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COOLING MEANS FOR ELECTRICAL APPARATUS

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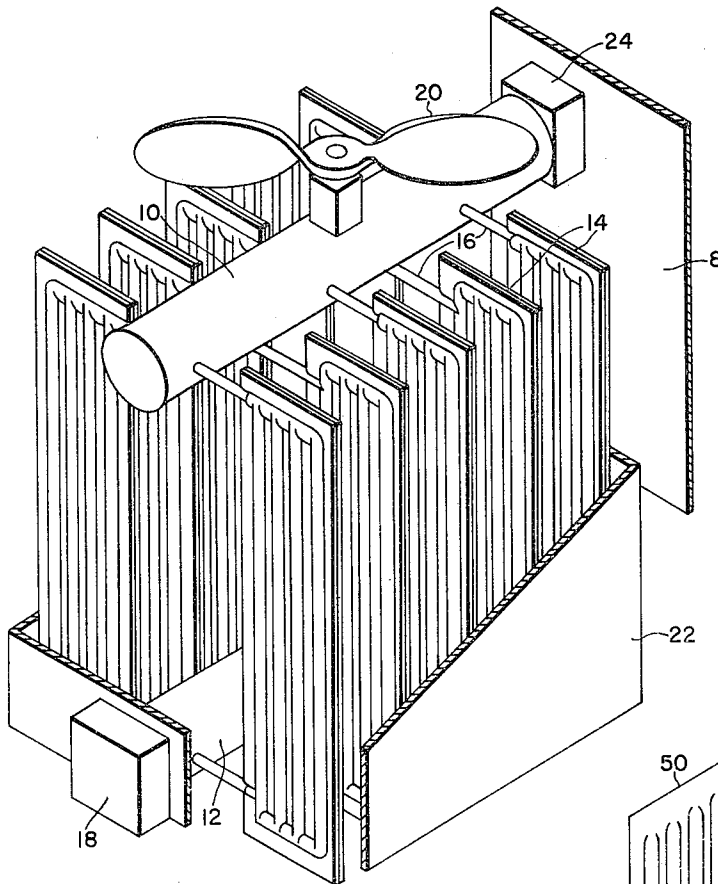


Fig. 1.

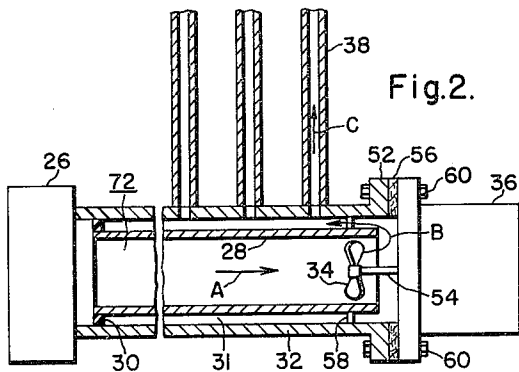


Fig. 2.

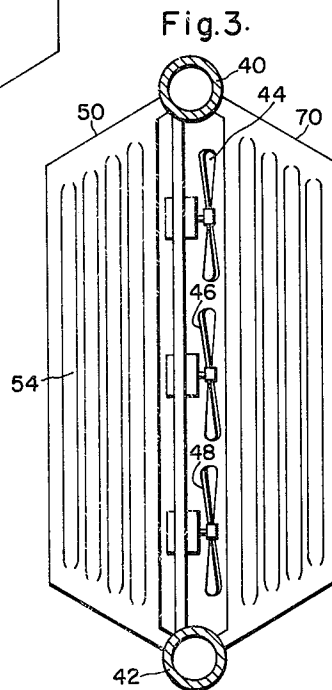


Fig. 3.

WITNESSES

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COOLING MEANS FOR ELECTRICAL APPARATUS

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5 Claims. (Cl. 165—108)

This invention relates in general to coolers for heat producing electrical apparatus and more particularly to coolers of the liquid filled type.

