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HEAT EXCHANGER FOR INTERNAL COMBUSTION ENGINES

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FIG. 1

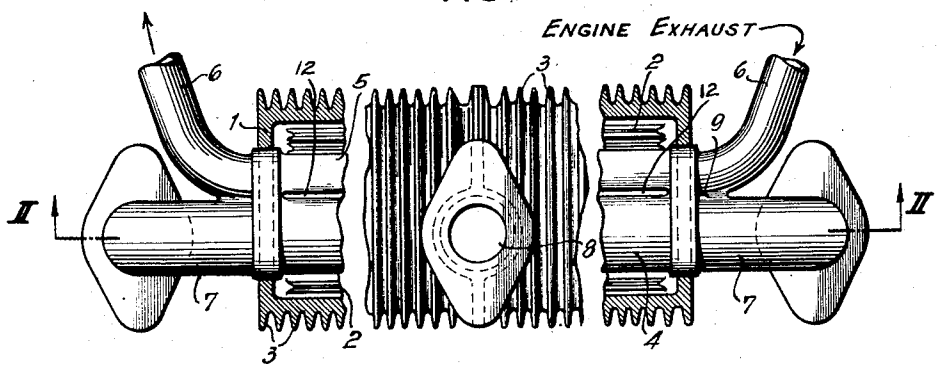


FIG. 2

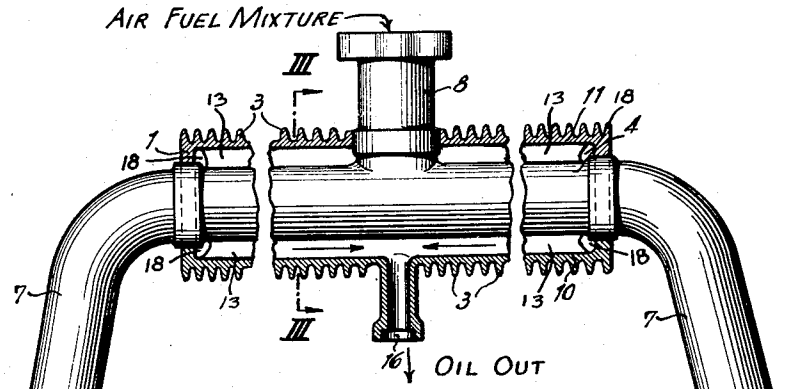
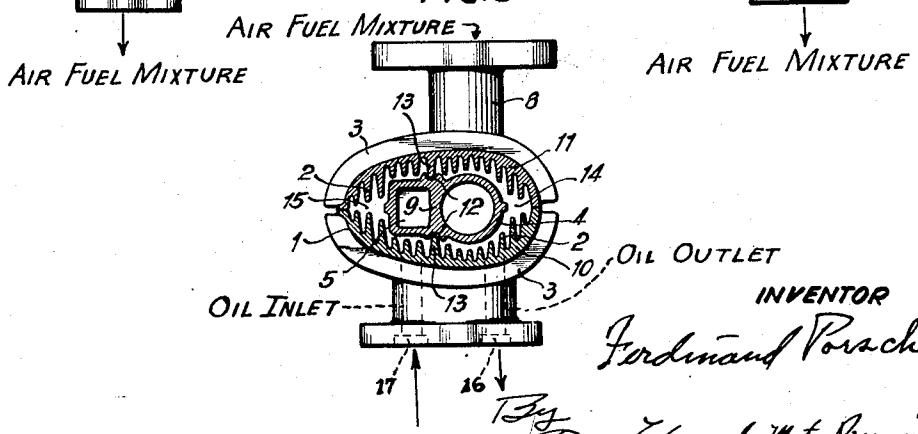


FIG. 3



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HEAT EXCHANGER FOR INTERNAL COMBUSTION ENGINES

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8 Claims. (Cl. 257—241)

This invention relates to improvements in internal combustion engines, and more particularly for such coolers which surround the engine suction pipe for delivering air to the engine.

In known types of arrangements for cooling the lubricating oil of an internal combustion engine, the lubricating oil has been conducted along the walls of the suction pipe supplying air to the engine. In this operation heat is abstracted from the hot lubricating oil and the relatively cold suction air is heated. The results of such heat exchange is desirable, but previously known coolers of this type have the disadvantage that the oil is cooled even when the engine is cold just after starting the engine and before the oil has been heated by the operation of the engine. In some instances these disadvantages have been overcome by providing means for regulating the flow of oil through the cooler, but the addition of such regulating means greatly increases the cost of the cooler and introduces constructional difficulties.

The primary object, therefore, of the present invention is to overcome the difficulties previously encountered in the provision and use of such heaters and to provide a heating unit which is arranged in such a way that the cold oil at the time of starting the engine is, in fact, heated rather than cooled.

In accordance with the present invention the cooler for the lubricating oil comprises a casing divided into two interconnecting chambers through one of which a pipe is arranged for conducting exhaust gases from the engine, while in the other chamber, a pipe is arranged for conducting the suction air for the engine. In this construction, means is provided for conducting lubricating oil from the engine into the chamber housing the exhaust pipe and means is provided for withdrawing oil from the chamber housing the suction pipe.

