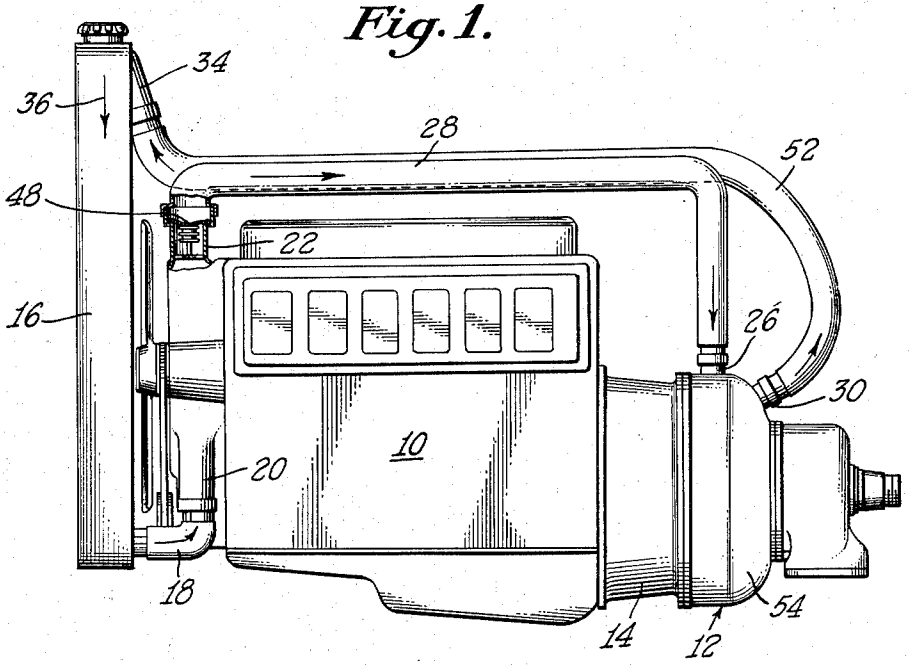
Jan. 18, 1955 K. G. AHLÉN 2,699,642

COOLING MEANS FOR HYDRODYNAMIC TORQUE CONVERTERS

Filed May 10, 1949 2 Sheets-Sheet 1

Fig. 1.



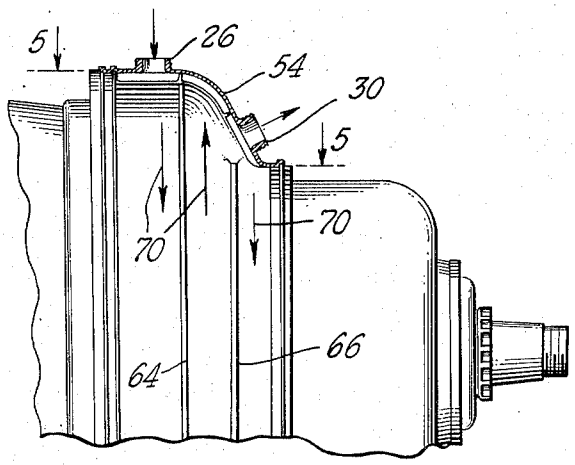


Fig. 4.

INVENTOR
Karl G. Åhlén

BY Jarvis C. Marble
his ATTORNEY

Jan. 18, 1955 K. G. AHLÉN 2,699,642

COOLING MEANS FOR HYDRODYNAMIC TORQUE CONVERTERS

Filed May 10, 1949 2 Sheets-Sheet 2

Fig. 2.

