

Aug. 1, 1939.

G. CAMILLI

2,168,154

TRANSFORMER

Filed March 16, 1938

Fig. 1.

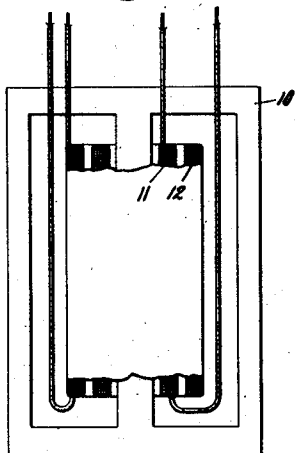


Fig. 2

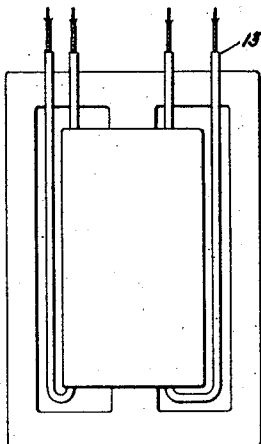


Fig. 3.

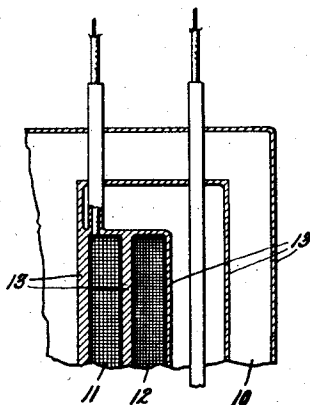


Fig. 4.

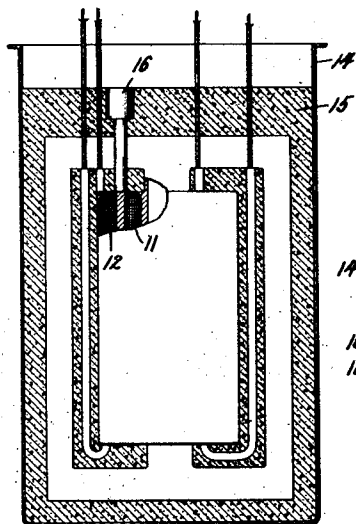


Fig. 5

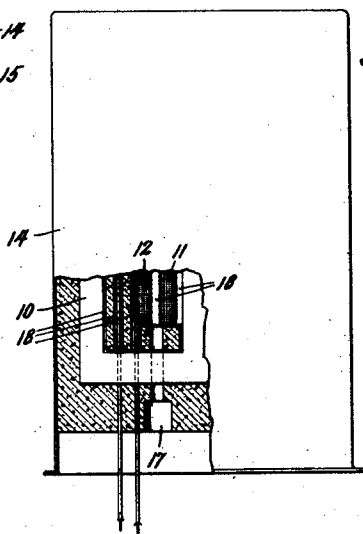


Fig. 6

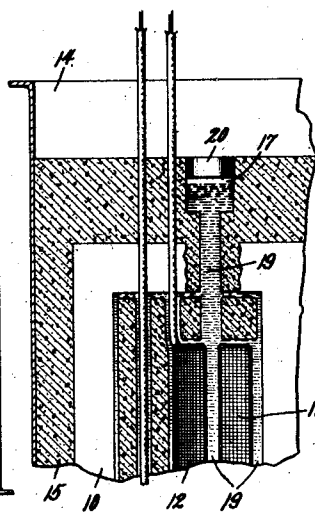
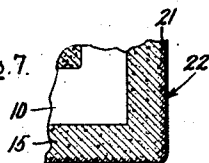


Fig. 7.



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UNITED STATES PATENT OFFICE

2,168,154

TRANSFORMER

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Application March 16, 1938, Serial No. 196,239

6 Claims. (Cl. 175—361)

My invention relates to transformers and its general object is to provide an improved transformer construction and an improved method of producing such construction in which the transformer is embedded in concrete. A concrete-encased transformer constructed in accordance with the invention is fireproof and weatherproof. It may be produced very economically and it has good load capacity because the heat conductivity of concrete is good.

There is a difference in the thermal expansion of the concrete and of the transformer parts and this tends to cause trouble if the concrete is cast directly onto the transformer. Thus, the difference in thermal expansion may cause the concrete and the transformer to separate slightly and leave voids in which corona may appear or it may cause such pressure as to crack the concrete. An object of the invention is to provide an improved method and construction which avoids any danger of these troubles.

The invention will be better understood from the following description taken in connection with the accompanying drawing in which Fig. 1 shows a transformer partly in section before it has been treated to prepare it for its concrete casing; Fig. 2 shows the transformer after treatment; Fig. 3 is a sectional view of a portion of the transformer shown in Fig. 2; Fig. 4 is a sectional view of the transformer with its concrete casing; Fig. 5 is a view, partly in section, of the transformer showing a step in the process of producing it; Fig. 6 is a sectional view of a portion of the completed transformer; and Fig. 7 is an explanatory detail of a modified form of casing for the transformer.

Like reference characters indicate similar parts in the different figures of the drawing.

