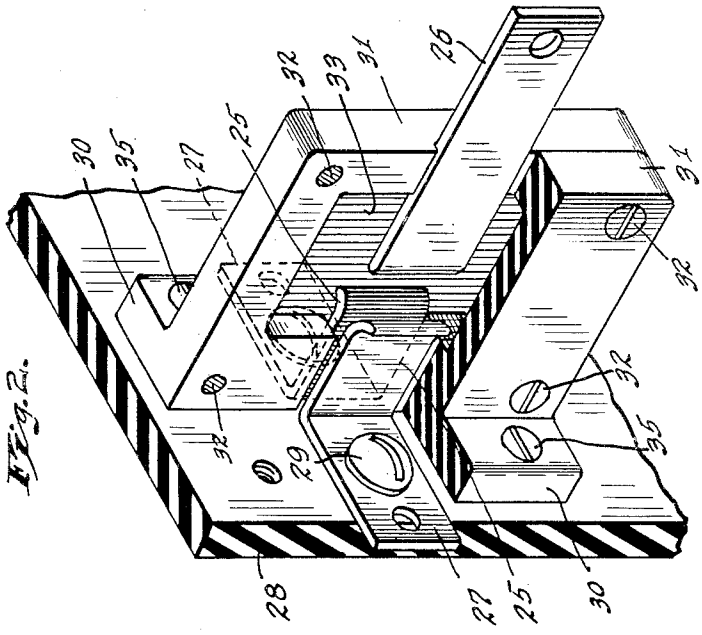
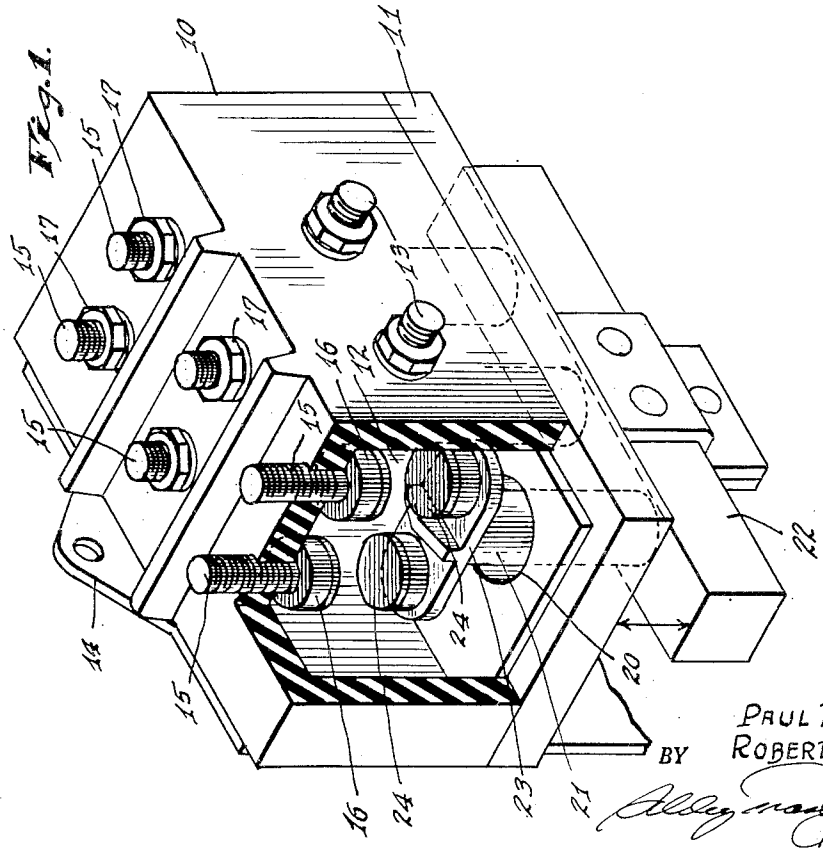
Oct. 23, 1956 P. W. JONES ET AL 2,768,264

ARC-SUPPRESSING DEVICE

Filed April 28, 1953





INVENTORS
PAUL W. JONES and
ROBERT E. WILKINSON,
BY
ATTORNEYS.

