

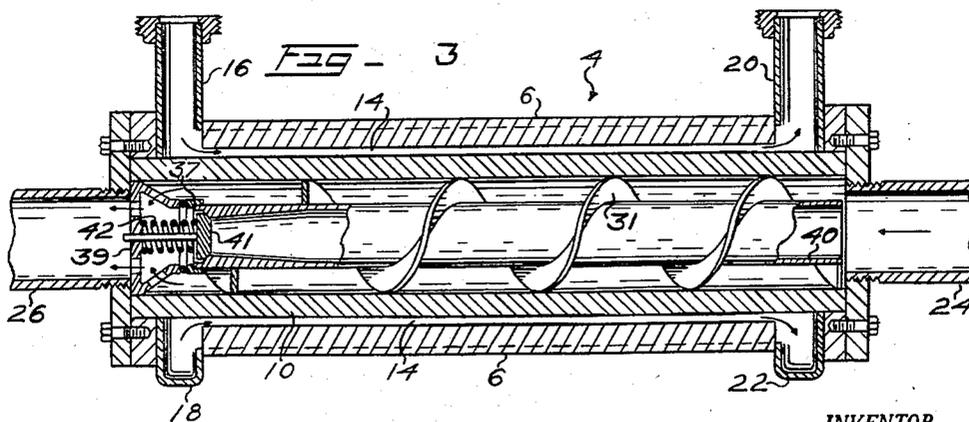
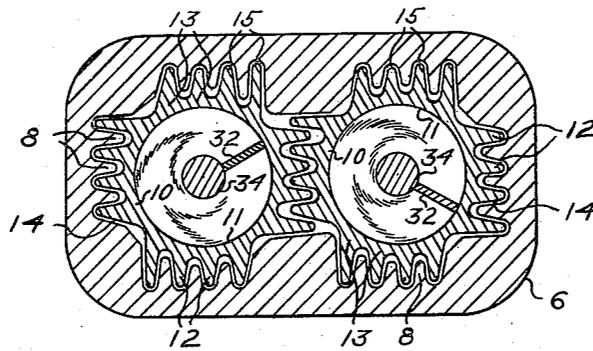
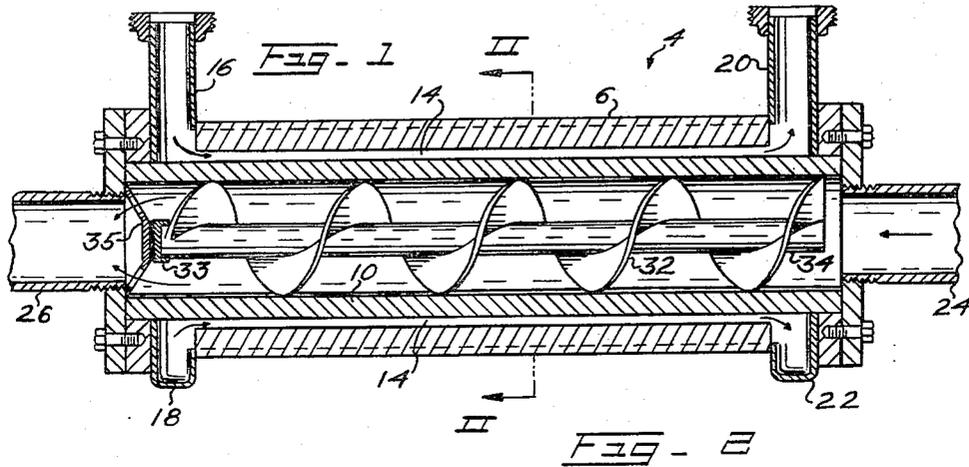
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HEAT EXCHANGER FOR VISCOUS FLUIDS

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HEAT EXCHANGER FOR VISCOUS FLUIDS

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2 Claims. (Cl. 257—312)

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This invention may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalties thereon.

This invention relates to heat transfer devices and in particular to a device for controlling the temperature of viscous fluid systems such as oil systems, by heat exchange between the oil with a hotter or cooler fluid.

The oil cooling systems, including oil coolers and fans, have always been a critical part of power packages especially in combat or military vehicles where unusual restrictions to cooling air flow are imposed due to the requirement for ballistic protection.

One of the primary reasons for failures in power packages of vehicles is the high heat transfer requirements of the power plant system necessitating the use of large oil coolers. The oil cooler systems in use are largely based on a multitude of narrow cross sections of flow and relatively thin thicknesses of walls assembled with brazed connections so that they are not adaptable to high pressures and which are therefore subject to leakage and vibration failures. While the hydraulic pipe system can withstand pressures of 1000 pounds per square inch, present oil coolers can withstand approximately 250 pounds per square inch and then only for short intervals of time.

The high demand of air coolant necessitates large fans of high horsepower input thereby providing favorable conditions for material and bearing failures in the fans also.

Accordingly, it is an object of this invention to provide a heat transfer device which is capable of efficient heat exchange between a viscous fluid, such as oil, and air.

It is also an object of this invention to provide a heat transfer device which prevents formation of a thick adherent layer of the viscous material on the walls of the device as it is cooled.

It is a further object of this invention to provide a heat transfer device in which the coolant quantity is kept to a minimum.

It is a further object of this invention to provide a heat transfer device having elements capable of withstanding pressures of the same level at the hydraulic pipe system to which the heat transfer device is connected.

It is another object of this invention to provide a heat transfer device in which it is possible to preheat efficiently the viscous fluid so that circulation will occur in the low temperature range.

