

Aug. 14, 1945.

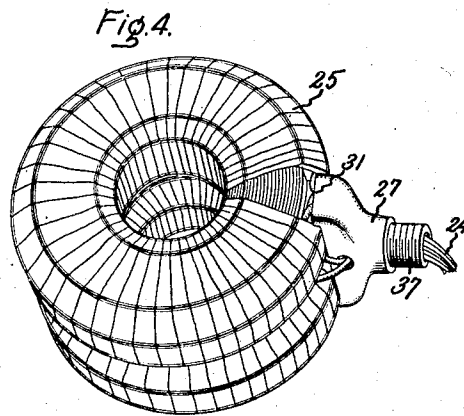
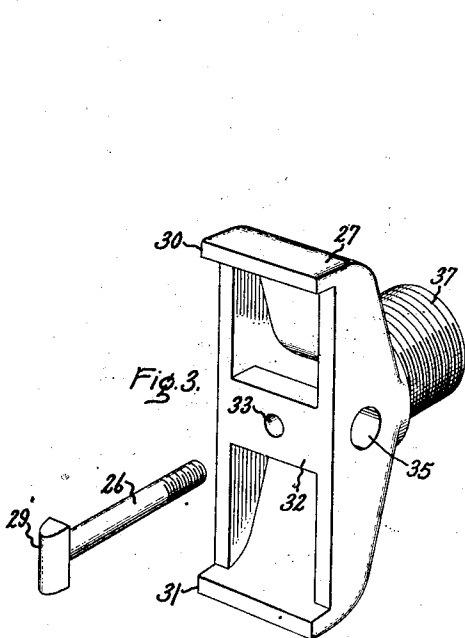
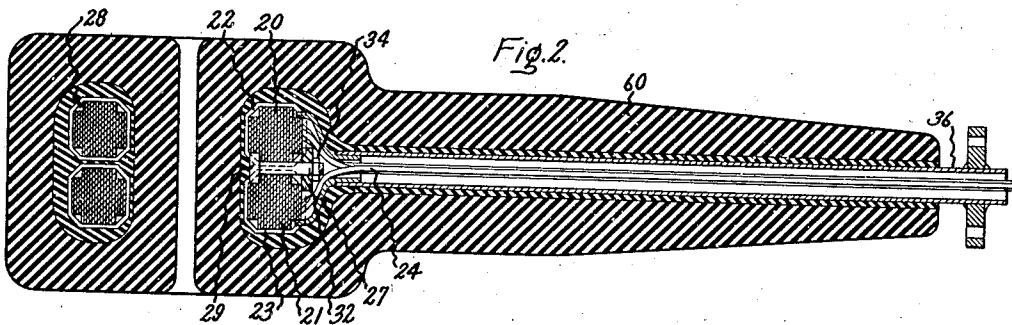
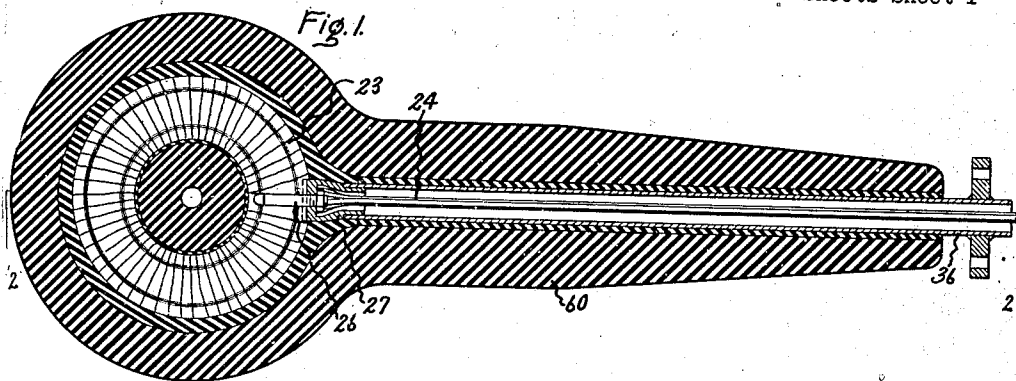
E. H. BRINK

2,382,199

ELECTRIC APPARATUS

Filed June 9, 1942

2 Sheets-Sheet 1



Inventor:
Edwin H. Brink,
by *Harry E. Durham*
His Attorney.