United States Patent Office

2,768,264

Patented Oct. 23, 1956

2,768,264

ARC-SUPPRESSING DEVICE

Paul W. Jones and Robert E. Wilkinson, Lafayette, Ind., assignors to Rostone Corporation, Lafayette, Ind., a corporation of Indiana

Application April 28, 1953, Serial No. 351,650

7 Claims. (Cl. 200—144)

This invention relates to devices and methods for suppressing electric arcs such as are formed upon the opening of switches or the melting of fuse-links carrying heavy electric currents. It has heretofore been proposed to suppress such arcs by the use of a shield which extends along the arc path and usually at least partially surrounds such path. The effectiveness of such shields depends upon their physical shape and also upon their composition. In many instances, the shield is, or forms part of, a switch enclosure or a fuse-link enclosure and has both structural and arc-suppressing functions to perform.

It is an object of the invention to produce an arc-suppressing shield having improved arc-suppressing characteristics. A further object is to produce a molding composition which can be employed to mold switch-enclosures, fuse-enclosures, or the like having improved arc-suppressing qualities. Still another object of the invention is to produce a non-ceramic molding composition from which strong and durable switch bases and fuse-enclosures can be molded without the employment of high temperatures. An additional object is to reduce the size of switch enclosures and the like.

An arc-suppressing shield or other device embodying our invention is characterized by the presence of a substantial proportion of an oxide or hydrate of either magnesium or aluminum. If the device is formed in whole or in part by molding, the composition of which it is formed will include a suitable organic or inorganic binder and a filler, the aluminum or magnesium oxide or hydrate constituting an ingredient of the filler. The proportions of such aluminum or magnesium oxide or hydrate may vary over wide limits, from about 5 percent to about 90 percent of the entire composition, depending on a number of other factors such as the nature of the binder, other ingredients, and the desired structural strength. An organic binder suitable for our purpose may be a resin of some type, such as a phenolic, urea, melamine, silicone, or poly-ester resin. Suitable inorganic binders would be calcium containing materials, such for instance as Portland cement or mixtures of shales, clays, and lime such as are set forth and described in United States Patent No. 1,852,672 to Peffer et al. With organic binders, it is frequently desirable to include asbestos along with the aluminum or magnesium oxide or hydrate as a filler, and asbestos may also be similarly employed in compositions including inorganic binders.

Any composition of the type just described may be employed in the molding of switch enclosures, fuse-enclosures, or other arc-suppressing shields. The compositions are adapted to the formation of such devices by cold-molding or non-ceramic processes in which the ingredients are mixed or molded at room temperatures or thereabouts and cured at slightly higher temperatures which are still well below the melting or "burning point" of the aluminum or magnesium oxide or hydrate; in which respect they distinguish from ceramic articles which, after molding, are subjected to "burning."

The accompanying drawing illustrates some devices in

which arcs are likely to occur, and which may embody portions made of our improved insulating material to suppress or interrupt any arcs which do occur:

Fig. 1 is an isometric view illustrating a switch having a housing, shown as partially broken away, which performs both structural and arc-suppressing functions; and

Fig. 2 is an isometric view showing a portion of a disconnect switch having an associated arc-suppressing shield embodying our invention.

The switch illustrated in Fig. 1, which is a three-phase switch, comprises an inverted box-like body **10**. The open bottom of the box is closed by a closure **11** having integral with it partitions **12** dividing the interior of the box into three compartments, one for each of the phases. Bolts or studs **13** extending through openings in the side wall of the body **10** and through alined openings in the partitions **12** retain the closure in position and secure the entire structure to a mounting plate **14**.

The upper wall of the body **10** is provided, in each compartment, with a pair of spaced openings adapted to receive the screw-threaded shanks **15** of contact members which, immediately below the upper wall of the enclosure, have heads **16** constituting fixed, spaced switch contacts. The contact members are held in place by nuts **17** on the threaded shanks **15**.

At each compartment, the closure **11** is provided with an opening **20** loosely receiving a post **21**, the several posts being attached in any convenient manner to a vertically movable contact carrier **22** located below the enclosure. At its upper end, each of the posts **21** carries an electrically conductive cross member **23** having at its ends a pair of contacts **24** adapted to co-operate with the fixed contacts **16** in the opening and closing of the switch.

Both the box-body **10** and the closure **11** with its integral partitions **12** may be formed of any of the compositions hereinafter described. Such compositions are electrically insulating in character and, in addition, possess the faculty of suppressing the arc which tends to form when the movable contacts **24** are moved out of engagement with the fixed contacts **16** by lowering of the contact-carrier **22**.

