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2,374,055

THERMAL RESPONSIVE DEVICE FOR ELECTRICAL COILS

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Fig.1.

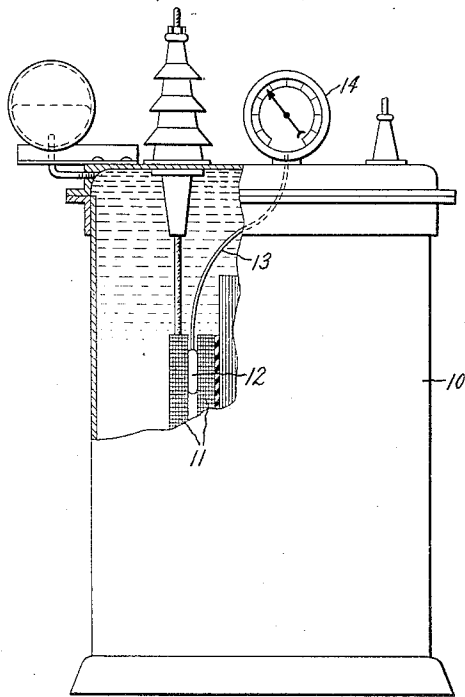


Fig.3.

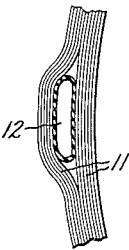


Fig.4.

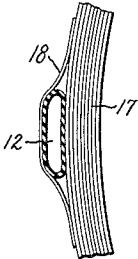


Fig.5.

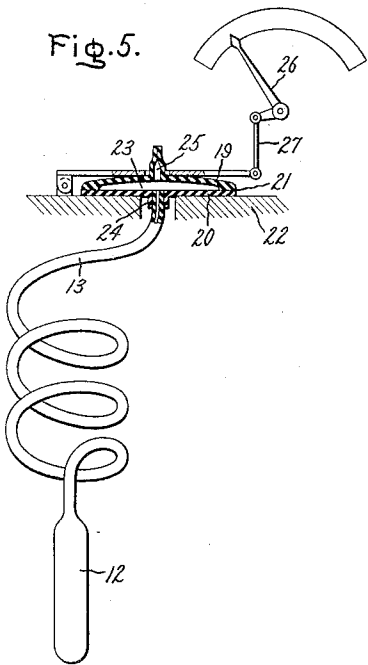
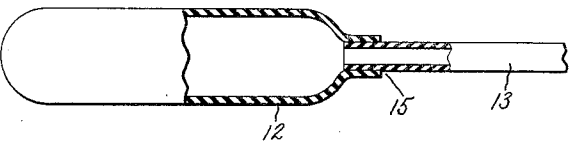


Fig.2.



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UNITED STATES PATENT OFFICE

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THERMAL RESPONSIVE DEVICE FOR ELECTRICAL COILS

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1 Claim. (Cl. 175—361)

My invention relates to a thermal responsive device for an electrical coil, and to an electric induction apparatus having a temperature responsive device for measuring the hot spot temperature of the coils of the apparatus.

Heretofore temperature indicators have been provided for electrical apparatus including metallic bulbs which are situated close to the windings of the apparatus. In order to insulate suitably the bulb, insulation has been placed between the bulb and the coil, and a section of the tube connected with the bulb has also been provided of insulating material. Also, bulbs have been provided which are situated adjacent windings of electrical apparatus, the bulbs being made of insulating refractory material, such as glass. In view of the difficulties of making apparatus with temperature indicators having metallic and vitreous materials for the bulbs, hot spot indicators have also been manufactured which measure the temperature of the winding by a device which is responsive to the current flowing through the winding, the temperature being a function of the value of the current.

It is, therefore, an object of my invention to provide an improved temperature responsive device for an electrical coil.

Another object of my invention is to provide an electric induction apparatus with an improved thermal responsive device which is simple in construction and economical to manufacture and which may be installed as a part of the electrical apparatus in a simple and convenient manner.

Further objects and advantages of my invention will become apparent from 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 claim annexed to and forming a part of this specification.

