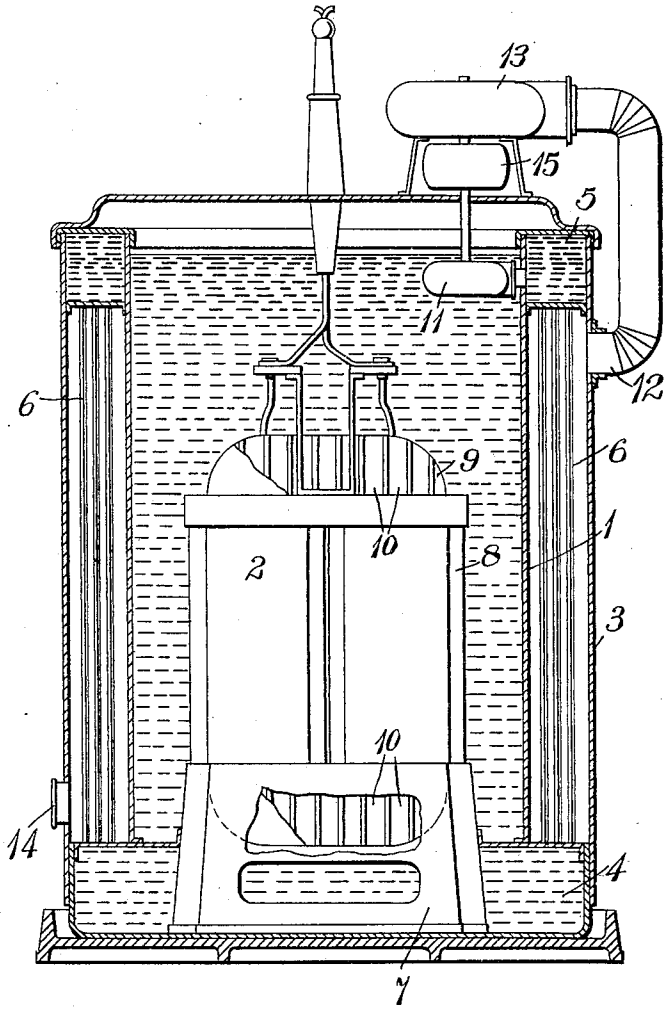
K. C. RANDALL.

COOLING SYSTEM FOR TRANSFORMERS.

APPLICATION FILED NOV. 6, 1908.

1,083,945. Patented Jan. 13, 1914.



WITNESSES:

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COOLING SYSTEM FOR TRANSFORMERS.

1,083,945. Specification of Letters Patent. Patented Jan. 13, 1914.

Application filed November 6, 1908. Serial No. 461,322.

To all whom it may concern:

Be it known that I, KARL C. RANDALL, a citizen of the United States, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Cooling Systems for Transformers, of which the following is a specification.

My invention relates to the cooling of electrical apparatus and it has special reference to transformers and other devices which are adapted for high voltage and are disposed in fluid-containing cases.

The object of my invention is to provide an improved casing for electrical apparatus and means for efficiently cooling the oil or other fluid in which the apparatus is immersed.

Transformers and other high-voltage electrical devices, and particularly those which are continuously operating for long periods of time, may be constructed and operated with greater economy when some artificial means is provided for cooling their active parts.

According to my present invention, I provide means for continuously conducting a portion of the fluid from the body of the tank in which it is contained through exterior pipes or tubes, and other means for circulating a cooling fluid around the pipes or tubes. In this way, the fluid in the tank is very effectively cooled and is continuously circulated so that the heat generated in a transformer or similar device immersed in the liquid is effectively dissipated.

The single figure of the accompanying drawing is a sectional elevation of an oil-immersed transformer which is arranged and cooled in accordance with my invention.

Referring to the drawings, the device illustrated comprises a tank 1 in which oil or other suitable insulating fluid is contained, a transformer 2 which is immersed in the liquid and an outer casing 3. The tank 1 is provided with an enlargement 4 at the bottom and with a closed chamber 5 at the top, communication being established between the chamber 5 and the enlargement 4 by means of a plurality of tubes 6 which are located outside of the tank and within the outer casing.

The transformer is representative of all such electrical devices as are usually oil-immersed and, as illustrated in the drawing, comprises a hollow base 7, a core member 8 and a winding 9, the structure being such that a plurality of ventilating ducts or passages 10, through which communication is established from the hollow base to the upper part of the tank, are provided between the coils. The enlargement 4 is so arranged as to communicate with the hollow base of the transformer and a fluid pump 11 is located near the top of the tank for forcing the oil into the upper chamber 5. In this way, a forced circulation of oil is established from the upper part of the tank, where the pump is located, into the chamber 5, down through the tubes 6, and through the enlargement 4 into the hollow base 7 and, from this point, the oil escapes into the tank through the ventilating ducts or passages 10. The outer casing 3 is provided with an inlet pipe 12 near its upper end through which a blast of cool air is forced by means of a fan or blower 13. From the inlet 12, the air circulates around the tubes 6 and finally escapes from an outlet port 14 which is located on the other side of the casing near the bottom of the tank. The oil pump 11 and the fan or blower 13 are driven by a single driving motor 15 which is located on the top of the tank so that the oil circulation and the air blast may be established simultaneously.

