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CAST-IN REACTOR TIE RODS

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Fig. 1.

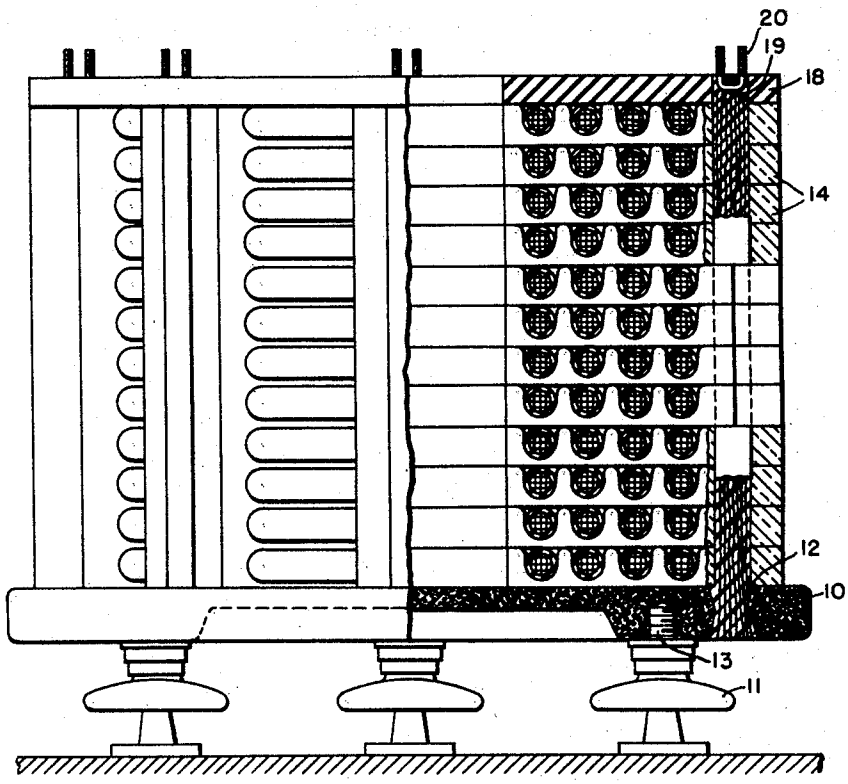
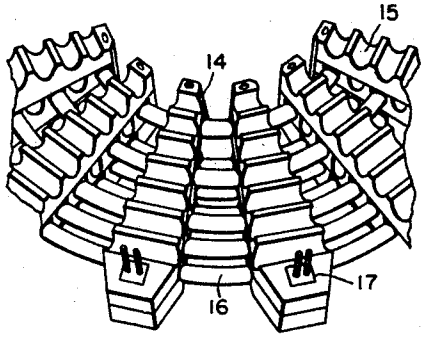


Fig. 2.



WITNESSES

Edwin E. Bassler

W. W. L. Groome

INVENTORS

Martin L. Seidel

& John H. Fooks

BY

Ezra W. Hayes

ATTORNEY

United States Patent Office

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CAST-IN REACTOR TIE RODS

Martin P. Seidel and John H. Fooks, Sharon, Pa., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

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The invention relates generally to reactors and, more particularly, to tie rods for holding the members of reactors in predetermined relationship.

In order to meet the needs of the trade, reactors have been built higher and higher with the result that it has been difficult to provide tie rods of the required length having adequate strength to hold the members of the reactor in the proper predetermined relationship. Since the reactors have to be built high in the interest of space factor, it is desirable to get rid of one or both of the concrete plates that are usually employed for supporting and capping the cleats provided for the conductors.

An object of the invention is to provide non-conductive members of the required length for tying the members of the reactors to one another in a predetermined relationship.

It is also an object of the invention to provide, in conjunction with the tie rods, reactor members which can be utilized in lifting the reactor to facilitate the erecting of it in the desired location.

Other objects of the invention will, in part, be obvious and will, in part, appear hereinafter.

The invention, accordingly, comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is a view in side elevation of a reactor with parts cut away to show an embodiment of the invention; and

Fig. 2 is a view in perspective showing how the cleats and the members for tying the cleats to one another are arranged.