In the drawing Fig. 1 is a side elevation of an electric apparatus in partial section which is provided with an embodiment of my invention; Fig. 2 is a sectional side elevation of a portion of the thermal responsive device employed in Fig. 1; Fig. 3 is a fragmentary view of a portion of the concentric coils in Fig. 1 showing the bulb of my improved temperature responsive device; Fig. 4 is a partial sectional side elevation of a coil provided with a modification of my invention; and Fig. 5 is a side elevation of a thermal responsive device illustrating a modification of my invention.

In the drawing I have illustrated an electrical apparatus such as a transformer having a tank

10 and windings including a plurality of concentric coils 11. In order to be able to measure the temperature inside the windings I have provided a thermal responsive device including a bulb

12 and a tube 13 which connects to a suitable indicating device 14. As is illustrated more clearly in Fig. 2 the bulb 12 is formed integral with the tube 13 by a suitable joint 15 such as by vulcanizing. The bulb 12 and tube 13 then provide an enclosed system which may contain a suitable insulating fluid which expands with temperature and which is compatible with the material of the bulb and tube such as transil oil, and the amount of expansion may be indicated through a suitable

15 indicating or contact making instrument 14. The tube 13 and bulb 12 are made of suitable insulating material such as rubber or a suitable synthetic rubber-like material which will not deteriorate under the action of the fluid dielectric within the casing 10, such as a butadiene and acrylonitrile copolymer, the material being insulating so as not to affect the electrical characteristics of the transformer windings. The bulb 12 is also formed of material which is flexible so that it may be suitably placed between the concentric windings 11 and follow the contour of the surface and thereby take up a minimum of space between the windings. Thus, as is illustrated in Fig. 3, the concentric coils 11 have therebetween the bulb 12 which will be deformed upon the application of the outer winding 11 so that the bulb will take up a minimum of space between the windings. Thus the bulb is contained in a small pocket, the surfaces of which are made up by the coils 11.

By employing a material which is both flexible and insulating not only are the electrical characteristics substantially unaffected but a minimum of space is occupied by the bulb 12 between the windings.

In Fig. 4 I have illustrated my bulb 12 as applied to the outer surface of a coil 17. The bulb 12 may be attached to the outer surface in any suitable manner, such as by a binding material 18 or a formed pocket of insulating material.

In Fig. 5 I have illustrated a modification of my invention including the tube and bulb and a pair of disk members 19 and 20 formed of insulating material similar to that which forms the bulb and tube. The disks are made integral at their outer edges 21 in any suitable manner such as by vulcanizing so as to form a flexible bellows. One of the disks 20 may be suitably attached to a support 22 such as the cover of the apparatus, and the disk 20 has an opening 23 which connects

with the opening of the tube 13. Thus the disk 20 is provided with an outwardly extending portion 24 into which an end of the tube 13 is integrally attached, such as by vulcanizing. The disk 19 is also provided with an opening 25 which may be sealed off after a suitable fluid has been introduced into the sealed system including the bellows, tube, and bulb. Upon heating of the apparatus within the casing 10 the fluid within the thermal responsive device will expand thus expanding the disk member 19, and an indication of this expansion may be provided through an indicating instrument 26 which is connected to the disk 19 through a suitable linkage 27. It is to be understood that the characteristics of flexibility of the bulb 12 and disk 19 are such that when the oil in the system expands on heating it will force the disk 19 to expand rather than the walls of the bulb, as the bulb need only be sufficiently resilient as to allow it to conform to the contour of the coil surface.

It will, therefore, be seen that I have provided a thermal responsive device in which all parts,

that is, the bulb, capillary tube, and bellows are made of flexible insulating material, all parts thereof being integrally attached so that all parts are permanently and tightly sealed.

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 claim 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:

An electric induction device including a coil having a plurality of conducting layers, a thermal responsive device having a bulb of insulating material and an integral tube of similar insulating material, said bulb being situated between adjacent conducting layers and being flexible so that said bulb will be held in a pocket which follows substantially the contour of said adjacent coil surfaces.

EDWARD D. TREANOR.