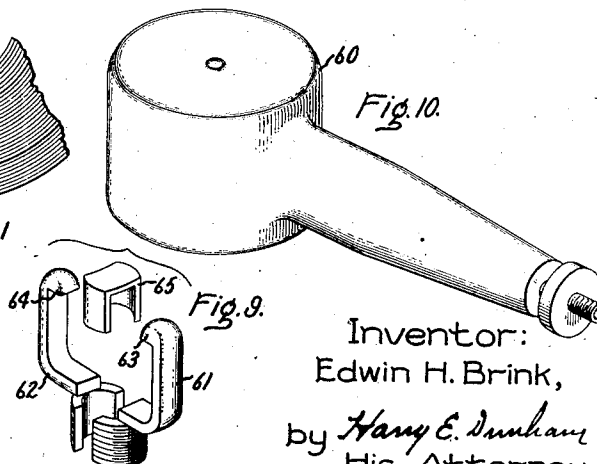
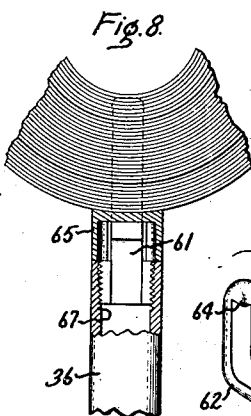
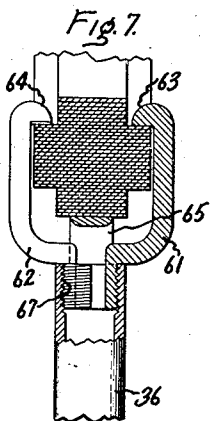
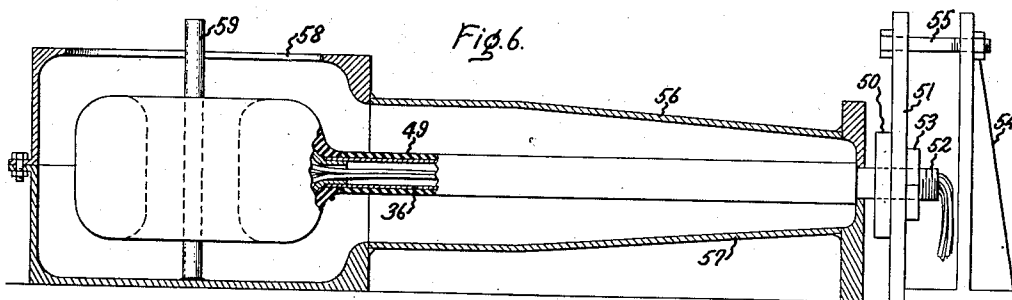
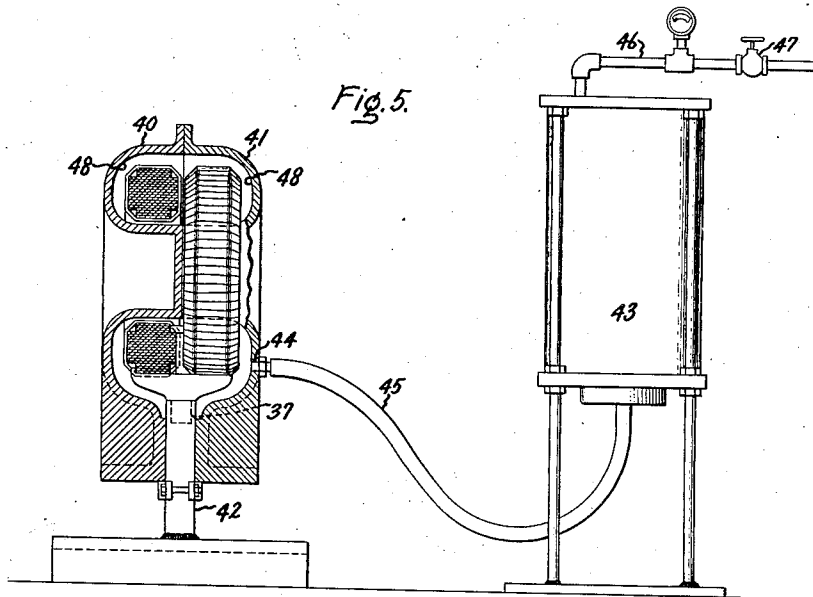
Aug. 14, 1945.

