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AIR COOLED OIL IMMERSED TRANSFORMER

Original Filed Oct. 28, 1926

Fig. 1.

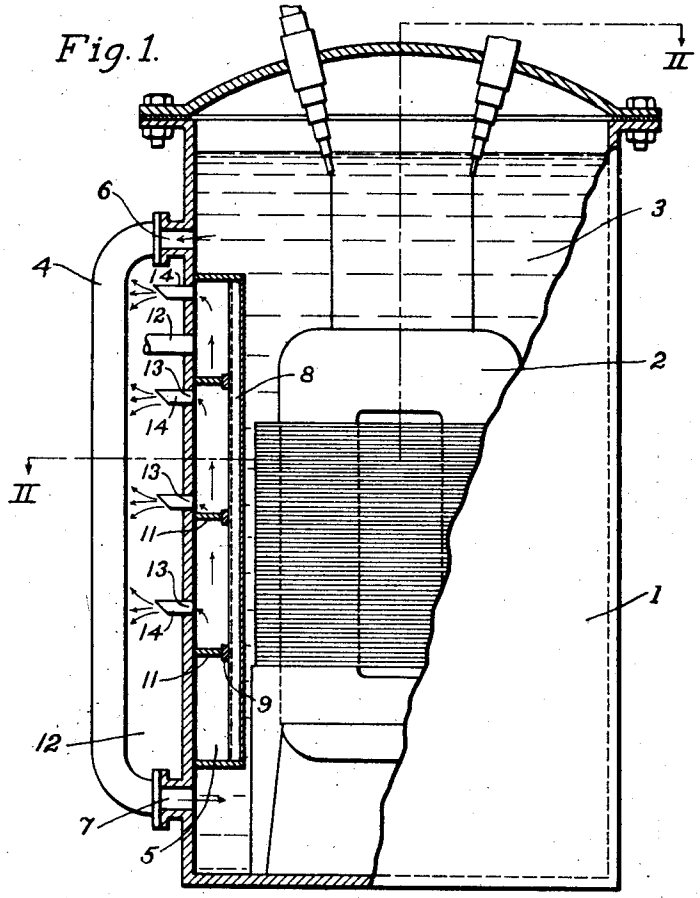
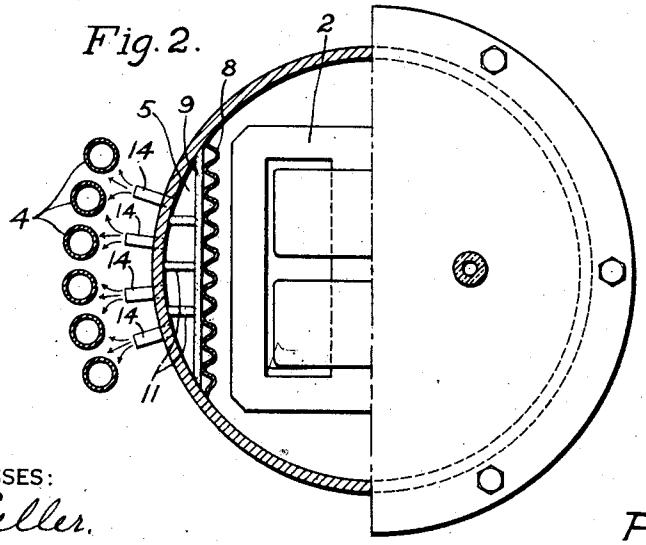


Fig. 2.



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UNITED STATES PATENT OFFICE

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AIR-COOLED OIL-IMMERSED TRANSFORMER

Application filed October 28, 1926, Serial No. 144,732. Renewed January 18, 1929.

My invention relates to electrical transformers and particularly to air-cooling devices therefor.

One object of my invention is to provide cooling apparatus for oil-immersed electrical apparatus that shall be effective to cool the insulating oil both internally and externally of the apparatus.

Another object of my invention is to provide cooling apparatus for oil-immersed electrical apparatus that shall utilize the same body of cooling air for cooling the electrical apparatus both internally and externally.

A further object of my invention is to provide a cooling system for oil-immersed electrical apparatus that shall pass a cooling medium through a duct in contact with the insulating oil within the apparatus and then direct the cooling medium against external radiators.

In cooling oil-immersed electrical apparatus, it has heretofore been proposed to direct a body of cooling medium, such as air, through tubes connected internally of the apparatus. It has also been proposed to employ external radiators for cooling such apparatus. When external radiators are employed a film of stagnant air frequently gathers along the radiating surfaces, the presence of which serves to decrease the heat-dissipating rate of the radiating surfaces.

According to my invention, a body of air is driven through a duct in contact with the oil body and is then directed outwardly against the surface of radiators for breaking up the film of air that adheres thereto, thereby increasing the circulation of the atmosphere along the surfaces of the radiators.

In the accompanying drawings,

Fig. 1 is a view, partially in elevation and partially in section, of a transformer embodying my invention; and

Fig. 2 is a sectional plan view of the transformer shown in Fig. 1, taken along the section line II—II of Fig. 1.

