Nov. 13, 1934. K. K. PALUEFF 1,980,821

MEANS FOR COOLING ELECTRICAL APPARATUS

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Fig. 1.

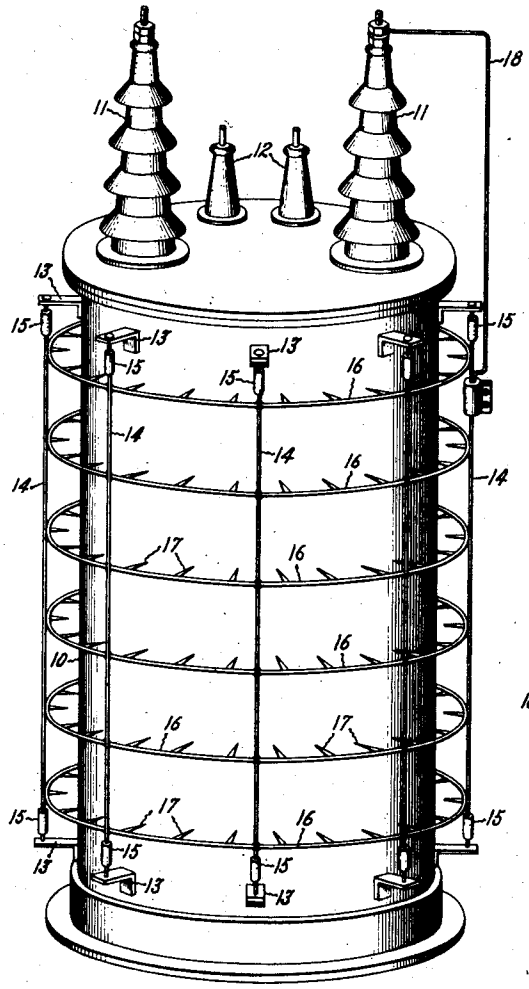
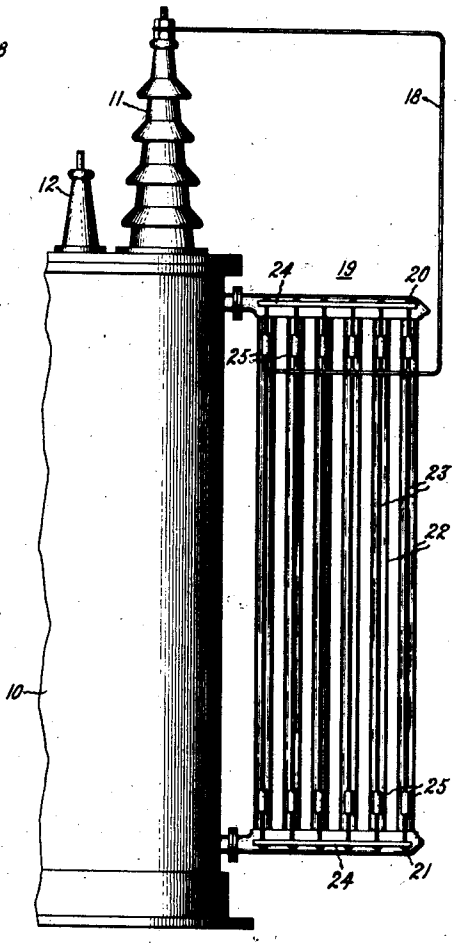


Fig. 2.



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MEANS FOR COOLING ELECTRICAL APPARATUS

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4 Claims. (Cl. 175—265)

My invention relates to means for cooling electrical apparatus. Some types of electrical apparatus such as transformers and reactors develop considerable heat during periods of normal operation and this heat must be dissipated at a rate sufficient to prevent such an increase in the temperature of the apparatus as might cause injury. The maximum safe load which such apparatus can carry may be increased by increasing the rate at which heat developed in the apparatus is dissipated. I have found that if corona is maintained near a heated surface, the dissipation of heat will be increased. The general object of the invention is to provide an improved arrangement utilizing the effect of corona for cooling electrical apparatus.

The invention will be explained more fully in the following description taken in connection with the accompanying drawing in which Fig. 1 shows one form of the invention applied to a transformer of the oil immersed type and Fig. 2 shows the invention applied to a heat radiator connected to the casing of an oil immersed transformer.