In Fig. 2, we have illustrated one set of contacts of a disconnect switch, such switch comprising a fixed contact in the form of a pair of opposed, spring jaws **25** and a movable contact in the form of a blade **26** insertable between the jaws **25** when the switch is closed. Each of the jaws **25** conveniently forms one leg of an L-shaped strip of metal the other leg **27** of which is secured to a switch base **28** as by a bolt **29**.

In the device of Fig. 2 the arc-suppresser, which is a simple shield having no structural function, comprises a pair of similar L-shaped parts each having a short leg **30** and a long leg **31**. The longer legs of the two shield-parts are held in engagement with each other, as by bolts **32**, and have their opposed faces recessed to receive the contact jaws **25** and the switch blade **26** and to provide a chamber **33** into which the contact jaws **25** and switch blade **26** extend. The shorter legs **30** of the two shield-portions are recessed to clear the legs **27** of the stationary contacts and the heads of the bolts **29**, and are secured to the switch base as by screws or bolts **35**.

In both the structures described, the arc which forms upon separation of the movable and stationary contacts is enclosed in a chamber the walls of which are molded of the compositions hereinafter described. In Fig. 2, the enclosure has only an arc-suppressing function to perform; but in Fig. 1 the structure additionally provides support for the stationary contacts **16**. Structural strength of the arc-suppressing material is therefore a more important factor in a device such as is shown in Fig. 1 than it is in the simple shield of Fig. 2.

Published by AsbestosClaims.Law
asbestosclaims.law/library/21726/2

Materials suitable for use in forming the enclosure 10—11 of Fig. 1 or the shield of Fig. 2 may have compositions such as are indicated by the following examples.

Materials embodying organic binders:

Example 1:
70% aluminum oxide, aluminum hydrate, magnesium oxide, or magnesium hydrate,
15% asbestos,
15% binder.

Example 2:
90% aluminum oxide, aluminum hydrate, magnesium oxide, or magnesium hydrate,
10% binder.

Example 3:
5% aluminum hydrate or magnesium hydrate,
65–85% other filler,
30–10% binder.

Example 4:
10% aluminum oxide,
60–80% other filler,
30–10% binder.

Example 5:
15% magnesium oxide,
55–75% other filler,
30–10% binder.

Materials embodying inorganic binders:

Example 6:
60% aluminum oxide, aluminum hydrate, magnesium oxide, or magnesium hydrate,
20% asbestos,
20% binder.

Example 7:
90% aluminum oxide, aluminum hydrate, magnesium oxide, or magnesium hydrate,
10% binder.

Example 8:
5% aluminum hydrate or magnesium hydrate,
45–75% other filler,
50–20% binder.

Example 9:
35% aluminum oxide,
15–45% other filler,
50–25% binder.

Example 10:
15% magnesium oxide,
20–50% other filler,
65–35% binder.

The substance designated "other filler" in certain of the above examples may be anything which will reduce the cost of the material or add structural strength to it. Substances suitable for use as such other fillers include fly ash, mica, barytes, zircon, silica, whiting, limestone, and asbestos.

The active arc-suppressing ingredients in the above examples may be used in commercial grades. The aluminum hydrates have the composition indicated by the formula Al_2O_3, $3H_2O$ or $Al(OH)_3$. Aluminum oxide suitable for use in our compositions may be a commercial calcined or tabular alumina, usually an aluminum hydrate calcined or heated to 1800°–3500° F., but preferably has not been fused. Fused alumina, which requires about 3700° F. for its formation, exists as crystals which are abrasive in character and result in excessive wear of molds. The magnesium oxide employed may be of any non-slaking commercial grade, including heavy-burned or dead-burned magnesia, or periclase. The magnesium hydrate, $Mg(OH)_2$ may be any commercial or technical grade of magnesium hydrate. In some instances it is practical to employ a magnesium hydrate formed by slaking the lighter-burned magnesias.

As will be noted by a comparison of Example 3 with Examples 4 and 5 or of Example 8 with Examples 9 and 10, the hydrates are more effective arc-suppressing substances than are the oxides. When the arc-suppressing ingredient is present in relatively small proportions the aluminum compounds give somewhat better results with organic binders than do the magnesium compounds, whereas the reverse is true when the binder is inorganic in character.

In general, the selection of a composition suitable for any specific use will depend upon a number of factors, including availability and cost of materials and the function which the material is required to perform in use. The materials embodying organic binders are generally stronger than those embodying inorganic binders and, cost permitting, are usually preferred for devices which have structural functions to perform or for uses where the device will be subjected to shocks or impacts of any kind. High percentages of the arc-suppressing ingredient tend to produce structural weakness, especially when that arc-suppressing ingredient is magnesium oxide.