E. H. BRINK
ELECTRIC APPARATUS

2,382,199

Filed June 9, 1942

2 Sheets-Sheet 2



Inventor:
Edwin H. Brink,
by *Harry E. Dunham*
His Attorney.

UNITED STATES PATENT OFFICE

2,382,199

ELECTRIC APPARATUS

Edwin H. Brink, Drexel Hill, Pa., assignor to General Electric Company, a corporation of New York

Application June 9, 1942, Serial No. 446,330

9 Claims. (Cl. 175—358)

My invention relates to an electric apparatus, and to a method of applying coverings of sponge latex and a cast resinous insulation to the apparatus.

Electric apparatus, such as high potential transformers, have been insulated in various ways, such as by applying coatings of cellulosic insulating materials around the windings. Transformers, and particularly high potential instrument transformers, have been insulated by surrounding the core and secondary winding with a cast resinous insulating material and by providing a layer of cushioning material around the core and secondary winding and inside the cast resinous material, as is described and claimed in Patent 2,222,729 Ver Planck & Brink, patented November 26, 1940, and assigned to the same assignee as this present invention.

It is therefore an object of my invention to provide an improved electric apparatus structure which will facilitate the application of a cast insulating covering therefor.

Another object of my invention is to provide an improved core clamping and supporting structure for an electrical apparatus.

A further object of my invention is to provide an improved electric induction apparatus having a cast synthetic resinous insulating covering.

Further objects and advantages of my invention will become apparent from the following description referring to the accompanying drawings, 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.

In the drawings Fig. 1 is a sectional side elevation of a relatively high potential transformer which is provided with an embodiment of my invention; Fig. 2 is a sectional side elevation taken along the lines 2—2 of Fig. 1; Fig. 3 is an exploded perspective view of the core clamping structure employed in the transformer illustrated in Figs. 1 and 2; Fig. 4 is a perspective view, in partial section, of the pair of coaxial cores of Figs. 1 and 2 being provided with the clamping structure illustrated in Fig. 3; Fig. 5 illustrates an apparatus which is employed in my improved method of casting a sponge latex covering around the core and secondary winding illustrated in Fig. 4; Fig. 6 is a side view in partial section illustrating the transformer after it has received a coating of sponge latex and being surrounded with a mold for casting the synthetic insulating covering; Fig. 7 is a sectional side elevation of a portion of a core provided

with a modification of the core clamping arrangement illustrated in Fig. 3; Fig. 8 is a sectional side elevation of the structure illustrated in Fig. 7 from a view 90 degrees disposed from that of Fig. 7; Fig. 9 is an exploded perspective view of the core clamping structure employed in Figs. 7 and 8; and Fig. 10 is a perspective view of a transformer insulated according to my invention.

In the arrangements illustrated in the drawings I have shown my invention as applied to a high voltage instrument transformer, but it is to be understood that my invention may be employed with any other suitable electrical apparatus. In casting an insulating covering around a core structure, and particularly an elongated structure, it was found desirable to support the apparatus in a horizontal position within a mold so that the casting liquid would have a minimum depth and therefore minimize the possibility of bubble formation during the casting operation. In order to be able to relatively rigidly support the core structure which is attached to one end of a supporting column, from the opposite end of the supporting column, I provide a core clamping structure including relatively rigid members which cooperate with the core members and one end of the column member so that the elongated core structure may be supported relatively rigidly and in a cantilever position. As described in the above-mentioned Ver Planck & Brink patent, it is desirable to place a layer of cushioning material between the resinous insulating body and the metallic core so as to prevent shrinkage stresses in the cast resinous body due to the different coefficients of expansion of the cast resin and metal. I have found that an efficient way of accomplishing this is to cast a covering of sponge latex around the metallic portions and coat the latex cushion with a non-porous and flexible film such as pre-vulcanized latex so as to insure an impervious surface which will minimize the penetration of the liquid insulating resin during casting of the resin. It was found, however, that in casting a sponge rubber around an irregular object such as a toroidal shaped core with a tubular shaped column, the sponge coating was susceptible of tearing upon removal of the mold. However, when the mold is composed of suitable material, such as aluminum, the inner surface of which being highly polished, and when this surface is coated with a glossy baked finish, upon allowing the initial set of the sponge rubber after casting, my improved mold may be removed without tearing the sponge