Liquid filled coolers for electrical apparatus of the prior art have conventionally employed either gravity circulation of the cooling liquid or pumping means to circulate the cooling liquid through the cooler.

Accordingly, it is the general object of this invention to provide a new and improved liquid filled cooler which may be quickly converted from gravity circulation to force circulation.

It is a more particular object of this invention to provide a new and improved coolant pump which is of general application but particularly adapted for use in the cooler of the invention.

It is yet another object of this invention to provide a coolant pump for single flange mounting.

Briefly, the present invention accomplishes the above cited objects by providing two manifolds or headers which are each attached at one end to the liquid filled electrical device which it is desired to cool. The manifolds are interconnected by several hollow cooling fins of generally rectangular cross section. The ends of the manifolds remote from the device to be cooled are sealed if it is desired to rely entirely on gravity circulation of the coolant liquid. If it is desired to pump the coolant through the cooler to increase the cooling capacity of the cooler a pump of novel design is inserted in one of the manifolds. This pump has an attached tube of smaller diameter than the manifold or header. This tube is essentially as long as the manifold or header. An impeller, driven by any suitable means, is located within the tube. The tube is open on both ends; the end of the tube remote from the device being cooled is in communication with the space between the tube and the header to allow coolant flow between the inside and the outside of the tube. The end of the tube closest to the apparatus being cooled is in communication with the coolant in the apparatus being cooled and is equipped with an exterior seal which engages the inner wall of the header or manifold. This seal provides mechanical support for the tube and prevents short circuiting of the pump intake and discharge. If the central tube is used as the pump intake, the impeller is so arranged to move the coolant axially along the tube and discharge the coolant into the annular space between the tube and the header or manifold. Alternatively, the impeller may be so constructed and driven as to move the coolant from the annular space between the header or manifold and the tube and discharge the coolant axially through the tube to the device being cooled. The cooler is also equipped with air moving means such as fans or blowers to move air over the fins and manifolds.

Further objects and advantages of the invention will become apparent as the following description proceeds and features of novelty which characterize the invention will be pointed out in particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the invention, reference may be had to the accompanying drawings in which:

FIGURE 1 is a perspective view of an embodiment of the invention with parts broken away for clearness;

FIG. 2 is a vertical transverse sectional view partly in

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side elevation of a coolant pump which may be used with the cooler illustrated in FIG. 1; and

FIG. 3 is an end view of another embodiment of the invention.

Referring to FIG. 1 of the drawings, there is illustrated the preferred embodiment of the invention. Two tubular headers or manifolds 10 and 12 are each attached at one end to a wall 8 of a liquid filled device that is to be cooled. These headers are connected by two rows of hollow fins, such as fins 14. Each of the fins 14 is attached to the headers by nipples such as 16. The connections of the nipples 16 to the headers may be staggered by providing staggered holes in the headers to permit closer spacing of fins 14 and less weakening of the header walls than would be the case if the holes in the headers were in a single straight line. A fan or blower 20 may be located on the top of header 10 to increase the natural flow of air over the fins 14. Valves such as valve 24, may be located between the headers 10 and 12 and the wall of the device 8 being cooled. One function of these valves is to permit closing off of one cooler for maintenance purposes in installations where a bank of coolers is used. The cooler may be surrounded on the sides by a sheet metal enclosure 22 to create a stack effect to better direct cool air from near ground level through the array of cooling fins 14. The new and improved circulating pump 18 of the invention is shown flange mounted on header or manifold 12, however, it will be understood that the pump 18 is also suitable for mounting in header 10. If desired pumps such as pump 18 may be installed in both headers 10 and 12.