The invention is particularly applicable in connection with transformers of rather small size so that the weight of the concrete casing may not be objectionable, such a transformer being indicated in Fig. 1 and including a magnetic core 10 provided with windings 11 and 12. The core and windings of the transformer should first be thoroughly dried by any suitable process, such as by heating the transformer in a partial vacuum. The transformer is next cooled and provided with a coating or film 13 of paraffin or other suitable wax which is solid when cold but which may be easily melted by heating it. The paraffin coating or film 13 may be quickly applied by dipping the transformer in a tank of molten paraffin and quickly removing it to allow the paraffin adhering to it to harden on the sur-

face of the transformer. The transformer may be dipped in the paraffin several times if necessary to provide a paraffin coating or film of desired thickness, as indicated in the sectional view of Fig. 3. Some of the paraffin coating 13 on the magnetic core 10 may be scraped off if desired as it may not all be necessary. The thin film of paraffin on the magnetic core 10 will protect it from the effects of moisture from the concrete to be applied later which might cause rusting and a consequent increase in core losses during operation. After the transformer has been provided with the coating or film 13 of paraffin, the transformer is placed in a casing 14 and the space around the transformer completely filled with a body of concrete 15, as shown in Fig. 4. Before the concrete 15 is poured around the transformer, a plug or rod 16 is placed with its lower end in contact with the paraffin layer 13 and with its upper end extending at least to the level to which the concrete is to be poured. After the concrete has hardened, it should be thoroughly dried by heating it in a partial vacuum. The plug 16 is now removed and the transformer with its concrete casing turned upside down, as shown in Fig. 5. The transformer is heated sufficiently to melt the paraffin layer 13 so that it will drain out through the opening 17 left by the removal of the plug 16. This will leave a space 18 between the concrete casing 15 and the transformer windings 11 and 12. The transformer is now turned right side up, as shown in Fig. 6, and the space 18 filled with an insulating liquid 19 preferably to a level somewhere in the opening 17. The outer end of the opening 17 may be closed by a stopper 20 leaving an expansion chamber or space between the stopper and the liquid as shown in Fig. 6 to permit thermal expansion and contraction of the liquid. The insulating liquid 19 provides efficient insulation around the windings 11 and 12 and prevents the formation of any voids between the windings and the concrete casing 15 by unequal thermal expansion and contraction of the windings and the concrete casing. It also permits unequal thermal expansion of the concrete and transformer without causing pressure which might crack the concrete. The necessary thickness of the liquid film will vary with the size of the transformer but may be of the order of one eighth inch or perhaps less for small transformers so that the concrete casing will conform closely and intimately to the surface of the transformer, the casing being spaced from the transformer only by the liquid film.

The casing 14 may be a permanent metal casing if desired or it may be merely a form to hold the concrete casing 15 while the concrete is being cast around the transformer, in which case it may be removed after it has served this purpose. If the casing 14 is removed from the concrete, however, the insulating liquid 19 will tend to penetrate outwardly through the pores of the concrete and gradually escape. To prevent this loss of the insulating liquid 19, the outer surface of the concrete casing 15 may be impregnated with a layer 21 of some liquid, such as linseed oil, which may be hardened by heat to provide a layer impervious to the insulating liquid 19. The surface may then be given a coating 22 of paint to improve its appearance.

The concrete casing 15 has good heat conductivity so that the heat generated by the losses in the transformer is rapidly dissipated and the load capacity of the transformer is consequently also good.

The invention has been explained by describing a transformer structure and a method for producing it in accordance with the invention but it will be apparent that changes may be made without departing from the spirit of the invention and the scope of the appended claims.

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

1. The combination of a transformer, a one-piece concrete casing surrounding said transformer and intimately conforming to its surface, and a thin film of insulating liquid surrounding the transformer between the transformer and casing, said casing being spaced from the transformer only by the liquid film.

2. The combination of a transformer, a one-piece concrete casing surrounding said transformer and intimately conforming to its surface, a thin film of insulating liquid surrounding the

transformer between the transformer and casing, and a liquid impervious layer impregnating the outer surface of the concrete casing, said casing being spaced from the transformer only by the liquid film.

3. A method of producing a concrete-encased transformer, said method including the steps of coating a transformer with a hardened film, casting a concrete casing around the film-coated transformer, melting and draining out said film, and filling the space between the transformer and the concrete casing with an insulating liquid.

4. A method of producing a concrete-encased transformer, said method including the steps of coating a transformer with a hardened film, casting a concrete casing around the film-coated transformer, melting and draining out said film, filling the space between the transformer and the concrete casing with an insulating liquid, and impregnating the outer surface of the concrete with a liquid impervious layer.

5. A method of producing a concrete-encased transformer, said method including the steps of drying a transformer, coating the dried transformer with a hardened film of wax, casting a concrete casing around the film-coated transformer, melting and draining out said film, and filling the space between the transformer and the concrete casing with an insulating liquid.

6. The combination of a transformer, a one-piece concrete casing surrounding said transformer and intimately conforming to its surface, a thin film of insulating liquid surrounding the transformer between the transformer and casing, said casing being spaced from the transformer only by the liquid film, and an expansion chamber communicating with said liquid film to permit thermal expansion and contraction of the liquid.

GUGLIELMO CAMILLI.