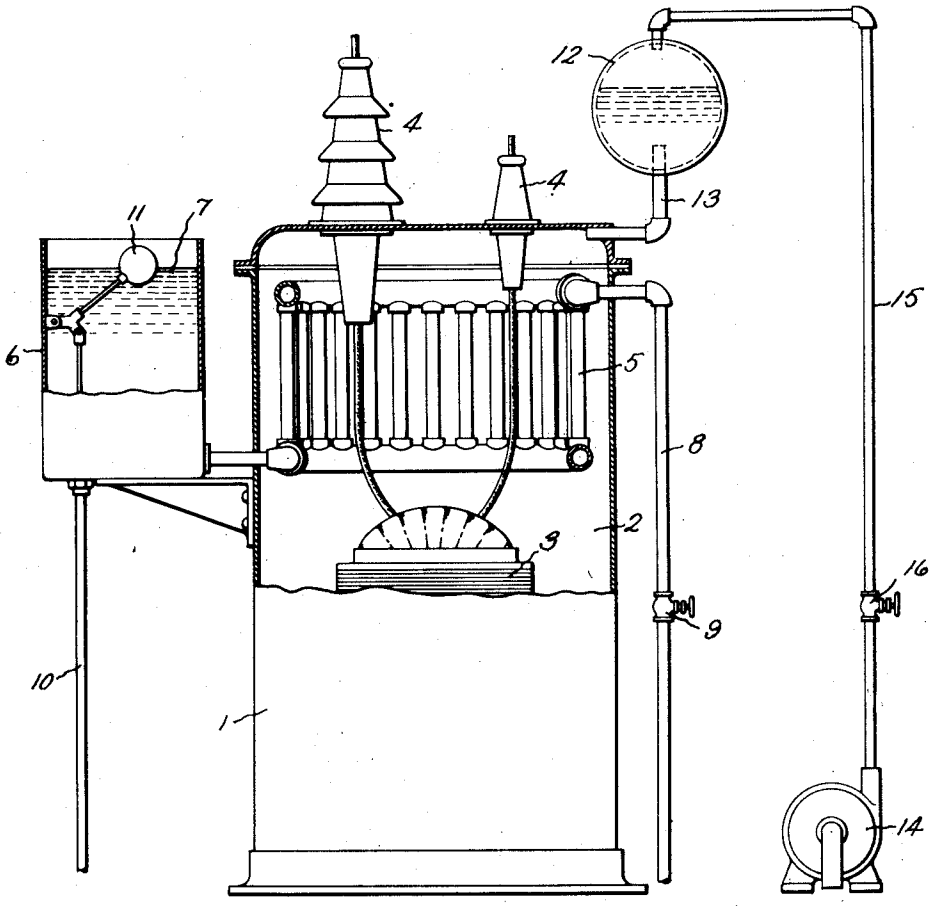
Sept. 14, 1926. 1,600,038

C. E. CANFIELD

TRANSFORMER

Filed Feb. 16, 1922



Inventor:
Charles E. Canfield,
by Albert G. Davis
His Attorney.

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UNITED STATES PATENT OFFICE.

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TRANSFORMER.

Application filed February 16, 1922. Serial No. 537,094.

My invention relates to transformers. The operation of a transformer produces heat in the windings and core and in many instances special provisions must be made for conducting away and dissipating this heat rapidly enough to prevent the occurrence of any dangerous temperatures. The general object of the invention is to provide an improved construction and arrangement of parts for absorbing and carrying away this excessive heat.

A great many methods have been devised for preventing undesirable temperatures in transformers and it is very common to immerse a transformer in a body of insulating liquid contained in a suitable casing or tank, the liquid usually employed being a specially treated oil having a high dielectric strength. Besides serving as an insulating medium, this oil or other liquid further serves to absorb the heat generated by the transformer and to transfer it by natural thermal circulation or otherwise to some suitable heat radiating means such as the walls of the casing whence it is dissipated or radiated to the surrounding air. A more rapid absorption of heat is frequently provided for by immersing in the insulating liquid an arrangement of piping or the like through which a current of heat absorbing liquid, usually water, is passed. A cooling arrangement of this nature, however, may not always be perfectly tight and if any of the water or other liquid contained in the piping leaks through into the surrounding oil, it may cause injury by reducing the dielectric strength of the oil and the transformer insulation. One of the objects of the present invention is to provide an improved arrangement of this nature in which danger of leakage from the current of cooling liquid into the oil is eliminated.

Further objects and advantages will appear from the following description and the accompanying drawing which disclose one embodiment of the invention.