In FIG. 2 of the drawings is illustrated a vertical sectional view with some parts shown in side elevation of a coolant pump 72 which may be used in the invention. This coolant pump 72 includes a central tube 28 having a diameter less than that of an enclosing header or manifold 32. A seal 30 is located between the tube 28 and the header 32. This seal 30 is located near the end of the header 32 closest to the device being cooled. A valve 26 may be located between the header 32 and the device being cooled to facilitate coolant shut off to the header 32 for maintenance purposes. An impeller 34 is located near the end of the tube 28 remote from the device being cooled. The impeller 34 may be driven, through shaft 54, by any suitable driving means such as an electric motor 36. The tube 28 is supported at one end by the seal 30 and at the other end by a web 58. The tube 28 is in communication with valve 26 at one end of the tube and the tube is in communication with an annular space 31 between the tube 28 and the header 32 at the other end of the tube 28. The annular space 31 is in communication with a plurality of hollow cooling fins such as cooling fin 38. The pump 72 is arranged for single flange mounting on the flange 52 of the header 32 by means of bolts 60. A gasket 56 prevents leakage of coolant about the flange 52. The shape and direction of rotation of the impeller 34 may be so chosen so as to use the tube 28 as a suction line and the annular space 31 as a discharge line. In this case, the coolant flow would be as indicated by the arrows A, B and C. Alternatively, the blades of the impeller 34 may be so shaped and the direction of rotation of the impeller so chosen as to use the annular space 31 between the tube 28 and the header 32 as the intake of the pump 72 and the tube 28 as the discharge or output of the pump. It will be noted that the seal 30 prevents any short circuiting of the pump intake and discharge at the end of the pump 72 closest to the device being cooled. The seal 30 is made strong enough to provide mechanical support for one end of the tube 28. The other end of tube 28 may be supported by bracket or spider 58 or any other open work support

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which will not prevent coolant flow. The pump 72 is easy to insert in the header 52 since the bolts 60 are the only fasteners used to secure the pump 72 to the flange 52 of the header. Should the pump 72 be removed, the flange 52 may be covered with a plate and gravity circulation of the coolant will not be impeded.

There is illustrated in FIG. 3 an embodiment of the invention which uses blowers or fans 44, 46, and 48 which are mounted between two banks of cooling fins 50 and 70. The cooling fins of each bank are connected between a header or manifold 40 and a header or manifold 42. The surface area of the fins 50 and 70 may be increased by corrugating the cooling fin with corrugations such as corrugation 54. It will be observed that the cooling fans 44, 46 and 48 are located in a protected zone between banks of fins where the need for guards is minimized. The cooling fans draw air horizontally through one bank of cooling fins and discharge the air horizontally through the second bank of cooling fins. A coolant pump as illustrated in FIG. 2 may be inserted in either or both of manifolds 40 and 42.

It will, therefore, be apparent that there has been disclosed a cooler for liquid filled electrical apparatus which is readily changed from gravity circulation to forced circulation.

Since numerous changes may be made in the above-described apparatus and different embodiments may be made without departing from the spirit thereof, it is intended that all the matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. A cooling system for liquid cooled electrical apparatus comprising first and second headers each having openings adapted to be disposed in communication with said electrical apparatus and its liquid coolant, said first and second headers each having additional openings therein, cooling fins each having an opening therein, said cooling fins being disposed between said first and second headers with the openings in said cooling fins being in communication with the additional openings in said first and second headers, a member having first and second open ends, said member having passage means interconnecting said first and second open ends, said member being disposed within said first header with its first open end being disposed adjacent the opening in said first header which is adapted for communication with said electrical apparatus, said member being sized to provide a space between said member and said first header, sealing means disposed between said member adjacent its first open end and said first header, impeller means disposed within said member, and driving means connected to said impeller means, said driven impeller means causing the liquid coolant from said electrical apparatus to circulate in a path which includes the passage means of said member, the space between said member and said first header, said cooling fins, and said second header, when the openings in said first and second headers are disposed in communication with said electrical apparatus.