Referring now to the drawing and Fig. 1 in particular, the reactor illustrated comprises a base **10** supported on a plurality of legs **11**. In this embodiment of the invention, the base **10** comprises a circular plate or disc of some suitable material, such as reinforced concrete.

In preparing the base **10**, openings **12** are provided for a purpose to be described hereinafter. As illustrated in this embodiment, the openings **12** in cross-section simulate two truncated cones meeting about the middle of the reactor base.

The legs **11** may be of any well known construction used in this art. In this particular embodiment of the invention, the legs are shown with upper threaded ends **13** embedded in the concrete base. In designing the legs, it is necessary to make them of adequate size and strength to carry the load. These reactors are usually quite heavy and are subject to stresses which necessitate the legs being made quite substantial.

In casting the concrete base **10**, the openings **12** will be arranged in a circle a predetermined distance from the center of the base. The distance the openings **12** are

from the center of the base will depend on the size of the cleat it is desired to employ. The angular spacings of the openings **12** around the circle will depend on the size of the reactor, and, therefore, the stresses to which the tie rods or members to be described hereinafter will be subjected.

The cleats **14**, which are provided with grooves **15** for receiving the conductor **16** will be of any of the well known designs utilized in building reactors. It is desirable to have these cleats made from some material which has substantial shock resistance. Good results have been obtained by employing porous ceramic materials impregnated with a suitable resin. This greatly increases the shock resistance of the resins. Since impregnated cleats of this type are well known in the art, it will not be necessary to set forth in detail the resins employed.

Considerable success has also been experienced with cleats made from transite board which has good insulating characteristics and which may be readily machined to give the shape and size of cleat required. Further, this material may be machined to provide the grooves for the conductors.

Cleats have also been molded from Fiberglas impregnated with polyester resins. The molding of cleats has many advantages. It is economical and gives accurate shapes.

The cleats **14** are provided with openings **17** near the outer end. These openings may be of any predetermined shape and will be made large enough to accommodate a tie member of adequate strength for the particular design. As shown in Fig. 2, the cleats **14** are disposed radially on the base **10**, and as the conductors **16** are wound in position, the cleats **14** are stacked. In stacking the cleats, care must be taken to align the openings **17** with the openings **12** in the base member **10**. Therefore, when the cleats and conductors are finally assembled, the stacking of the cleats, as described, will provide a plurality of openings around the reactor for receiving the tie members.

In practice, after the conductors have been wound in position in the cleats **14**, the assembled members clamped between metal plates are dipped in some suitable impregnating varnish. The number of dips in the resin will depend on the amount of resin it is desirable to apply. Usually two or three coats is adequate. The varnish is then heated to effect polymerization or curing. The metal plates are then removed, and the cleats and conductors assembled on the base with the openings in alignment with the openings **12** in the base. A top disc or cap **18** of a material, such as transite board, is then placed on the assembly. Openings **19** are provided in the cap and so located as to align with the openings in the cleats **14**. However, a top disc is not essential. Blank cleats, that is, cleats not grooved may be applied to each stack of cleats and employed to hold the conductors in place.

In order to tie the base cleats and the top member **18** or blank cleats together in a predetermined relationship, non-magnetic U members **20** with openings or eyes in the arms of the U members **20** are supported on the cap or blank cleats **18**, the cleats being the equivalent of the cap. The eyes or openings provided in the arms of the U members are provided for receiving hooks or the like for lifting the reactor. Since the U members **20** will have to carry the weight of the reactor, they must be made from some suitable metallic material having adequate strength. Good results have been obtained by using manganese bronze members **20**.

After the U members **20** have been supported as shown in alignment with the openings through the reactor,

filamentary or fibrous members or threads are suspended from the U members and depend through the openings to the bottom of the base member **10**. Glass string has been found very satisfactory for use as a fibrous member since it has appreciable tensile strength. For some purposes, it has been found satisfactory to use hemp and synthetic fibers. Other fibers of this kind are well known in the art and may readily be selected by a designer. The fibers may be supported in any suitable manner, and it has been found satisfactory merely to loop them over the U members **20**. Of course, it is desirable that the fibers be flared outwardly or spread in the opening in the interest of greater strength in the final rods.