These and other advantages will be apparent from the following description and drawings:

Fig. 1 is a sectional elevational view of a heat transfer device.

Fig. 2 is a sectional view taken along line II—II of Fig. 1.

Fig. 3 is a sectional elevational view of a modification of the heat transfer device.

Referring to the drawings, a heat transfer device 4 utilizing air as a coolant comprises a hollow housing 6

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having a plurality of longitudinal fins 8 on the internal surface. Within the housing 6 is a series of cores or tubes 10 having a plurality of longitudinal fins 12 which intermate with longitudinal fins 8 of housing 6. The thickness of these cores from the inner diameter 11 to the roots 13 is sufficient to withstand the pressure encountered in the hydraulic system of which inlet 24 and outlet 26 is a part. This thickness will vary in accordance with the pressures to be encountered and the material used for the core. Fig. 2 shows only two cores within the housing but any number may be used dependent on the requirements of the individual system. The space 14 between the pairs of intermating fins forms a passageway for the cooling air which enters through conduit 16 of inlet manifold 18 and then flows axially through the longitudinal passage formed by space 14. This space has a greater clearance at the roots 13 of the fins 12 than at the tips or peaks 15 resulting in a concentration of the maximum flow of coolant past the surfaces of highest temperatures, namely the root of the respective fins, thereby providing a most effective heat transfer. This also results in keeping the amount of coolant at a minimum, since it is applied at the highest temperature zone thereby eliminating every cross section of flow of low efficiency. The coolant then discharges through outlet 20 of exit manifold 22.

The fluid to be cooled enters the core 10 by intake pipe 24 and exits through outlet pipe 26, each of the pipes being attached to housing 6 in any conventional means. Within core 10 is a free rotating helicoidal screw 32 on central shaft or bar 34 rotatably supported against axial movement by thrust bearing 33 and spider network 35 or any other thrust bearing device which forces the oil to flow along the walls of the core in spiral paths thereby increasing the time of contact of the oil with the core 10 with a tendency toward turbulent flow.

Rotation of screw 32 is generally accomplished by the flow of the oil or other viscous fluid. As the oil is cooled by the flow of coolant through the counterfins, layers of the oil tend to adhere to the walls of core 10. The rotation of the screw 32 meets with more resistance with decreasing temperature of the oil and by the rotation of screw 32 the layers are then sheared from the core allowing the higher temperature fluid to come into immediate contact with the walls of the core 10. The behavior of the screw 32 is self-controlling in that the flow of fluid is forced along the spiral in a greater number of helices at lower temperatures of the fluid and vice versa for higher temperatures of the fluid.

If desired, the helical screw 32 can be actuated by a gear or hydraulic device. In such a case, rotation of screw 32 is independent of the flow of the fluid and is easily controlled in accordance with the cooling requirements.

The device 4 can also be utilized for facilitating starting the engine under the low temperature conditions by merely shifting from a coolant to a heating medium (a "heated" coolant) in order to preheat and thereby liquefy the oil and provide an unrestricted circulation. Once the engine is operating cooling air can again be provided.

In the modification shown in Fig. 3, the shaft 34 is replaced by a central tube 40. A similar helicoidal screw 31 is rotatably supported against axial movement by thrust bearing 37 and spider network 39 on tube 40 or any other supporting device. At the exit end of tube 40 is a valve 41 normally urged to a closed position by spring 42. This valve is utilized to control the pressure within core 10. When the pressure of flow from the intake 24 reaches a given point the valve 41 opens and flow takes place through the central tube 40 rather than through the spiral path within core 10. Under the in-

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fluence of spring 42 the valve 41 closes on decreasing pressure allowing the oil to again flow in the manner previously described.

If desired the valve 41 could be operated by a remote control system (not shown). In such a case automatic controls could be used which could be activated by the temperature of the entering fluid or the temperature of the discharging fluid as well as the regulation by the pressure.

I claim:

1. A heat transfer device of the character described comprising a core having an inner fluid flow passage and a plurality of peripheral fins thereon each extending parallel to the longitudinal axis thereof, a housing surrounding said core and having a plurality of longitudinal fins therein intermating with said core fins and defining a second fluid flow passage positioned in direct heat transferable relation to said core fluid flow passage, a shaft carrying a bladed helicoidal screw rotatably mounted in said core inner passage and adapted to be rotated upon flow of fluid in said core inner passage, said screw in said core inner passage defining a spiral fluid flow passage therein, the blade of said screw during rotation thereof being adapted to prevent adherence of fluid in said

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core inner passage, said shaft having an inner passage therethrough defining a diverting fluid flow passage, and fluid flow control means regulating fluid flow in said diverting fluid flow passage.

2. A heat transfer device as set forth in claim 1 wherein said fluid flow control means comprises a check valve positioned in said diverting fluid flow passage and adapted to open when flow resistance in said spiral path reaches a predetermined value and to close when said flow resistance decreases below said predetermined value.

References Cited in the file of this patent

UNITED STATES PATENTS

1,132,420	Anderau	Mar. 16, 1915
2,313,705	Jack	Mar. 9, 1943
2,549,687	Jack et al.	Apr. 17, 1951

FOREIGN PATENTS

279,446	Great Britain	Jan. 3, 1929
310,157	Great Britain	Apr. 25, 1929
347,904	Great Britain	May 7, 1931
807,939	Germany	Apr. 26, 1951
1,132,667	France	Mar. 14, 1957