In a preferred construction the suction and exhaust pipes are arranged as a unit and serve to divide the cooler casing into the two interconnecting chambers, and the casing is advantageously provided with internal and external ribs for transferring heat.

The improved oil cooler includes other features and advantages which are described in greater detail hereinafter in connection with an embodiment of the invention illustrated in the accompanying drawings in which:

Fig. 1 is a plan view of an oil cooler constructed in accordance with the invention, shown partly broken away and partly in section;

Fig. 2 is a longitudinal sectional view taken on the line II—II of Fig. 1; and

Fig. 3 is a cross-sectional view taken on the line III—III of Fig. 2.

Referring to the drawings, the improved oil cooler includes a body or outer casing 1, which is essentially in the form of a prismatic hollow member provided on the inside with cooling or heat transferring ribs 2 extending longitudinally of the casing. The casing is also provided on the outside with heat transferring ribs 3 which extend transversely around the casing. A suction pipe 4, which

may in part at least constitute the intake manifold of the engine, extends through the hollow casing 1, and parallel to this pipe there extends a heating pipe 5 supplied with exhaust gases from the engine, the pipe 5 being provided with connections 6 for connecting it to the exhaust manifold or exhaust pipe leading from the engine and the exhaust pipe leading to the muffler or tail pipe of the automotive vehicle.

The suction pipe 4 is provided with branches 7 having the usual flanges for connection to the suction pipes of the cylinder heads of the engine and also with a branch pipe 8, having a flange for connecting it to the carburetor. The pipe 8 extends through the casing 1 and connects into the pipe 4 intermediate its ends in the casing.

In the particular construction shown in the drawings, the pipes 4 and 5 are joined in an integral unit constituting a double pipe or inner casing in which the partition 9 forms a common heat transfer wall for the two pipes. The cooling body 1 or casing comprises two shells 10 and 11, as shown more particularly in Fig. 3, and these shells may in turn consist of different elements or parts, which parts can be castings, preferably die castings. The parts are connected to each other and the double pipe or inner casing unit by means of welding or brazing after having been fitted around the double pipe element, as shown in the drawings. The two shells may be similarly joined together at their opposite sides along the seams shown in Fig. 3.

The double pipe is provided with a groove or slot 12 at each of its sides and the shells 10 and 11 are respectively provided with longitudinal ribs 13, which engage in the respective slots 12 to provide, with the pipe unit, a separating partition. The ribs 13 in conjunction with the double pipe divide up the oil cooler into two chambers 14 and 15, as indicated in Fig. 3, connected with each other at the ends of the cooler, that is, around the ends of the ribs 13 by passageways 18, since the ribs 13 and the remaining longitudinal ribs do not extend quite to the end of the inside of the casing 1. The chamber 15 is provided at its longitudinal center with an inlet 16 for lubricating oil and the chamber 14 is similarly provided with an outlet 17 for lubricating oil.

The lubricating oil coming from the oil sump of the engine is delivered by the oil pump through the inlet connection 16 into the chamber 15 of the oil cooler through which the heating pipe 5 passes. If the oil is still cold, it will be heated up as it flows along past the heating pipe 5. If the oil has reached or exceeded its operating temperature in the engine, a portion of its heat will be given off to the surrounding air by heat transmitted through the inner and outer cooling ribs. After the oil has passed through the chamber 15, it flows around the ends of the ribs 13 into the chamber 14 through which it flows along the outer surface of the suction pipe 4 and gives up more heat to the cold suction air as well as to the cooling air which is flowing over the outer cooling ribs 3 of the casing. The cooled lubricating oil then flows from the chamber 14 through the outlet connection 17 to the various points of the engine to be lubricated. The cooler of the present invention may, therefore, be included in the oil pressure system for lubricating the engine.

The air inside the suction pipe 4 is not only heated by the oil flowing through the chamber 14 but also, because of the structure of the double pipe or inner casing, it is heated by the exhaust gases flowing through the heating pipe 5. It will be noted from the showing in Fig. 3 that the pipes 4 and 5 have a common wall which extends between the slots 12.

What I claim is:

1. An apparatus for exchanging heat between fluids, comprising an elongated outer casing, an inner casing extending longitudinally through the outer casing in spaced

relation to the interior thereof, a longitudinally-extending partition dividing said inner casing into a pair of non-communicating, fluid-flow passageways and forming a common heat-transferring wall for said passageways, fluid-flow connections at the ends of one of said passageways, separate fluid-flow connections at the ends of the other of said passageways, whereby fluids having different temperatures may flow through the respective passageways and exchange heat through said common wall, means dividing the space between the outer casing and the inner casing into two chambers, said dividing means being so located relative to said common wall that one of said passageways is located in one of said chambers and the other of said passageways is located in the other chamber, means defining a passageway at each end of the space between the outer and inner casings for interconnecting said chambers, an inlet connection for a third fluid leading into one of said chambers at a point located intermediate the end portions of said inner casing, and an outlet connection for said third fluid from the other of said chambers located intermediate the end portions of said inner casing, whereby said third fluid may be introduced into one of said chambers through said fluid inlet connection and flow through the chamber connected therewith in heat exchange with a higher temperature fluid in the passageway therein toward the respective end portions of said inner casing, flow through said passageways at the respective end portions of said inner casing into the other chamber and finally through the other chamber toward the fluid outlet connection in heat exchange with the lower temperature fluid in the passageway therein and through the fluid outlet connection from said other chamber.

