Sept. 16, 1969 C. D. WARE 3,467,178

TRANSFORMER COOLING APPARATUS

Filed Dec. 27, 1966 2 Sheets-Sheet 1

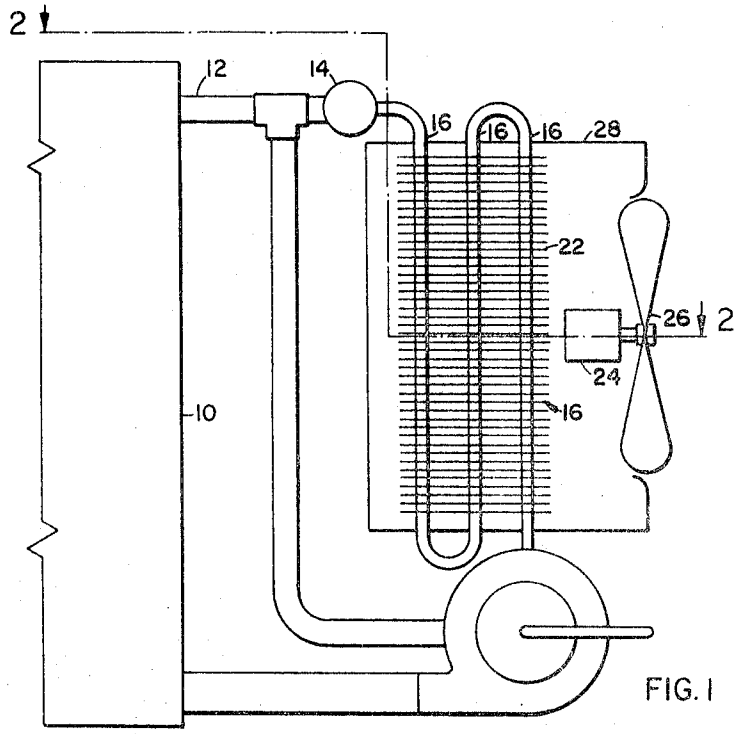


FIG. 1

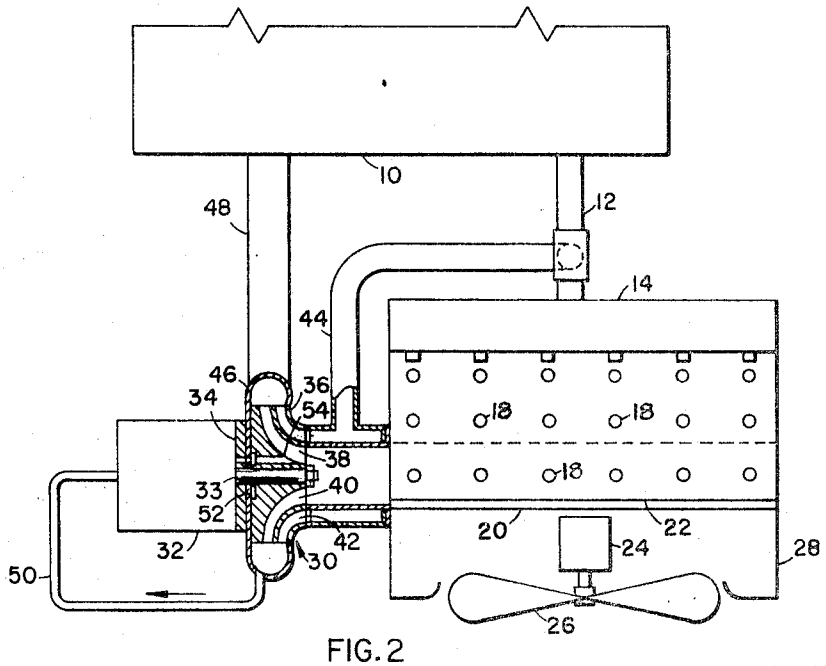


FIG. 2

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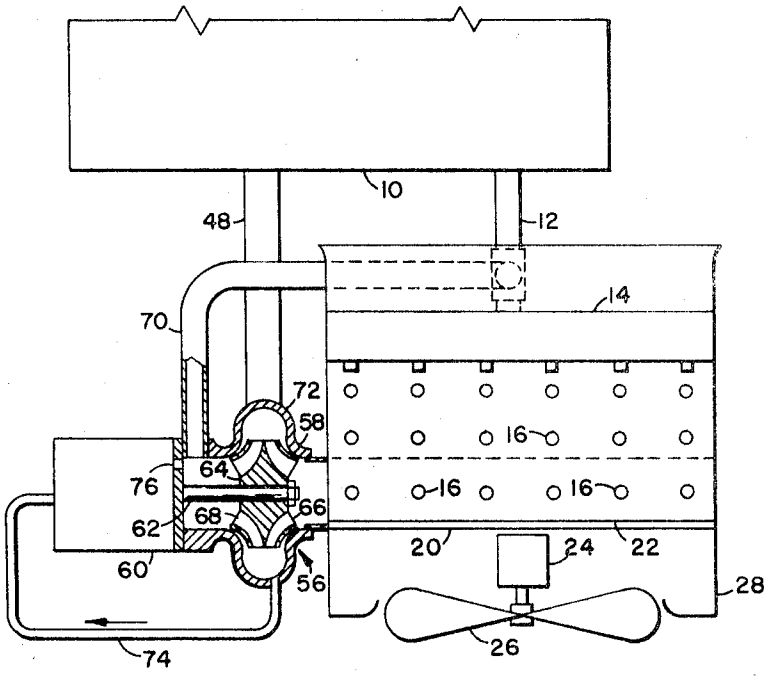


FIG.3

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TRANSFORMER COOLING APPARATUS

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U.S. Cl. 165—107 4 Claims

ABSTRACT OF THE DISCLOSURE

Transformer cooling apparatus including means for pumping transformer fluid from the transformer and back to the transformer through a circuit containing parallel paths one of which contains a heat exchanger in which heat is transferred to a heat sink such as air by forced convection of air through the heat exchanger.

Transformers require a relatively large flow of cooling fluid through the transformer in order to prevent certain areas from reaching an excessive temperature. If all of the cooling fluid is circulated through the heat exchanger, the total cross-sectional flow area of the tubes must be large and the size of the headers must also be large. These requirements make the heat exchanger generally large and expensive.

It is therefore an object of this invention to provide transformer cooling apparatus having a more efficient lower cost heat exchanger by passing some of the cooling fluid around the heat exchanger and thus maintaining the flow required in the transformer.

With a construction in which some of the cooling fluid is bypassed around the heat exchanger, the pump operates against a lower head with respect to the bypassed fluid.