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

The casing 10 shown in the drawing is provided with high voltage bushings 11 and low voltage bushings 12 for the leads of a transformer immersed in insulating and cooling liquid within the casing. As shown in Fig. 1, top and bottom brackets 13 secured to the casing wall support a plurality of vertical conductors 14 spaced from each other around the casing, the conductors 14 being insulated from the brackets and casing by insulators 15. A plurality of vertically spaced horizontal conductive rings 16 surrounding the casing 10 are conductively secured by soldering or otherwise to the vertical conductors 14. The rings 16 are spaced from the casing 10 and are provided with spaced pointed conductive projections 17 extending toward the surface of the casing. The vertical conductors 14, rings 16 and pointed projections 17 are thus all conductively connected together but are insulated from the casing 10. A conductor 18 connects one of the vertical conductors 14 to a suitable high voltage source which may be one of the terminals of the transformer as shown in the drawing, thus impressing a high voltage on the pointed projections 17. This impressed voltage must be high enough to produce corona on the pointed ends of the projections 17 and these projections should be near the casing but yet spaced far enough from it to avoid arcing to the casing. One arrangement which I now consider satisfactory is to space the projections 17 about two inches from the surface of the casing and to impress about ten thousand volts on the projections.

With the arrangement which has been described, the presence of the corona near the heated surface of the casing 10 considerably increases the dissipation of the heat from the casing and therefore from the apparatus which it contains. When a heated body such as a transformer casing is in contact with surrounding air, the heat flows into the air near the body. This raises the temperature of the air which rises by convection and carries away the heat. A thin layer of air, however, adheres to the surface of the heated body and acts as insulation to retard the flow of heat into the rising air. The presence of the corona near the heated surface has the effect of agitating the air and preventing its adhesion to the surface so that the insulating film or layer does not form and retard the dissipation of heat. The rate at which the heat is dissipated is thus substantially increased.

Another application of the invention is shown in Fig. 2. The transformer casing 10 is provided with a heat radiator 19 through which the insulating liquid in the casing 10 may circulate and be cooled. The radiator 19 includes a top header 20 and a bottom header 21 connected by vertical tubes 22. Vertical conductors 23 are supported between brackets 24 and are insulated from the brackets and radiator by insulators 25. The vertical conductors are connected by a conductor 18 to a suitable high voltage source which may be one of the transformer terminals as shown. The conductors 23 are preferably small wires and the voltage impressed on them must be high enough to produce corona. These conductors are spaced far enough from the radiator tubes 22 to prevent arcing to the tubes but yet near enough to prevent formation of an insulating film of air on the tubes. The conductors 23 may, of course, be distributed in any desired arrangement about and among the tubes 22. The presence of the corona near the surfaces of the heated tubes will increase the dissipation of heat from them in the manner already described in connection with the casing 10 of Fig. 1.

The invention provides a simple and efficient cooling arrangement for electrical apparatus such as encased transformers and reactors. There are no moving parts and very little power is required.

The invention has been explained by describing and illustrating certain applications thereof but it will be apparent that changes in form and

application 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 with electrical apparatus which develops heat during operation, said apparatus having a high voltage terminal, of conductive means adjacent a surface heated by said apparatus, and means connected to said high voltage terminal for producing corona on said conductive means to increase the cooling effect of the surrounding air.

2. The combination with electrical apparatus which develops heat during operation, said apparatus having a high voltage terminal, of conductive pointed projections adjacent a surface heated by said apparatus, and means connected to said high voltage terminal for producing corona on said projections to increase the cooling effect of the surrounding air.

3. The combination with electrical apparatus which develops heat during operation, said apparatus having a high voltage terminal, of small conductive wires adjacent a surface heated by said apparatus, said wires being conductively connected to said high voltage terminal for producing corona on said wires to increase the cooling effect of the surrounding air.

4. The combination with an encased transformer having a high voltage terminal, of conductive means adjacent a surface heated by the transformer, and a conductive connection between said conductive means and said high voltage terminal for producing corona on said conductive means to increase the cooling effect of the surrounding air.

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