Fig. 1.

Fig. 2.

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This invention relates to oil-cooled electric transformers provided with external air cooled tubes through which and the casing of the transformer, oil can circulate automatically by reason of the difference in temperature thereof in the lower and upper portions of the tubes. In such an arrangement the rate of cooling of the oil in the tubes is slow, so that the rate of circulation of the oil through the tubes and the casing is also slow.

Now the present invention has for its object to effect the cooling of the oil in the tubes in a quicker and more effective manner than hitherto and thus to produce a quicker circulation thereof through the tubes and transformer casing.

For this purpose, in an oil-cooled transformer arrangement according to the present invention, the transformer casing is provided externally with a number of oil circulating tubes of larger diameter than heretofore usual and through each of which extend a number of ducts connected to plates and communicating with upper and lower headers through which and the ducts a cooling medium can be caused to flow so as to effect rapid cooling of the oil in contact with the ducts, each tube having inlet and outlet branches near its ends and an uninterrupted bore from end to end. The cooling medium which may conveniently be water, may be forced under pressure through the ducts in the opposite direction to that in which the oil flows through the tube.

In the accompanying illustrative drawings, Figs. 1 and 2 are elevations at right angles to one another and Fig. 3 a plan, showing one construction of oil-cooled transformer embodying the present invention. Fig. 4 is a longitudinal central section, showing, to a larger scale, one of the oil tubes with associated cooling ducts and headers employed with the transformer casing. Fig. 5 is an underside view of part of the lower header and of the tube with associated ducts.

In the example shown a is the casing of an oil cooled transformer and b external vertical oil circulating tubes each of which is provided with inlet and outlet branches b₁ and b₂ respectively by which it is secured to the casing, the tube extending throughout the greater part of the height of the casing. Each of the tubes b has, as shown in Fig. 4, an uninterrupted bore and is provided internally with a number of ducts c which extend throughout the length of the tube, are carried by tube plates c₁ and c₂ and communicate with lower and upper headers d and e provided with water inlet and outlet branches d₁ and e₁ respectively.

The upper tube plate e₁ is provided with a flange e₂ by which it is secured in place between the upper end of the tube b and the upper header e, whilst the lower tube plate e₂ is fitted to slide in a liquid tight manner within the lower end wall of the tube and the adjacent header d which is bolted to the lower end of the tube, f being an interposed packing ring that is compressed in place by the header to ensure a liquid tight joint between the tube plate c₁ and the tube end wall and header. In this way expansion and contraction of the ducts c is provided for. The lower header d is provided with a removable cover g so that ready access can be gained to the ducts c when desired.

As will be seen, the arrangement is such that when the transformer is in action, heated oil within the casing can flow downward freely through the tubes b and be quickly cooled by contact with the ducts e through which the cooling fluid is caused to flow in an upward direction. Each tube b may be provided with a hole b₃ for attachment of an air cock, each branch b₁ b₂ may be provided with holes b₄ b₅ for attachment of a thermometer and pressure gauge respectively, each upper header e may be provided with a hole e₁ for the insertion of a thermometer and with a hole e₂ for connection to an air cock and the cover g of each lower header d may be provided with a hole d₂ for attachment of a drain cock.

The number and diameter of the tubes b employed and the number of ducts c used in each tube can be varied to suit requirement.

What I claim is:

1. An oil-cooled electric transformer comprising a casing, external cooling tubes each connected at its upper and lower ends to said casing and through which oil can circulate in an automatic and uninterrupted manner when the transformer is in action, a plurality of cooling ducts arranged within each external cooling tube and through which a cooling medium can be caused to flow, upper and lower headers secured to the upper and lower ends respectively of said cooling tube and communicating with said cooling ducts and upper and lower plates to which the ends of said cooling ducts are connected, one of said plates being held between one end of
said external cooling tube and the adjacent header and the other plate being fitted to slide in a liquid-tight manner within the other end of said external cooling tube.