The operation of the device is as follows: Assuming that full load current is traversing the transformer winding and that the oil pump and the fan are being driven by the motor; the oil circulation within the tank will be established as above indicated. As the oil leaves the ventilating ducts or passages 10 between the coils of the transformer, its temperature will be considerably higher than the bulk of the oil in the tank,

by reason of the heat received from the winding and, consequently, it will rise to the surface of the liquid in the tank. Since the oil pump is located near the top of the tank, the warm oil will be forced into the chamber 5 and drawn down through the tubes 6 into the enlargement 4. As the oil passes through the tubes, its temperature will be materially reduced by reason of the air blast which is established by the fan 13 and, consequently, it will enter the enlargement 4 in condition to take more heat out of the transformer windings.

The cylindrical boiler-iron tank here shown, which corresponds to present practice for large transformers, is intended to be illustrative of the general principles involved in my invention without restricting it to any specific form of inclosing casing. I do not desire to limit myself to the use of oil within the tank or to air as a cooling medium, for some other insulating liquid or gas may be substituted for the oil and water or other suitable medium may be used for cooling, the pumps or fluid propellers being adapted to the fluids employed.

It is to be understood that structural modifications may be effected within the spirit and scope of my invention, and it is also to be understood that the transformer may be replaced by a similar device of some other size or type or by some entirely different device in which undesirable heat is generated.

I claim as my invention:

1. The combination with a liquid-containing tank having enlargements at the top and bottom and tubes located outside the tank and connecting the enlargements, and an outer casing for the tank and tubes, of means for producing a circulation of liquid through the tank and the tubes, and means for producing a circulation of cooling fluid within the casing.

2. The combination with a liquid-containing tank having enlargements at the top and bottom, tubes located outside the tank and constituting conduits between the enlargements, and a casing for the tank and tubes, of a pump located within the tank for producing a downward circulation of liquid through the tubes, a fan located outside the tank and casing for producing a circulation of air within the casing and a driving motor for the pump and the fan.

3. The combination with a liquid-containing tank having a closed annular chamber at the top and an annular chamber at the bottom having open communication with the tank and a plurality of external tubes interposed between the two chambers, of a pump within the tank for forcing liquid therefrom into the closed annular chamber.

4. The combination with a liquid-containing tank, an electrical apparatus disposed in said tank, and an outer casing, of means for producing a circulation of liquid within the tank, and means for producing an artificial circulation of air between the tank and the casing.

5. The combination with a liquid-containing tank, an electrical apparatus disposed in said tank, a casing around the tank, and tubes located between the tank and casing and in open communication with the top and the bottom of the tank, of means for producing a circulation of liquid through the tubes and means for producing a circulation of cooling fluid within the casing.

6. The combination with a liquid-containing tank, a transformer immersed in the liquid, a casing around the tank, and tubes in open communication with the bottom and the top of the tank, of a pump located within the tank for producing a circulation of liquid downwardly through the tubes, a propeller for circulating cooling fluid around the tubes, and a motor for driving both the pump and the propeller.

7. The combination with a fluid-containing tank, electrical apparatus disposed within the tank and a plurality of tubes or pipes located outside thereof and adjacent thereto for establishing direct communication between the fluid near the top and the fluid near the bottom of the tank, of means for circulating a cooling fluid around the tubes or pipes.

8. The combination with a fluid-containing tank, electrical apparatus disposed therein, and a plurality of tubes or pipes outside the tank and adjacent thereto for establishing direct communication between the fluid near the top and the fluid near the bottom of the tank, of means for circulating a cooling fluid around the tubes or pipes and means for causing liquid to flow from the tank downwardly through the tubes or pipes.

9. The combination with a fluid-containing tank, electrical apparatus disposed therein and a plurality of tubes or pipes outside the tank and adjacent thereto for establishing direct communication between the fluid near the top and the fluid near the bottom of the tank, of propellers for forcing fluid from the tank through the tubes or pipes and means for circulating a cooling fluid around the tubes or pipes.

10. The combination with a fluid-containing tank, electrical apparatus disposed within the tank, and conducting means located adjacent to the tank for establishing direct communication between the fluid near its top and the fluid near its bottom, of means for circulating a cooling fluid around said conducting means and said tank.

11. The combination with a fluid-containing tank having external conducting means for transferring fluid directly from one end to the other, and a shell surrounding said conducting means, of means for circulating a cooling fluid within said shell.

In testimony whereof, I have hereunto subscribed my name this 26th day of October, 1908.

KARL C. RANDALL.

Witnesses:
WM. P. L'HOMMEDIEN,
BIRNEY HINES.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."