2. An apparatus as claimed in claim 1, including a fluid inlet connection extending from outside the outer casing and opening at a point intermediate the ends of the one of said pair of fluid flow passageways located in said other chamber in the casing, whereby fluid may be introduced into said last-mentioned fluid flow passageway at a point intermediate its ends and caused to flow therethrough toward both of its ends countercurrent to the third fluid flowing through said other chamber in the casing.

3. An apparatus as claimed in claim 1, in which said outer casing comprises a pair of shells fitted over said heat exchange structure and including internal and external heat transferring ribs.

4. An apparatus as claimed in claim 1, in which the means for dividing the space between said casings comprises a pair of opposite ribs on the interior of the outer casing extending toward and in engagement with the inner casing adjacent said common heat-transferring wall.

5. An apparatus for exchanging heat between fluids, comprising an elongated outer casing, an inner casing in spaced relation to the interior thereof, a longitudinally-extending partition dividing said inner casing into a pair of non-communicating, fluid-flow passageways and forming a common heat transferring wall for said passageways, said passageways each having end portions terminating outside the outer casing with fluid flow connections, whereby fluids having different temperatures may flow respectively through said passageways and heat be transferred from the fluid of higher temperature through said common wall to the fluid of lower temperature, means for conducting a third fluid into the space between the outer and inner casings and for causing such third fluid to flow in such space in heat exchange relation with the fluid flow passageway therein containing the higher temperature fluid, and means in the space between said casings for thereafter directing said third fluid around the fluid flow passageway of the inner casing containing the lower temperature fluid, whereby said third fluid augments the heat transferred to the fluid of lower temperature through said common heat-transferring wall by transferring heat from the higher temperature fluid to the lower temperature fluid and being cooled thereby.

6. An apparatus as claimed in claim 5 in which the opposite sides of the inner casing each includes a slot substantially opposite said partition and extending in the direction of said passageways, said outer casing includes a pair of sections respectively extending over said opposite sides of said inner casing, and a longitudinally-extending rib extending inwardly from the inner wall of each of the outer casing sections and terminating short of each end of the inner casing, said ribs engaging in the respective slots to divide the space between the outer and inner casings into two interconnected chambers.

7. A heat exchanger for simultaneously heating the intake air for an internal combustion engine and the engine lubricating oil by the engine exhaust gases and for cooling the engine lubricating oil by the intake air for the engine, the heat exchanger comprising a casing, means dividing the casing into two chambers, first and second non-communicating pipes having a common wall for heat exchange between fluids flowing through said pipes, said pipes extending in parallel relationship respectively through the chambers in spaced relation to the walls of the casing, said first pipe having an inlet at one end outside the casing for receiving hot engine exhaust gases and an outlet at the other end outside the casing for discharging the engine exhaust gases, said second pipe having an inlet outside the casing for receiving the intake air for the engine and an outlet outside the casing for delivering the intake air heated by the engine exhaust gases and to be supplied to the engine, means defining a fluid flow passageway at each end portion of the first pipe in the casing inter-connecting said chambers, an inlet connection into the one of said chambers through which the first pipe extends for receiving lubricating oil from the engine, said inlet connection being located in the casing intermediate the end portions of said first pipe in the casing, and an outlet connection extending from the other of said chambers for discharging lubricating oil to be returned to the engine, said outlet connection being located intermediate the end portions of the first pipe in the casing, whereby lubricating oil from the engine delivered through said inlet connection is caused to flow through the chamber through which said first pipe extends along said pipe toward the respective end portions of said first pipe in said chamber, then through said passageways into the other chamber through which the second pipe extends, and finally along said second pipe to the outlet connection for return to the engine.

8. In a heat exchanger for an internal combustion engine in which means is provided for passing intake air for the engine in heat exchange with the engine lubricating oil, a casing through which the engine lubricating oil is caused to flow, an engine exhaust pipe extending through said casing for the flow of the hot exhaust gases from the engine, and an air intake pipe extending through the casing for the flow of intake air for the engine, said pipes being non-communicating and comprising an integral heat exchange structure including a heat-transferring wall common to each pipe and forming a part of the passageway for the fluids flowing through the respective pipes, said wall constituting the sole means separating the flow passageways of said pipes, said wall transferring heat directly from the engine exhaust cases to the engine intake air thereby heating the intake air when the engine lubricating oil is cold.

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