It is therefore one of the objects of this invention to provide apparatus which permits the use of a lower cost motor and which also results in lower power requirements.

It is another object of this invention to provide transformer cooling apparatus having a pump for proportioning the flow through the heat exchanger and the flow around the heat exchanger.

It is still another object of the invention to provide in transformer cooling apparatus a simple system in which only the cooled fluid pumped is passed through the motor to cool the same.

Other objects and advantages of the invention will become apparent as the specification proceeds to describe the invention with reference to the accompanying drawings in which:

FIGURE 1 is a side elevational view of a transformer and cooling apparatus connected thereto;

FIGURE 2 is a sectional view taken substantially on line 2—2 of FIGURE 1 with the pump shown in section;

FIGURE 3 is a sectional view of a modification of the invention taken substantially on line 2—2 of FIGURE 1.

Referring now to FIGURE 1, a transformer **10** has a conduit **12** for conducting cooling fluid to the inlet header **14** of a heat exchanger **16**. Heat exchanger tubes **18** conduct cooling fluid from inlet header **14** to outlet header **20**. Fins **22** are secured to tubes **16** to increase the heat transfer.

A motor **24** drives a fan **26** which moves air through the casing **28** and over the coil **16** to cool the cooling fluid flowing in the coil.

A pump **30** is driven by a motor **32**. The shaft **33** of the motor **32** extends through the end wall **34** of the motor and into the housing **36** of the pump **30**. An impeller **38** is secured on the shaft **33** to rotate therewith.