2. A cooling system for liquid cooled electrical apparatus comprising first and second headers each having openings adapted to be disposed in communication with said electrical apparatus and its liquid coolant, said first and second headers each having additional openings therein, cooling fins each having an opening therein, said cooling fins being disposed between said first and second headers with the openings in said cooling fins being in communication with the additional openings in said first and second headers, air moving means disposed to move air over said cooling fins, a member having first and second open ends, said member having passage means interconnecting said first and second open ends, said member being disposed within said first header with its first end being disposed adjacent the opening in said header which is adapted for communication with said

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electrical apparatus, said member being sized to provide a space between said member and said first header, sealing means disposed between said member adjacent its first end and said first header, impeller means disposed within said member near its second end, and driving means connected to said impeller means, said driven impeller means causing the liquid from said electrical apparatus to circulate through said cooling fins.

3. A cooling system for liquid cooled electrical apparatus comprising first and second headers each having openings adapted to be disposed in communication with said electrical apparatus and its liquid coolant, said first and second headers each having additional openings therein, cooling fins each having an opening therein, said cooling fins being disposed between said first and second headers with the major axes of said cooling fins being substantially perpendicular to said first and second headers and the openings in said cooling fins being in communication with the additional openings in said first and second headers, air moving means disposed to move air over said cooling fins, said air cooling means being disposed adjacent one of said headers and moving air substantially parallel with the major axes of said cooling fins, a tubular member having first and second open ends, said tubular member having passage means interconnecting said first and second open ends, said tubular member being disposed within said first header with its first end being disposed adjacent the opening in said header which is adapted for communication with said electrical apparatus, said tubular member being sized to provide a space between said tubular member and said first header, sealing means disposed between said tubular member and said first header, impeller means disposed within said tubular member, and driving means connected to said impeller means, said driven impeller means causing the liquid from said electrical apparatus to circulate through said cooling fins.

4. A cooling system for liquid cooled electrical apparatus comprising first and second headers each having openings adapted to be disposed in communication with said electrical apparatus and its liquid coolant, said first and second headers each having additional openings therein, cooling fins each having an opening therein, said cooling fins being disposed between said first and second headers with the major axes of said cooling fins being substantially perpendicular to said first and second headers and the openings in said cooling fins being in communication with the additional openings in said first and second headers, air moving means disposed to move air over said cooling fins, said air moving means being disposed intermediate said cooling fins and moving air substantially perpendicular to the major axes of said cooling fins, a tubular member having first and second open ends, said tubular member having passage means interconnecting said first and second open ends, said tubular member being disposed within said first header with its first end being disposed adjacent the opening in said header which is adapted for communication with said electrical apparatus, said tubular member being sized to provide a space between said tubular member and said first header, sealing means disposed between said tubular member and said first header, impeller means disposed within said tubular member, and driving means connected to said impeller means, said driven impeller means causing the liquid from said electrical apparatus to circulate through said cooling fins.

5. A cooling system for liquid cooled electrical apparatus comprising first and second vertically spaced elongated headers each having first and second ends, said first and second headers each having wall portions which define an opening extending between their first and second ends, the first end of said first and second headers each being open and adapted to be disposed in communication with said electrical apparatus and its liquid coolant, said first and second headers each having openings in their respective wall portions, cooling fins, each of said cooling fins having an opening extending between its

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ends, said cooling fins being disposed between said first and second headers with the openings in said cooling fins being in communication with the openings in the wall portions of said first and second headers, pumping means removably disposed within said first header, said pumping means sealing the second end of said first header, said second header having its second end sealed, said pumping means including a tubular member having first and second open ends, said tubular member having passage means interconnecting said first and second open ends, an impeller, and driving means for said impeller, said impeller being disposed within said tubular member, said tubular member being disposed within said first header with its second end adjacent the first end of said first header and sized to provide a space between said tubular member and said first header, sealing means disposed

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between said tubular member and said first header, said driven impeller causing the liquid from said electrical apparatus to circulate through the openings in said cooling fins, said cooling system operating by gravity when said pumping means is removed.

References Cited by the Examiner

UNITED STATES PATENTS

1,835,470	12/31	Clarke	-----	165—107	X
2,347,989	5/44	Burnham	-----	165—107	
2,654,583	10/53	Treanor	-----	165—107	
3,030,077	4/62	Disler et al.	-----	165—108	

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