After the fibers have been disposed in the openings in the reactor, a suitable resinous material is flowed into the openings to envelop the fibrous material and fill the opening to give a solid tie member. Usually, the resins are flowed in from the top, and any suitable means may be provided for stopping the flow of resin at the bottom of the base **10** so as to completely fill the opening. A rubber pad compressed by the weight of the structure will close the openings effectively.

In selecting a resin, best results can be obtained by employing a resin that will wet the fibers and the faces of the cleat defining the opening and also the varnish film that may be in the openings. Good results have been obtained using epoxy resins and polyester resins. These epoxy resins are particularly satisfactory since their shrinkage is low. With certain epoxy resins, it has been found that the shrinkage is of the order of three tenths of one percent. This shrinkage may be considerably reduced by admixing with such fillers as silica, alumina, magnesia, or aluminum (powdered). Further, these resins have high adhesion to varnish which is bound to get into the openings through the reactor when it is diped in varnish.

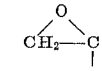
In order to give a better explanation of the epoxy resins that may be utilized, the following details are given. The resinous polymeric epoxides, also known as glycidyl polyethers, employed in accordance with the present invention may be prepared by reacting predetermined amounts of at least one polyhydric phenol and at least one epihalohydrin in an alkaline medium. Phenols which are suitable for use in preparing such resinous polymeric epoxides include those which contain at least two phenolic hydroxy groups per molecule. Polynuclear phenols which have been found to be particularly suitable include those wherein the phenol nuclei are joined by carbon bridges, such for example as 4,4'-dihydroxy-diphenyl-dimethyl-methane (referred to hereinafter as bis-phenol "A"), 4,4'-dihydroxy-diphenyl-methane and 4,4'-dihydroxy-diphenyl-methane. In admixture with the named polynuclear phenols, use also may be made of those polynuclear phenols wherein the phenol nuclei are joined by sulfur bridges, such for example as 4,4'-dihydroxy-diphenyl-sulfone.

While it is preferred to use epichlorohydrin as the epihalohydrin in the preparation of the resinous polymeric epoxide starting materials of the present invention, homologues thereof, for example, epibromohydrin and the like also may be used advantageously.

In the preparation of the resinous polymeric epoxides, aqueous alkali is employed to combine with the halogen of the epihalohydrin reactant. The amount of alkali employed should be substantially equivalent to the amount of halogen present and preferably should be employed in an amount somewhat in excess thereof. Aqueous mixtures of alkali metal hydroxides, such as potassium hydroxide and lithium hydroxide, may be employed although it is preferred to use sodium hydroxide since it is relatively inexpensive.

The resinous polymeric epoxide, or glycidyl polyether of a dihydric phenol, suitable for use in this invention has a 1,2-epoxy equivalency greater than 1.0. By epoxy

equivalency reference is made to the average number of 1,2-epoxy groups



contained in the average molecule of the glycidyl ether. Owing to the method of preparation of the glycidyl polyethers and the fact that they are ordinarily a mixture of chemical compounds having somewhat different molecular weights and contain some compounds wherein the terminal glycidyl radicals are in hydrated form, the epoxy equivalency of the product is not necessarily the integer 2.0. However, in all cases it is a value greater than 1.0. The 1,2-epoxy equivalency of the polyethers is thus a value between 1.0 and 2.0.

It has been found that these resins reinforced with fibrous materials, such as glass string, have a tensile strength of the order of 30,000 pounds per square inch compared with 6,000 pounds per square inch for hickory and 10,000 pounds per square inch for micarta, the latter two materials having been used heretofore as independent tie rods in the building of reactors.

A resinous material for filling the opening through reactors and enveloping the fibrous materials, such as glass string, which has been found satisfactory, comprises a mixture of 30 parts of silica, 100 parts of liquid epoxy resin and 7 parts of diethylene triamine or triethylene tetramine. The pigment silica is dispersed into or admixed with the vehicle in some well known manner, such as by the use of a dispersion mixer or three roll paint mill. The amine is stirred into the pigmented resin just prior to use by means of a hand-manipulated paddle or motor-operated stirrer. The mixture is fluid and will flow readily enough to penetrate the glass reenforcing string. It has good adhesion to transite and impregnated porcelain cleats. It has also been found that the mixture has good pot life and will cold-set in 24 hours at room temperature.

