

[54] **TRANSFORMER HAVING IMPROVED
HEAT DISSIPATING SYSTEM**

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[51] Int. Cl. **H01f 27/08**

[58] Field of Search **336/58, 61, 55; 174/15 R**

[56] **References Cited**

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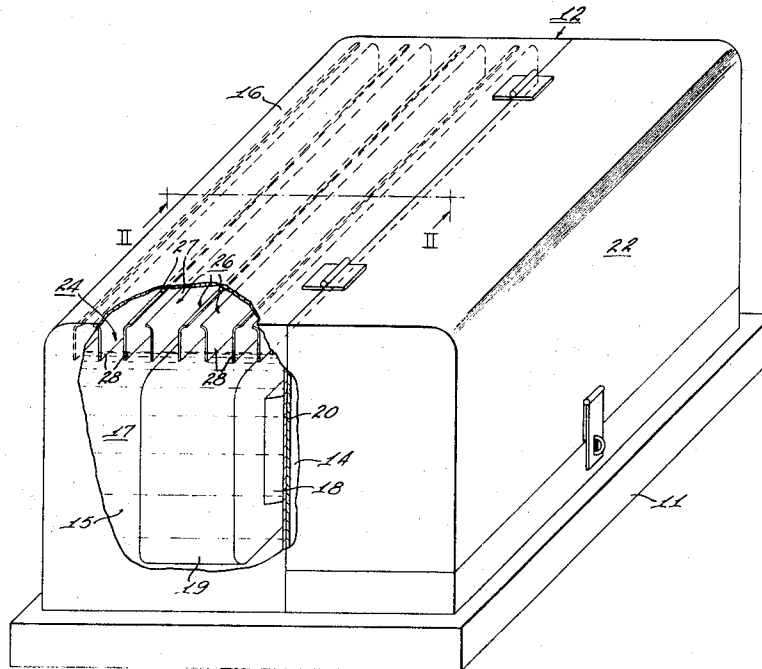
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[57] **ABSTRACT**

Heat dissipation from an electrical transformer having a core and coil assembly immersed in oil within the transformer casing and a gas cushion above the oil is increased by a plurality of metallic fins attached to the inner surface of the metallic cover which depend through the gas cushion with their ends immersed in the oil and augment the amount of heat transmitted from the hot oil through the gas cushion to the cover.