The arrangement shown partly in section in the drawing includes a casing or tank 1 containing a body of insulating liquid 2 in which is immersed a transformer 3. The insulating liquid commonly used is oil and, for the purpose of disclosing this invention, the use of oil will be assumed although it is to be understood that any other suitable liquid may be used. Insulating bushings 4 for the transformer leads pass through the cover of the casing 1. An arrangement of heat absorbing piping 5 is immersed in the oil within the casing and preferably in the upper part thereof as shown so as to be in contact with that portion of the body of oil which is warmest. A storage tank 6 holds a supply of suitable heat absorbing liquid 7 such as water and is connected with the piping 5 as is also a discharge pipe 8 which may be closed by a valve 9. The liquid 7 is maintained at a constant level within the tank 6 by a supply pipe 10 and a valve controlled by a float 11. The level of this liquid 7 is somewhat above the highest part of the piping 5 so that this piping may be kept filled at all times and so that a current of this liquid will pass through the piping whenever the valve 9 is open, this valve being used to control the rate at which the liquid passes through the piping. The purpose of this current of liquid is of course to absorb heat through the walls of the piping 5 from the warm oil surrounding it. The greater the load on the transformer, the greater will be the rate at which heat is generated, thus making an increased flow of liquid in the piping 5 desirable so as to absorb the heat more rapidly. By maintaining the level of the liquid 7 above the highest part of the piping 5, the liquid in the piping 5 is maintained throughout at greater than atmospheric pressure so that the air dissolved in the liquid cannot be given off and accumulate in the top of the piping to break the flow of liquid. The expansion chamber 12, however, maintains a pressure in the insulating liquid 2 greater than the pressure of the cooling liquid in the piping 5 so that in case of a leak in the piping none of the cooling liquid can ever flow out into the insulating liquid.

An oil conservator 12 is connected by a pipe 13 with the highest point of the space within the casing 1 and enough oil is introduced to completely fill the casing 1 and to partially fill the conservator as shown. The upper end of the pipe 13 is preferably a short distance above the bottom of the conservator so that any moisture or sediment in the conservator will settle to the bottom of the conservator around this pipe and cannot pass through the pipe into the casing 1. One feature of the present invention is that the difference in level between the surface

of the oil in the conservator and the surface of the water or other cooling fluid 7 in the supply tank 6 is such that the pressure of the oil outside the piping 5 will be somewhat greater than that of the fluid within this piping. As a result of this, any leak which may occur in the piping 5 may permit oil surrounding this piping to pass into the piping where it can do no harm but none of the fluid within the piping can pass out into the oil so as to reduce the dielectric strength of the oil or cause injury to the transformer or its connections. If it is desired to increase the pressure of the oil outside the piping 5, a blower 14 may be used to introduce air under pressure through the pipe 15 into the conservator until the desired pressure is attained, the valve 16 being then closed.

The piping 5 includes upper and lower hollow members connected by a plurality of vertical pipes or tubes. The lower member is connected to receive the current of cooling water from the storage tank 6 and, after rising in parallel paths from this lower member through the vertical tubes into the upper member, the water is discharged from the upper member through the descending discharge pipe 8. By providing the plurality of paths for the water through the piping 5, the pressure necessary to create the desired rate of flow of this water is decreased and consequently a decreased pressure of the oil surrounding the piping 5 will be sufficient to overcome this water pressure. If the valve 9 is opened so as not to hold back the column of water in the pipe 8, this column of water will then act to further decrease the pressure of the water within the piping 5 and so permit a further decrease in the surrounding oil pressure. Another advantage of this arrangement of piping 5 is that the plurality of vertical pipes or tubes form parallel paths for thermal circulation of the water between the upper and lower hollow members connected by them.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. The combination with a transformer immersed in a body of insulating liquid within a casing, of a cooling pipe for conducting a current of cooling liquid through said insulating liquid, an expansion chamber, said insulating liquid extending from said casing into said expansion chamber, whereby the insulating liquid in the casing is under a pressure due to the head of liquid in said expansion chamber, a pipe for supplying cooling liquid at high pressure, and means interposed between said high pressure pipe and said cooling pipe for reducing the pressure of the cooling liquid in said cooling pipe to a value between that of the atmosphere and that of the insulating liquid surrounding said cooling pipe.

2. The combination with a transformer immersed in a body of insulating liquid within a casing, of a cooling pipe for conducting a current of cooling liquid through said insulating liquid, an expansion chamber, said insulating liquid extending from said casing into said expansion chamber, whereby the insulating liquid in the casing is under a pressure due to the head of liquid in said expansion chamber, and means for supplying a flow of cooling liquid through said cooling pipe at a pressure between that of the atmosphere and that of the insulating liquid surrounding said cooling pipe.

In witness whereof I have hereunto set my hand this 14th day of February, 1922.

CHARLES E. CANFIELD.