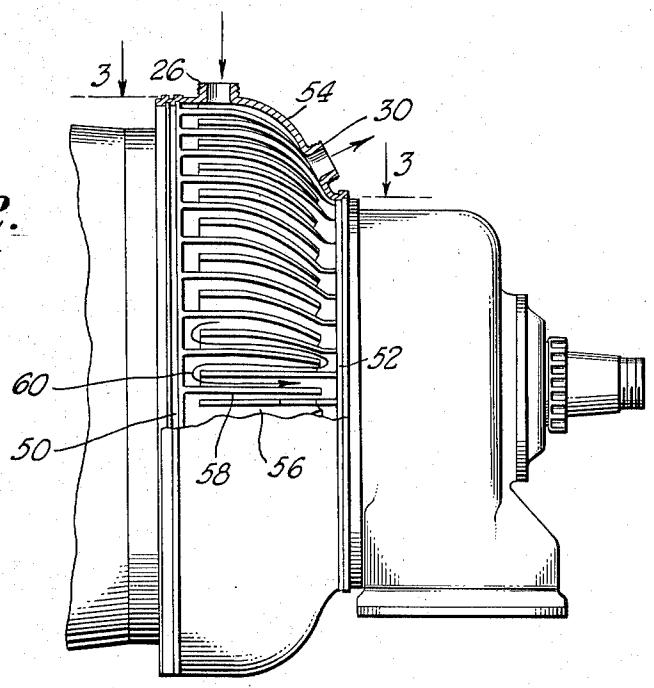
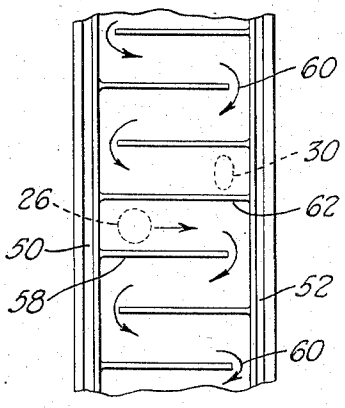
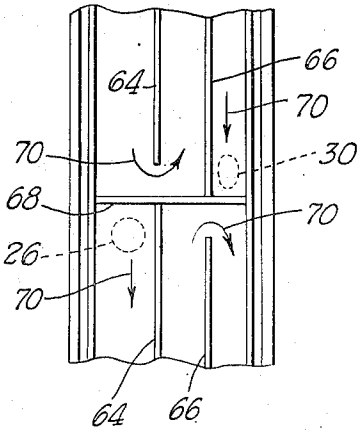


Fig. 5.

Fig. 3.





INVENTOR
Karl G. Åhlén

BY Jarvis C. Marble
his ATTORNEY

United States Patent Office 2,699,642
Patented Jan. 18, 1955

2,699,642

COOLING MEANS FOR HYDRODYNAMIC TORQUE CONVERTERS

Karl G. Åhlén, Stockholm, Sweden, assignor, by mesne assignments, to Jarvis C. Marble, New York, N. Y., Leslie M. Merrill, Westfield, N. J., and Percy H. Batten, Racine, Wis., as trustees

Application May 10, 1949, Serial No. 92,399

2 Claims. (Cl. 60—12)

The present invention relates to the cooling of hydraulic torque converters and more particularly to the cooling of such converters of the hydrodynamic type in which pump and turbine members operate in a working chamber providing for the circulation of working liquid in a closed path of flow, and of which the kind disclosed in Lysholm U. S. Patent No. 1,900,118, is a typical example.

Converters of the character under consideration operate at variable efficiencies, all materially less than 100% efficiency, and the power represented by the difference between the input power and the output power is transformed into heat which must be dissipated to prevent overheating of the converter.

Heretofore the most common method of cooling converters to dissipate the heat generated has been to withdraw a part of the working liquid from the working circuit, pass it through a separate cooler and return the cooled liquid to the circuit. This arrangement involves certain difficulties and disadvantages among which may be mentioned disturbance to the flow of the working liquid in the working chamber due to the withdrawal and reintroduction of part of the fluid and difficulty in keeping tight and free from leaks the outside separate cooler and the necessary conduits which usually include flexible hose or the like for connecting the cooler with the converter. In connection with this latter difficulty it has to be borne in mind that the working liquid which is ordinarily some kind of oil such as kerosene, diesel oil, or even lubricating oil or various mixtures thereof, is under pressure which may vary from approximately 45 p. s. i., to as much as 90 p. s. i. or even more, when the converter is in operation and also usually has an operating temperature which may and frequently does exceed 212° F., sometimes reaching temperatures of the order of 300° F. Cooling arrangements employing separate coolers for the converter have the further disadvantage of expensive construction and furthermore since the circulation of the liquid is usually effected by taking out liquid from the high pressure zone in the converter for cooling and returning the liquid to a low pressure zone, the circulation of the liquid and cooling of the converter is dependent on the converter being in operation to create the necessary pressure differential.