4 Claims, 2 Drawing Figures



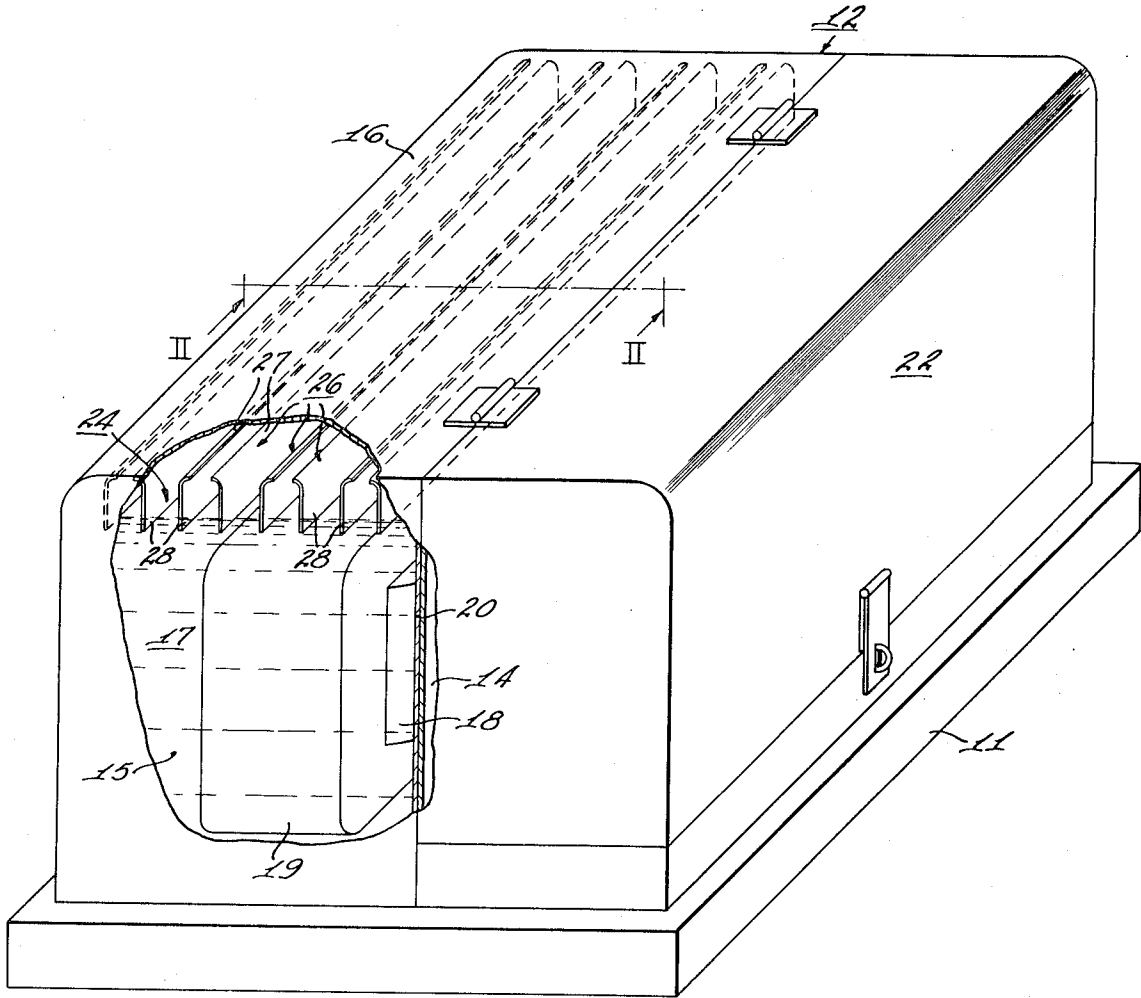


Fig. 1

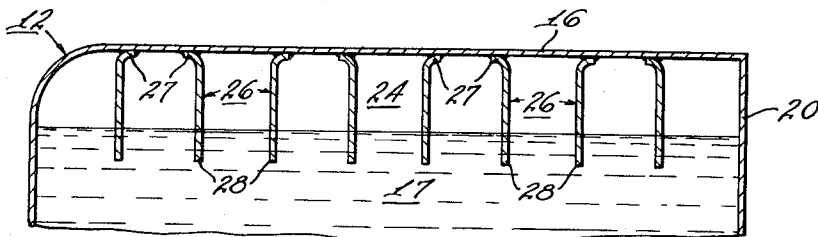


Fig. 2

TRANSFORMER HAVING IMPROVED HEAT DISSIPATING SYSTEM

This invention relates to a cooling system and more particularly to a cooling system for heat generating apparatus such as an electrical transformer immersed in an insulating and cooling dielectric liquid.

Efforts are continuously being made in the electrical industry to reduce the size of pad-mounted residential transformers since the most aesthetic appearance for a transformer in a residential area is a minimum, or inconspicuous appearance. Reduction in the size and weight of the magnetic core, winding copper and insulating liquid of a pad-mounted transformer for the purpose of making it more compact reduces its ability to absorb large quantities of heat without an appreciable temperature rise. Operation of a transformer at high temperature overloads substantially reduces the life of the transformer by reducing the useful life and strength of the electrical insulation. Direct sunlight on a pad-mounted transformer may raise its peak top-oil temperature 8° to 10°C and thus contribute to high temperature overloads and make more difficult the problem of reducing transformer size without a corresponding increase in top-oil temperature.

It is an object of the invention to provide a residential pad-mounted transformer having improved means for dissipating the heat generated by the transformer windings, thereby permitting the transformer to be made more compact for a given temperature rise.

This and other objects and advantages of the invention will be more readily apparent from consideration of the following detailed description when read in conjunction with the accompanying drawing wherein:

FIG. 1 is a perspective view of a pad-mounted transformer embodying the invention with a portion of the casing wall broken away to illustrate the internal construction; and

FIG. 2 is a view taken along line II—II of FIG. 1.

Referring to the drawing, a pad-mounted transformer supported on a concrete pad 11 at ground level has a metal casing 12 defining an air compartment 14 and a hollow oil compartment 15 closed by a metallic top wall, or cover 16 and containing an insulating and cooling liquid 17 such as transformer oil. A transformer core and coil assembly immersed in the oil 17 typically includes a cylindrical transformer coil 18 inductively linked by a pair of back-to-back closed magnetic cores 19. Electrical connections from the primary and secondary windings (not shown) of transformer coil 18 are completed through insulating bushings (not shown) which extend through a sidewall 20 of oil compartment 15 into air compartment 14 which is closed by a hinged cover member 22.