latex covering. The so covered apparatus may then be placed in a substantially horizontal position and surrounded with another mold for the casting of the synthetic resinous insulating material.

Referring more particularly to Figs. 1 and 2 of the drawings I have illustrated a high tension transformer which finds efficient application as an instrument transformer or for connection in relay circuits of high potential breakers. The structure includes a core structure having a pair of coaxially arranged cores 20 and 21 which may be made in any suitable manner such as being wound from a ribbon of silicon steel. Suitable windings 22 and 23 surround the core members 20 and 21, the windings having any suitable number of leads 24. Suitable insulation 25 in the form of a varnished cambric tape may be employed around each of the core and coils, as will be seen in Fig. 4.

In order to relatively rigidly support the cores in a coaxial relationship I provide a core clamping structure including a pair of relatively rigid members 26 and 27, as will be seen in Fig. 3. It will be seen in Fig. 2 that the cores have a cruciform cross section so as to provide stepped portions 28 at the four corners thereof. The T-shaped bolt 26 is provided with a head 29 which cooperates with adjacent portions or adjacent stepped portions at the inner periphery of the pair of core members, as is illustrated in Fig. 2. Also, the bracket portion 27 is provided with outwardly extending portions 30 and 31 for clamping over the sides of the cores opposite to the portions cooperating with the member 29 and at the outer periphery of the core structure, as will be seen in Fig. 2. The bracket 27 is also provided with a bridge portion 32 having an opening 33 for receiving an end of the bolt 26, and when the relatively movable or adjustable core clamp members 26 and 27 are connected together and tightened with a nut 34, as will be seen in Fig. 2, and with the core clamp members cooperating with opposite sides of the cores, a relatively rigid unit is thereby provided. The bracket 27 also may be provided with holes 35 to accommodate the leads 24.

In order to support the pair of core members with the clamping structure, the clamping structure may be attached to any suitable support, and in the arrangement illustrated in the drawings the bracket member 27 is attached to one end of a column or tubular member 36 by co-operable threads 37 on the outer surface of a portion of the bracket member 27 and by threads at one end of the inner surface of the tubular member 36. With such a construction it will be seen that the core members with the core clamping structure relatively rigidly supported thereto is also relatively rigidly supported to one end of the column member 36.

As is described in the above-mentioned Ver Planck & Brink patent, when providing a covering of insulating resinous material around a metallic object such as a transformer core, it is desirable to place a cushioning layer of cork, fabric materials, or sponge rubber, between the object and the resinous covering so as to minimize the possibility of cracks in the covering during and after curing thereof due to the different expansion characteristics of metal and usual synthetic resinous materials. I have found that an efficient cushioning layer may be provided by a sponge latex covering which may be molded by an improved low pressure casting procedure

which will be described below, and which does not require heat, high pressure molds, or laborious finishing operations. That method forms the subject matter of and is claimed in my divisional application Serial No. 565,916, filed November 30, 1944 and assigned to the assignee of this application. Another advantage of my improved sponge latex covering is that the resiliency or sponginess can be controlled so as to produce a cushion which will not collapse under pressures encountered in the casting procedure, and the latex covering also has a high compression ratio at relatively low pressures.

Furthermore, when a sponge latex is cast in my improved manner a sponge covering is obtained which will not tear during the removal of the mold.