It will be readily appreciated that many other resins and cross linking agents may be utilized. For example, successful results were obtained by the use of meta phenylene diamine instead of diethylene triamine as well as combinations of the two. We prefer one part diethylene triamine to two parts of meta phenylene diamine by weight.

Since certain changes may be made in the above article and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In a reactor, in combination, a base member, a plurality of cleats carried by the base member, windings disposed on the cleats and a top carried by the cleats, the base member, cleats and top all being made of insulating material and having aligned openings extending substantially vertically therethrough, filamentary members depending through the openings and a resinous material applied to the filamentary members bonding the filamentary members to one another and to the base member, cleats and top member thereby tying the base member, cleats and top member solidly in a predetermined relationship to one another.

2. In a reactor, in combination, a base member, a plurality of cleats carried by the base member, windings disposed on the cleats and a top carried by the cleats, the base member, cleats and top all being made from insulating material and having aligned openings extending substantially vertically therethrough, a plurality of fibers depending through the openings and a resinous material enveloping the fibers bonding them to one another and to the base member, cleats and top thereby ty-

ing the base member, cleats and top to one another in a predetermined relationship.

3. In a reactor, in combination, a base member, a plurality of cleats carried by the base member, windings disposed in the cleats and a top member carried by the cleats, the base member, cleats and top member being made of insulating material and having aligned openings extending substantially vertically therethrough, a non-magnetic member carried by the top member, fibers depending from the non-magnetic member through the openings and a resinous material flowed into the openings to bond the fibers to one another and to the members of the reactor thereby tying the base member, cleats, top member and non-magnetic member to one another in a predetermined relationship.

4. In a reactor, in combination, a base member, a plurality of cleats carried by the base member, windings disposed in the cleats and a top carried by the cleats, the base member, cleats and top all being made from insulating material and having substantially aligned openings extending vertically therethrough, glass fibers depending through the openings, an epoxy resin applied to the glass fibers enveloping them and bonding them to one another and to the base member, cleats and top thereby tying the base member, cleats and top to one another in a predetermined relationship.

5. In a reactor, in combination, a base member, a plurality of cleats carried by the base member, windings disposed in the cleats and a top member carried by the cleats, the base member, cleats and top all being made from insulating material and having substantially aligned openings extending vertically therethrough, non-magnetic U-shaped members carried by the top, one U-shaped member being disposed in alignment with each of the vertical openings, glass fibers connected to the U-shaped members and extending into the openings and a resinous bonding material consisting of silica, a liquid epoxy resin and diethylene triamine filling the openings enveloping the glass fibers bonding the fibers to one another and cooperative to tie the base member, cleats and top to one another in a predetermined relationship.

6. In a reactor, in combination, a base member, a plurality of cleats carried by the base member, windings disposed in the cleats and a top member disposed above the cleats, the base member, cleats and top member all being made from insulating material and having substantially aligned openings extending vertically therethrough, non-magnetic members carried by the top member, one being disposed in alignment with each opening, glass fibers depending from the non-magnetic members through the openings, a resinous bonding material applied to the glass fibers in the openings bonding them to one another and to the cleats, base member and top member, the glass fibers and resinous material serving to tie the base member, cleats and top member to one another in a predetermined relationship to provide a strong unitary structure, the non-magnetic members presenting means for engaging the reactor to lift it and move it around.

7. In a reactor; a base member; a plurality of insulating members stacked on said base member, each of said insulating members carrying an electrical winding; a top member; said base member, said insulating members and said top member each having a plurality of holes therein which substantially align from the top to the bottom of said reactor; a plurality of filamentary members extending through said aligned holes substantially from the bottom to the top of said reactor; and plastic material completely filling said holes and bonding to said filamentary members to provide a tie rod for holding said base member, said insulating members and said top member in assembled relationship.

8. In a reactor; a plurality of stacked electrical coils, said coils being supported by insulating members, each of said insulating members having a plurality of holes therein, said holes in each insulating member being substantially in alignment with the holes in each other so as to provide a continuous opening through said insulating members; filamentary members located in said continuous opening and extending substantially the entire length of said continuous opening, and plastic material substantially filling said continuous opening and bonding said filament members together to provide a tie rod for holding said insulating members in stacked relationship.

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