It has further previously been suggested, when converters have been driven by internal combustion engines having liquid cooling systems, to utilize the same liquid as a working liquid in the converter and for cooling the engine, with the engine cooling system and the working circuit of the converter interconnected. Such an arrangement is shown in the aforementioned Lysholm patent. The difficulty with the latter proposal is that it has been found impractical for numerous reasons to employ the same fluid both for hydraulic working fluid and as engine cooling fluid.

The general object of the present invention is to provide a new and improved means for cooling converters of the kind under consideration, when they are driven by internal combustion engines having liquid cooling systems, which utilizes the engine cooling system for cooling the converter as well as the engine, the cooling of the converter being effected by a surface type heat exchanger between the working liquid and the engine cooling liquid. Other and more detailed objects of the invention and the advantages to be derived from its use will appear as this specification proceeds taken in conjunction with the accompanying drawings forming a part hereof in which;

Fig. 1 is a diagrammatic elevation, partly in section, illustrative of a suitable embodiment of the invention;

Fig. 2 is a side elevation partly in section showing one form of converter housing construction embodying the invention;

Fig. 3 is a fragmentary view from above Fig. 2, along line 3—3 and with the outer casing broken away, illustrative of the path of flow of the cooling fluid with respect to the converter casing;

Fig. 4 is a view similar to Fig. 2 of another form of converter casing structure; and

Fig. 5 is a view similar to Fig. 3, along line 5—5 and with the outer casing broken away, showing the path of flow of the cooling liquid relative to the casing of Fig. 4.

Referring now more particularly to Fig. 1, reference numeral **10** indicates an internal combustion engine to which is secured and from which is driven the hydraulic torque converter, indicated generally at **12** and having a rotationally stationary casing **14** enclosing the working chamber of the converter. So far as the present invention is concerned the construction of the converter may be of well known nature, such for example as that shown in the aforementioned Lysholm patent. The casing **14** is jacketed for cooling liquid, advantageously in a manner to be hereinafter described more in detail. The engine shown is of the liquid cooled type provided with the usual engine cooler or radiator **16** from which the cooling liquid, usually water, is withdrawn through the connection **18** by the circulating pump **20** the outlet of which delivers the cooling liquid to the jacket spaces of the engine in the usual manner. The outlet for the cooling liquid from the engine is indicated at **22** and is provided in accordance with usual practice with a thermostatically controlled valve **48** for restricting circulation through the motor block until the engine reaches normal operating temperature. The outlet **22** is connected with the inlet port **26** of the jacketed converter casing by means of the conduit **28**, and cooling liquid leaving the jacketed casing through the outlet port **30** is conducted through conduit **32** to the top inlet connection **34** of the radiator **16**. As will be evident from the drawings the engine jacket space and the converter jacket space are in this arrangement connected in series, with the direction of flow of the cooling liquid being indicated by the several arrows **36**.

Referring now to Figs. 2 and 3 there is illustrated more in detail a suitable form of jacket arrangement for the converter housing. In this arrangement a portion of the converter housing surrounding the working chamber of the converter is grooved with axially spaced grooves **50** and **52** and an outer shell or jacket **54**, which advantageously may be of sheet metal, is secured to the housing (by crimping or equivalent operations for effecting a fluid tight seal). The jacket **54** provides the inlet and outlet ports **26** and **30** and is also provided with two series of axially extending baffles **56** and **58** arranged to cause zig-zag flow of the cooling liquid around the periphery of the housing from the inlet port to the outlet port, as indicated by the arrows **60**. The liquid is forced to flow around the casing by the axially extending partition or wall **62** located peripherally between the inlet **26** and the outlet **30**.