Referring to Fig. 5 I have illustrated a pair of mold portions 40 and 41 which may be suitably attached together around the core structure with the core clamping arrangement, which structure is illustrated in Fig. 4. In order to support the core structure in such a manner a tube 42 may be temporarily placed over the end 37 of the bracket, as will be illustrated in Fig. 5. It is to be understood, however, that if desired the long tube 36 may be attached and the structure placed in a mold similar to that shown in Fig. 5 instead of employing a relatively short tube 42 which will be later removed. Liquid uncured foamed latex may then be placed in the tank 43, the tank being connected to a port 44 in the mold by a hose 45. Suitable pressure such as air pressure may be applied to the top of the tank 43 through a pipe 46 and upon opening a valve 47 the liquid latex will be forced into the space between the inner surface of the mold portions and the core and coil of the electrical apparatus. The mold portions 40 and 41 are then allowed to remain around the sponge latex for a sufficient time, such as for about 30 minutes so as to allow the latex to have an initial set. The mold portions 40 and 41 are then removed and the latex covering vulcanized and dried in any suitable manner, such as by placing in an oven.

In casting sponge latex material around such an irregular object as a toroidal shaped core, it was found when ordinary molds were employed that the latex coating would tear and disintegrate upon the removal of the mold, as portions of the latex coating would stick to the inner surface of the mold rather than cohere to the remainder of the latex covering. In order to overcome this difficulty, I have found that by employing a mold of suitable material such as aluminum with the inner surface thereof polished and by applying a glossy surface 48 on the inner periphery of the mold, sponge latex may be cast around irregular objects and allowed to initially set and the mold removed without tearing the latex covering. This glossy finish may be obtained in any suitable manner, such as by coating the inner surface of the molds which have been previously polished with a suitable varnish material such as an alkyd resin, and then baking the surface to provide a glossy non-porous finish.

After the sponge latex coating has been applied to the core and coils and the clamp member, the tube 42 may be removed and the column 36 attached to the threaded end 37 of the bracket member 27. Suitable cushioning material may be placed on the column 36 such as by casting latex around it in the same manner as is shown

in Fig. 5 or by winding a covering of cork 49 around the surface thereof.

When casting a synthetic resinous material around a body such as an electric apparatus structure having an elongated shape, such as that disclosed in the drawings, it was found desirable to mount the apparatus in a horizontal position so that when pouring the liquid resinous material it would have a minimum depth and thereby minimize the possibility of bubble formation during the casting operation. Since the core structure for a relatively high voltage transformer such as one for a 69-kv. rated voltage of the type illustrated in Figs. 1 and 2 is relatively heavy, a very rigid and strong core clamping structure must be provided so that the apparatus may be mounted in a horizontal position from one end of the column member 36. The core clamping structure as illustrated in Fig. 3 not only supports a pair of core members in a coaxial position but also relatively rigidly supports them on the end of the column 36. The opposite end of the column member is provided with a shoulder 50 for attachment against a vertical supporting member 51, as is illustrated in Fig. 6. This may be accomplished in any suitable manner such as by threading the outer end 52 of the column 35 and by screwing a nut 53 on the side of the support 51 opposite to that adjacent the shoulder 50 so as to relatively rigidly support the outer end of the column 36 on the supporting member 51. The supporting member 51 may be rigidly supported in a substantially vertical position, such as through a base member 54 and a bolt member 55. A suitable mold structure including portions 56 and 57 may be placed around the core structure and column 36 which have the cushioning covering, the mold portion 56 having an opening 58 through which the liquid insulating material may be poured. A rod member 59 may be attached to the mold portion 57 and so positioned with respect to the toroidal shape cores that when the core structure is placed as illustrated in Fig. 6, the rod 59 will pass through the opening of the pair of coils on their axes. Insulating synthetic resin of any suitable type, such as a phenolic condensation product, may then be poured into mold through the opening 58 and allowed to set so as to provide an insulating covering 60 around the core structure and column 36 as is illustrated in Fig. 10.