2. An oil-cooled electric transformer comprising a casing, external cooling tubes each connected at its upper and lower ends to said casing and through which oil can circulate in an automatic and uninterrupted manner when the transformer is in action, a plurality of cooling ducts arranged within each external cooling tube and through which a cooling medium can be caused to flow, upper and lower headers secured to the upper and lower ends of said cooling tube and the lower of which is provided with a removable cover one of said plates being secured between one end of said cooling tube and the adjacent header and the other plate being arranged to slide endways in said cooling tube, and a packing ring surrounding the latter plate and adapted to be compressed between the adjacent ends of the cooling tube and its companion header and around the latter plate.

3. For an oil-cooled transformer, a cooling arrangement comprising a cooling tube having lateral inlet and outlet branches for attachment to a transformer casing, headers secured to the ends of said tube and having branches for attachment to a source of cooling fluid, ducts extending longitudinally through said tube, plates to which the ends of said tubes are secured, one of said plates being secured between one end of said tube and the adjacent header, and the other plate being arranged to slide in a liquid tight manner in said tube, a packing ring surrounding the latter plate and arranged to be compressed between the adjacent end of said tube and header, and a removable cover secured to one of said headers.

4. For an oil-cooled transformer, a cooling arrangement comprising a cooling tube having lateral inlet and outlet branches for attachment to a transformer casing headers secured to the ends of said tube and having branches for attachment to a source of cooling fluid, ducts extending longitudinally through said tube, plates to which the ends of said tubes are secured, one of said plates being secured between one end of said tube and the adjacent header, and the other plate being arranged to slide in a liquid tight manner in said tube, and a removable cover secured to one of said headers.

5. An oil-cooled electric transformer comprising a casing enclosing the transformer, external tubes each connected at its upper and lower ends to said casing and through which oil can circulate in an automatic and uninterrupted manner when the transformer is in action, a plurality of straight parallel cooling ducts extending through said tube, and headers arranged above and below the upper and lower ends of each tube and having their interior out of communication with the interior of said tube, each header being in free and direct communication with the adjacent ends of all the said cooling ducts so that a cooling medium can flow through all the cooling ducts in parallel.

6. An oil-cooled electric transformer comprising a casing enclosing the transformer, external tubes each connected at its upper and lower ends to said casing and through which oil can circulate in an automatic and uninterrupted manner when the transformer is in action, headers arranged above and below the upper and lower ends of each tube, tube plates separating the interior of the tube from the interiors of said headers and a plurality of straight parallel cooling ducts carried by said tube plates and in communication with the interiors of said headers and through which said headers a cooling medium can be caused to flow, one of said tube plates being adapted to admit of expansion and contraction of said ducts.

7. An oil-cooled electric transformer comprising a casing enclosing the transformer, external tubes each connected at its upper and lower ends to said casing and through which oil can circulate in an automatic and uninterrupted manner when the transformer is in action, headers arranged above and below the upper and lower ends of each tube, a stationary tube plate separating the interior of one header from the interior of said tube, a movable tube plate arranged to slide in a fluid tight manner in said tube and to separate the interior of said tube from the interior of the second header, and straight plain parallel cooling ducts extending through said tube and connected to said tube plates and through which said headers a cooling medium can be caused to flow.

8. An oil-cooled electric transformer comprising a casing for said transformer, external tubes each connected at its upper and lower ends to said casing and through which oil can circulate in an automatic and uninterrupted manner when the transformer is in action, headers connected to the upper and lower ends of said tube, a stationary tube plate separating the upper header from the interior of said tube, a movable tube plate arranged to slide in a liquid tight manner in said tube below the lower oil outlet therefrom and to separate the interior of said tube from the interior of the lower header, straight parallel ducts connected to the tube plates and through which the headers, a cooling medium can be caused to flow and a cover detachably connected to the lower side of said lower header.

Signed at London, this 26th day of August, 1926.

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