Another form of jacket structure for the converter casing is shown in Figs. 4 and 5. In this embodiment the jacket or shell **54** carries axially spaced circumferentially extending baffles **64** and **66** and an axially extending partition **68** for causing the cooling liquid to flow from the inlet **26** to the outlet **30** along the path indicated by the arrows **70**.

Obviously many other specific cooling jacket arrangements may be made for causing desired flow of the cooling liquid through the jacket space of the converter.

As previously mentioned, the usual hydraulic working liquid is some form of oil or fluid which at normal temperatures is more viscous than water and in order to reduce the losses occasioned by high viscosity of the working liquid, it is generally desirable to operate the converter at relatively high temperature in order to reduce the viscosity of the working liquid, the normal desirable operating temperature of the working liquid usually being higher than the normally desired operating temperature of the engine cooling liquid which in nearly all instances

is water. The present invention enables the desired relative temperatures to be employed while at the same time obtaining a relatively high rate of heat flow through the converter casing. On the one hand there is within the converter a body of working liquid operating at high temperature and high velocity so that a high rate of heat transfer from the liquid to the casing is obtained even though the heat transfer co-efficient from the oily liquid is relatively very low. On the other hand the cooling liquid flowing through the converter jacket is usually water which has a relatively very high co-efficient of heat transfer and has moreover a considerably larger area of heat transfer surface to contact than does the working liquid. Consequently, the amount of heat absorption by the cooling water necessary to effectively cool the converter can be obtained with relatively low velocity flow of the cooling water through the jacket, so that effective cooling can be obtained without material pressure drop and consequent absorption of power for circulating the cooling liquid through the converter jacket.

The series flow arrangement is particularly advantageous where the operating conditions are such that the converter is under more or less constant and substantial load. With such an arrangement the converter receives cooling water which is pre-heated by first passing through the engine jackets so that the cooling of the converter is carried out at a relatively high level of cooling water temperature. With constant load operation, even though the load be relatively heavy, the amount of heat required to be absorbed from the converter is still sufficiently small so that it can be satisfactorily absorbed in a series system.

So far as the jacketing arrangements shown in Figs. 3 and 5 are concerned, either may be used, and it will be evident that many changes in the design and arrangements of the parts may be made without departing from the invention, which is to be considered as embracing all forms of apparatus falling within the scope of the appended claims.

What is claimed:

1. The combination, with an engine having a liquid cooling system including an engine cooling jacket space provided with a thermostatic valve for controlling the flow of cooling liquid from the outlet thereof, a pump for circulating cooling liquid and a cooler, of a hydrodynamic torque converter driven by the engine and comprising a housing structure having a wall defining the outer portion of a working chamber in which a working liquid is circulated in a closed path of flow in contact with said wall, a jacket around said wall and spaced therefrom to provide a jacket space for flow of cooling liquid over said wall, said space having an inlet and an outlet, and connections arranged to provide for series flow of cooling liquid from the cooler through the engine jacket space and the converter jacket space back to said cooler in the order named under the control of said thermostat.

2. Structure as defined in claim 1 in which the jacket space around said wall contains a plurality of baffles providing both an elongated path of flow through the converter jacket space and extended heat transfer surface for transmitting to the cooling liquid the heat conducted through said wall.

References Cited in the file of this patent

UNITED STATES PATENTS

998,876	Daimler	July 25, 1911
1,559,301	Barnard	Oct. 27, 1925
1,688,968	Huwiler	Oct. 23, 1928
1,840,876	Rayburn	Jan. 12, 1932
1,900,118	Lysholm	Mar. 7, 1933
1,915,547	North et al.	June 27, 1933
2,164,173	Durrell et al.	June 27, 1939
2,175,448	Schlagintweit	Oct. 10, 1939
2,310,269	Waeber	Feb. 9, 1943
2,598,367	Fiser	May 27, 1952