In Figs. 7, 8, and 9 I have illustrated an improved and convenient core clamping arrangement for relatively rigidly supporting a single core structure on the end of the column member 36. This structure includes a pair of bracket members 61 and 62 which have inwardly extending portions 63 and 64, respectively, cooperable with the stepped portions of the inner periphery of the core member and a stop or saddle member 65 cooperable with the outer periphery of the toroidal shape core member. As will be seen in the exploded perspective view of Fig. 9, the brackets 61 and 62 and the saddle member 65 cooperate to form a tubular member with threads on the tubular end portions of the bracket members 61 and 62. These threads cooperate with threads 67 on the inner surface of the column 36 so that upon tightening the threads, the opposite surfaces of the core member will be clamped between the stop 65 and the inwardly extending portions 63 and 64. In this manner it will be seen that a single toroidal core member may be

relatively rigidly supported on the end of the column member 36.

Although I have shown and described particular embodiments of my invention, I do not desire to be limited to the particular embodiments described, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

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

1. In an electric induction apparatus, a core structure, and a core supporting means including a tubular member, a pair of relatively rigid clamping members cooperable with opposite sides of said core structure at the inner and outer peripheries thereof for relatively rigidly attaching one end of said tubular member to said core structure so that said core may be supported from the opposite end of said tubular member in a substantially horizontal position during the application of a plastic insulating covering to said core structure.

2. In an electric induction apparatus, a core structure, and a core supporting means including a tubular member, relatively rigid clamping means cooperable with opposite sides of said core structure at the inner and outer peripheries thereof and adjustably connected to one end of said tubular member so that said core structure may be relatively rigidly supported from the opposite end of said tubular member in a substantially horizontal position during application of a plastic insulating covering to said core structure.

3. In an electric induction apparatus, a core structure, and a core supporting means including a column member, relatively rigid clamping means cooperable with opposite sides of said core structure at the inner and outer peripheries thereof, and cooperating screw threads on said clamping means and on one end of said column member for relatively rigidly attaching said core structure to said end of said column member so that said core structure may be relatively rigidly supported from the opposite end of said column member in a substantially horizontal position during application of a plastic insulating covering to the core structure.

4. In an electric induction apparatus, a pair of coaxially disposed toroidal core members, and a core supporting means including a column member, a pair of relatively rigid clamping members cooperable with adjacent and opposite sides of said pair of core members and one end of said column member for relatively rigidly attaching said end of said column member to said core members so that said core members may be supported from the opposite end of said column member in a substantially horizontal position during the application of a plastic insulating covering to said core member.

5. In an electric induction apparatus, a pair of coaxially disposed toroidal core members, and a core supporting means including a column member, a pair of relatively rigid clamping members cooperable with adjacent and opposite sides of said pair of core members and one end of said column member for relatively rigidly attaching said end of said column member to said core members, a cast covering of insulating material surrounding said pair of core members and said column member and a cast cushioning layer of foamed latex around said core members and inside said insulating covering.

6. In an electric induction apparatus, a pair of

coaxially disposed toroidal core members, and core clamping means including a T-shaped bolt cooperable with adjacent sides of said core members and a bracket means cooperable with opposite sides of said core members, said bolt and bracket means being adjustably cooperable so that said core clamp means may be relatively rigidly attached to said pair of core members.

7. In an electric induction apparatus, a pair of coaxially disposed toroidal core members, secondary windings surrounding said core members, a column member, core clamp means including a T-shaped bolt cooperable with adjacent sides of said core members and bracket means cooperable with opposite sides of said core members, said bolt and bracket means being adjustably cooperable so that said core clamp means may be relatively rigidly attached to said pair of core members, means for attaching said bracket means to one end of said column member, and a cast insulating covering surrounding said core members and column member, said covering having an

opening axially disposed of said coils for the reception of a primary winding.

8. In an electric induction apparatus, a toroidal shaped core member, and core clamping means including a pair of bracket members cooperable with the inner periphery of said core member and a stop member cooperable with the outer periphery of said core member, and means for relatively rigidly clamping said bracket members and said stop member to said core member.

9. In an electric induction apparatus, a toroidal shaped core member, a column member, and core clamping means including a pair of bracket members cooperable with the inner periphery of said core member and a stop member cooperable with the outer periphery of said core member, and means including cooperating threads on one end of said column member and on said bracket members for relatively rigidly clamping said core clamping means to said core and for attaching said core to said column.

EDWIN H. BRINK.