In cold-molding arc-suppressing devices employing organic binders, the ingredients are preferably first blended in a dry state. The blended dry mixture is then wetted with an agent capable of liquefying or softening the binder, and mixing is continued. The wet mixture is then granulated and molded under pressure into the desired shape. Following the molding operation, the devices are cured in baking ovens under elevated temperature which gradually increases to a maximum of 300 to 400° F.

Compositions embodying organic binders may alternatively be made by a hot-molding process. In that event, a wet mixture produced as above set forth would be dried before granulating, and the dry granular product molded into an article of the desired form under heat and pressure, as in conventional compression-molding methods. Since fluidity of a hot-molded mixture depends on softening of the binder, the binder content of such mixtures should preferably not be less than about 35%.

In manufacturing devices of compositions embodying inorganic binders, the ingredients are first blended dry, water is added, and mixing continued. After a granulating step, the composition is molded into the desired form, and the molded devices are cured either by aging or by subjecting them to saturated steam under pressure. After drying at 400° F. or thereabouts, the devices are immersed briefly in molten wax to impregnate them and reduce the tendency of the material to absorb moisture.

In referring to devices embodying our invention as arc-suppressing, we do not imply that they prevent arcing. They do, however, tend to quench any arc that forms, they greatly reduce the energy represented by the existence of the arc, and in switching mechanisms which operate so frequently as to cause temperature rises and a maintained state of ionization in the atmosphere within the switch chamber they greatly delay the creation of conditions which result in a permanent arc. In compositions which include an organic binder, our arc-suppressing substances reduce the tendency of the binder to carbonize on the surface of the material and form a conductive path. As a result of these characteristics the spacing provided between switch contacts can be diminished, and it is thus possible to reduce the over-all size of switch mechanisms of any given rating.

While it has been indicated above that increased proportions of the magnesium or aluminum oxide or hydrate will, as a general rule, result in increased arc-suppressing ability, that indication is subject to the qualification that for aluminum oxide, and to a lesser extent for magnesium oxide, there is an optimum proportion. That optimum proportion, for both oxides and irrespective of whether the binder is organic or inorganic, lies in the neighborhood of 80 to 85%. A composition containing an oxide-proportion greater than the optimum will still possess an improved arc-suppressing effect, but may be somewhat less effective than one containing the optimum concentration.

Published by AsbestosClaims.Law
asbestosclaims.law/library/21726/3

It will be understood that the various examples set forth above are merely illustrative. Examples 2 to 5, and 7 to 10, represent extremes of practical ranges of proportions for molding compositions incorporating the respective arc-suppressing substances mentioned.

We claim as our invention:

1. In electrical apparatus, two electroconductive elements between which an arc may form, a molded insulating element having a surface extending along and close to the arc-path between said electroconductive elements, at least one of said electroconductive elements being supported from said molded element, said molded element being rigid and possessed of sufficient structural strength to be self-supporting, the material of said molded element being a composition comprising a water-insoluble binder and an arc-suppressing substance selected from the class consisting of the oxides and hydrates of aluminum and magnesium, said binder constituting at least ten percent of said composition.

2. The invention of claim 1 with the addition that said arc-suppressing substance is one of said hydrates and constitutes between five and ninety percent of the composition.

3. The invention of claim 1 with the addition that said binder is inorganic, said arc-suppressing substance being one of said oxides and constituting between ten and ninety percent of the composition.

4. The invention of claim 1 with the addition that said composition comprises about seventy percent of said arc-suppressing substance, about fifteen percent of asbestos, and about fifteen percent of a binder.

5. The invention of claim 1 with the addition that said binder is organic, said arc-suppressing substance being an aluminum compound.

6. The invention of claim 1 with the addition that said binder is organic, said arc-suppressing substance being one of said hydrates.

7. The invention of claim 1 with the addition that said binder is organic, said arc-suppressing substance being an aluminum hydrate.

References Cited in the file of this patent

UNITED STATES PATENTS

1,828,292	Paul	Oct. 20, 1931
2,240,007	Power	Apr. 29, 1941
2,253,719	McMahon	Aug. 26, 1941
2,325,416	McMahon	July 27, 1943
2,386,659	Clark	Oct. 9, 1945
2,551,830	Dryer	May 8, 1951

Published by AsbestosClaims.Law
asbestosclaims.law/library/21726/4