Impeller **38** has a first annular passageway **40** with

blades therein and a second annular passageway **42** with blades therein. Passageway **40** is in fluid communication with header **20** to receive cooling fluid therefrom and passageway **42** is in fluid communication with conduit **44** which receives cooling fluid from conduit **12**.

Housing **36** has a volute discharge chamber **46** in which the cooled fluid from header **20** and the bypassed cooling fluid from conduit **44** are partially mixed. Volute chamber **46** is connected to discharge the cooling fluid into a conduit **48** which conducts it to the transformer **10**.

The motor **32** is cooled with the cooling fluid of the system as will now be described. A conduit **50** is in fluid communication with volute discharge chamber at a location to intercept fluid from passageway **40** which conducts the cooled fluid from the heat exchanger. This cooled fluid flows from conduit **50** into the motor **32** to cool the motor **32**. This fluid then passes from the motor to annular passageway **52** in impeller **38** and then through one or more holes **54** to the suction inlet side of impeller **38**. Although it is preferred to use the cooled cooling fluid for motor cooling, it should be understood that a mixture of the cooled cooling fluid and the bypassed cooling fluid could be used and the motor could even be cooled by using all bypassed cooling fluid provided that the motor is designed for high temperature operations.

Referring now to FIGURE 3 it can be seen that the construction is quite similar to that of FIGURES 1 and 2 except that in this case the pump impeller has the passageways in back to back relationship. The pump **56** of FIGURE 3 has a casing **58** and is driven by a motor **60** which has a shaft **62** extending into the pump casing **58** and supporting an impeller **64**.

Impeller **64** has a first annular passageway **66** with blades therein and a second annular passageway **68** with blades therein.

Passageway **66** is in fluid communication with header **20** to receive cooled cooling fluid therefrom, and passageway **68** is in fluid communication with bypass conduit **70** to receive cooling fluid therefrom. Bypass conduit **70** is connected to receive cooling fluid from conduit **12**.

Pump **56** has a volute discharge chamber **72** which receives fluid from both passageways in impeller **64** and discharges the fluid into conduit **48** for flow to transformer **10**.

Motor **60** receives cooling fluid from conduit **74** which is connected to volute discharge chamber **72** in the plane of the outlet of passageway **66** in order that the fluid entering conduit **74** may be substantially all cooled cooling fluid. Cooling fluid leaves the motor and enters the pump through opening **76**. As explained with reference to FIGURE 2, it is preferred that the fluid conducted to the motor for motor cooling be substantially all cooled cooling fluid, however it is possible to use a mixture of cooled and bypassed cooling fluid or even all bypass fluid under certain conditions.

While I have described the preferred embodiments of my invention, I contemplate that many changes may be made without departing from the scope or spirit of my invention and I desire to be limited only by the claims.

I claim:

1. Apparatus for cooling a transformer comprising a first conduit for conducting fluid from and to a transformer in a closed circuit, a heat exchanger in said first conduit, means for forcing a heat exchange fluid over the outside of said heat exchanger to cool said heat exchanger, a second conduit in fluid communication with said first conduit and bypassing said heat exchanger, a pump, a motor for driving said pump, said pump being connected in fluid communication with said first and second conduit to move fluid through said first and second

conduits, said pump having a centrifugal impeller with a first passageway in suction fluid communication with said heat exchanger and a second passageway in suction fluid communication with said bypass conduit.

2. Apparatus of claim 1 including a third conduit extending from the discharge side of said centrifugal impeller to said motor for conducting fluid to said motor to cool said motor, means for conducting fluid from said motor to said conduit at a point upstream from the discharge side of said pump.

3. Apparatus of claim 2 in which said centrifugal impeller is arranged with said first and second passageways nested one within the other, said passageways in common discharge fluid communication.

4. Apparatus according to claim 2 in which said centrifugal impeller is arranged with said first and second passageways back to back, said passageways in common discharge fluid communication.

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U.S. Cl. X.R.

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