My invention comprises, in general, a casing 1 in which an electrical device 2, such as a transformer, is immersed in a body of insulating oil 3, and a cooling system comprising a plurality of external radiators 4 and a duct 5 within the casing 1 for causing a body of air to pass through the casing 1 and then be directed outwardly against the radiators 4.

Elements 1 to 3, inclusive, of this invention may be of any preferred type, inasmuch as they form no essential part of the present invention except insofar as they are necessary to complete the combination with the cooling system hereinafter described.

The radiators 4 may be of any suitable type that have communication with the fluid 3 within the casing 1 through upper orifices 6 and lower orifices 7, whereby a thermal-siphonic movement of the insulating oil 3 takes place through the radiators 4. The internal duct 5 comprises a corrugated partition 8 that is mounted, by a fluid-tight joint, within the casing 1 and is supported by suitable cross-braces 9 and stays 11 from the wall of the casing.

An opening 12 is provided near the top of the duct 5 for connection to a source of compressed air, (not shown). The wall of the casing 1 is provided with a plurality of openings 13 in which sections of pipe 14 may be inserted, if desired. The openings 13 and the sections of pipe 14 face outwardly from the casing 1 and are in alinement with the radiators 4. The number of openings 13 may be varied as desired but should preferably extend along substantially the entire length of the radiators 4.

By having the opening 12 near the top of the duct 5, the cooling air is made to come first in contact with the hottest parts of the duct 5, which are at the top near the opening 12, with a resulting maximum difference in temperature between the cooling medium and the radiating surfaces, thereby utilizing the cooling medium in the most efficient manner.

While I have shown and described only one duct 5 in the present application, it is obvious that the number and shape of such ducts may be varied in accordance with the size and type of the casing 1 to which my invention is applied.

When the electrical apparatus 2 is in operation, a considerable amount of thermal en-

ergy is liberated which heats the insulating oil 3 and, in part, determines the capacity of the electrical apparatus 2. Under such conditions, a certain amount of the insulating oil 3 rises and moves outwardly through the orifices 6 and downwardly through the radiators 4 and returns to the casing 1 through the orifices 7. The degree of cooling to which the oil 3 traversing the radiators 4 is subjected depends upon the cross-sectional area of the radiators 4, the thermal conductivity of the material used therein, the initial temperature of, and the rate at which the surrounding atmosphere passes over, the surface of the radiators 4.

When a body of air is forced into the duct 5 through the opening 12, the air absorbs a certain amount of the heat from the insulating oil 3 through the corrugated wall 8. The absorption of such heat by the cooling medium increases the temperature of the latter before it is discharged through the openings 13 and pipes 14 against the inner surfaces of the radiators 4. The cooling medium thus directed against the radiators 4 may absorb a portion of the heat dissipated by the radiators 4, if it has not been raised to substantially the temperature of the radiators 4 while within the duct 5.

The jets of air liberated by the pipe sections 14 against the radiators 4 serve to break up any film of air that may be adhering to the faces of the radiators and, accordingly, they increase the velocity of the air currents passing over the radiators 4 and thereby the heat-dissipating capacity of such radiators.

Accordingly, I have devised a cooling system for oil-immersed electrical apparatus in which a body of cooling medium is utilized to cool the electrical apparatus internally and is then directed outwardly against the radiating surfaces of external radiators for breaking up any air film that may exist along the radiating surfaces, thereby expediting the circulation of air along such radiators.

While I have illustrated only one embodiment of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention, as set forth in the appended claims.

I claim as my invention:

1. In combination, a casing, a fluid disposed within the casing, a radiating surface for the fluid disposed externally of the casing, and a duct for the passage of a cooling medium within the casing, the wall of the casing being provided with an opening for directing a portion of the cooling medium against the radiating surface.

2. In combination, a casing, a fluid disposed within the casing, radiating surfaces for the fluid disposed externally of the casing, and a duct for the passage of a cooling medium within the casing, the wall of the casing being provided with openings for directing a portion of the cooling medium against the radiating surfaces.

3. In combination, a casing, a fluid disposed within the casing, radiating surfaces for the fluid disposed externally of the casing, and a duct for the passage of a cooling medium within the casing, in proximity to the radiating surfaces, the wall of the casing being provided with openings for directing a portion of the cooling medium against the radiating surfaces.

4. In combination, a casing, a fluid disposed within the casing, radiators connected between the upper and the lower portions of the casing, and a duct disposed within the casing for the passage of a cooling medium, the wall of the casing being provided with openings for directing a portion of the cooling medium outwardly from the casing into engagement with the radiators.

5. In combination, a casing, a fluid disposed within the casing, radiators connected between the upper and the lower portions of the casing, and a duct disposed within the casing for the passage of a cooling medium, the wall of the casing being provided with openings for directing a portion of the cooling medium outwardly from the casing into engagement with the radiators at different points throughout their lengths.

6. In combination, a casing, a fluid medium within said casing, a radiating surface for the fluid medium disposed externally of the casing, means for passing a cooling medium into heat-exchanging relation with respect to said fluid medium while the latter is within the casing, and means for passing a portion of said cooling medium into contacting relation with said radiating surface.

In testimony whereof, I have hereunto subscribed my name this 20th day of October, 1926.

PAUL R. BOUNCE.