The windings of coil 18 carry electrical current which generate heat that is transferred to the oil 17 and raises the temperature of the oil 17 above the ambient. Heat from the oil 17 is dissipated to the atmosphere through the walls of casing 12 defining oil compartment 15. A gas cushion 24, which may be air, exists above the oil 17 in compartment 15 to permit the oil 17 to expand when heated. The hottest portion of the oil 17 is adjacent its top surface but, in absence of the present invention, only a relatively small amount of heat from the oil is transmitted through the gas cushion 24 to the top wall 16 of casing 12 and then dissipated

by cover 16 to the atmosphere. The thermal conductivity of the air in cushion 24 is relatively low, and consequently only a small amount of heat is transmitted from the hot oil 17 through gas cushion 24 to metallic top wall, or cover 16.

In accordance with the invention, a plurality of elongated fins 26 constructed of metal such as steel or aluminum having relatively high thermal conductivity are affixed to the inner surface of top wall 16. The fins 26 may be of L-shaped cross section as illustrated in the drawing or of channel configuration and may extend substantially the entire length of top wall 16 with the cross bar 27 affixed by suitable means such as welding to the top wall 16 and the legs 28 thereof depending a sufficient distance through air cushion 24 so that they are immersed in the hot oil 17. The relatively high thermal conductivity fins 26 conduct heat from the hot oil 17 to the top wall 16 and raise the surface temperature of the top wall 16 so that a materially greater amount of heat is dissipated to the atmosphere.

In one embodiment wherein top wall 16 has an area of approximately 720 square inches, it was found that the top wall 16 radiated heat at the rate of approximately 0.15 watts/in.² or 108 watts when no fins were provided and the top oil temperature was 50° above ambient. With eight steel channel fins affixed to the inner surface of top wall 16, the top wall 16 radiated approximately 0.25 watts/in.², or 180 watts. Further, when the fins 26 are of still higher conductivity material such as aluminum (which has a thermal conductivity more than three times higher than that of steel), the efficiency of the top wall 16 for cooling the transformer is still further increased and the number of fins can be reduced proportionally.

While only a single embodiment of the invention has been illustrated and described, it should be understood that I do not intend to be limited to the single embodiment for many modifications and variations thereof will be obvious to those skilled in the art.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an electrical transformer, the combination of: a hollow metallic casing mounted on a the horizontal surface of a level concrete ground pad, a non-volatile cooling and insulating liquid within said casing, a transformer core and coil assembly immersed in said liquid within said casing, a metallic cover closing said casing and being spaced from the top surface of said liquid to provide a gas cushion within said casing above said liquid and beneath said cover, and at least one elongated, vertical heat transfer fin having a high thermal conductivity relative to the gas in said cushion affixed to and extending a substantial distance along the inner surface of said cover and depending through said gas cushion and having its end immersed in said liquid, whereby heat is transmitted from said liquid through said heat transfer member to said cover and the heat dissipation from the top surface of said cover to the atmosphere is increased.
2. In an electrical transformer having a casing provided with a compartment containing a non-volatile cooling and insulating liquid,

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a level concrete ground pad having a horizontal upper surface on which said casing is mounted, a transformer core and coil assembly immersed in said liquid within said compartment, a metallic cover closing said compartment and being spaced above the top surface of said liquid, and a gas cushion within said compartment above the top surface of said liquid and below said cover, the improvement comprising a plurality of elongated, vertical heat transfer metallic fins affixed in spaced apart relation to and extending a substantial distance along the inner surface of said cover and depending through said gas cushion with their ends immersed in said liquid, whereby heat is transmitted from said liquid through said metallic fins to said cover and the heat dissipation from the top surface of said cover to the atmosphere is increased.

3. In an electrical transformer in accordance with claim 2 wherein said fins are elongated channels having the web thereof affixed to the inner surface of said cover and the legs thereof depending through said gas cushion with the ends of said legs immersed in said liquid.

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4. In a pad-mounted electrical transformer having a metallic casing with an oil compartment therein, a level concrete ground pad having a horizontal upper surface on which said casing is mounted, transformer oil in said compartment, a transformer core and coil assembly immersed in said oil, a metallic cover closing said compartment and being spaced above the top surface of said transformer oil, a gas cushion within said compartment above said oil and beneath said cover, and a plurality of elongated vertical metallic heat transfer fins affixed in spaced apart relation to and extending a substantial distance along the undersurface of said cover and depending from said cover through said gas cushion with their ends immersed in said liquid, whereby heat is transmitted from said transformer oil through said heat transfer fins to said cover and the heat dissipation from the top surface of said cover to the atmosphere is increased.

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