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2,159,558

OIL COOLER AND FILTER

Filed May 26, 1937

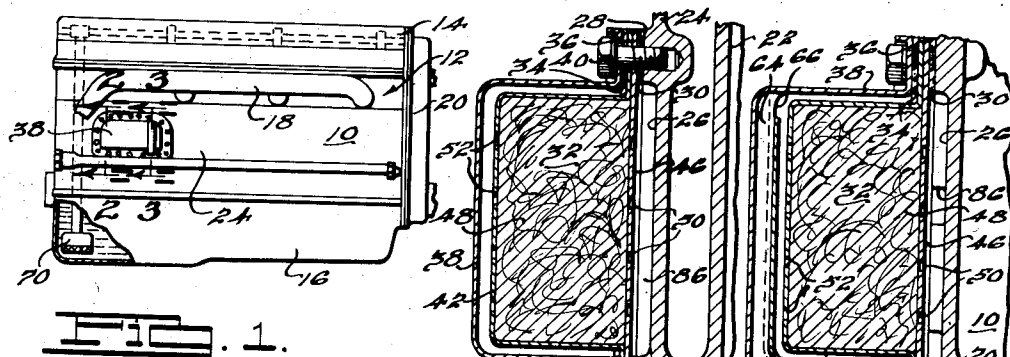


FIG. 1.

FIG. 2.

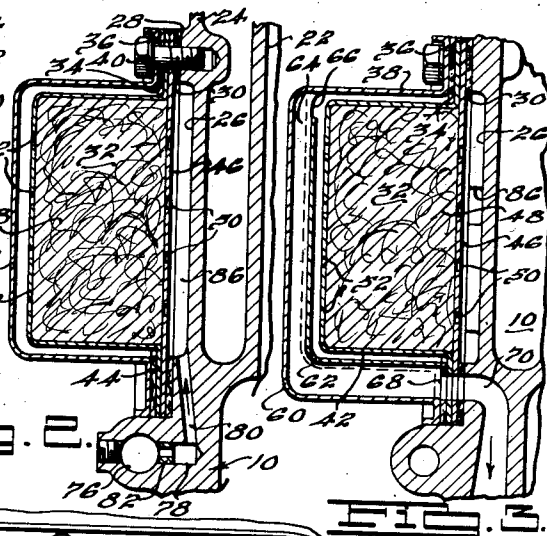


FIG. 3.

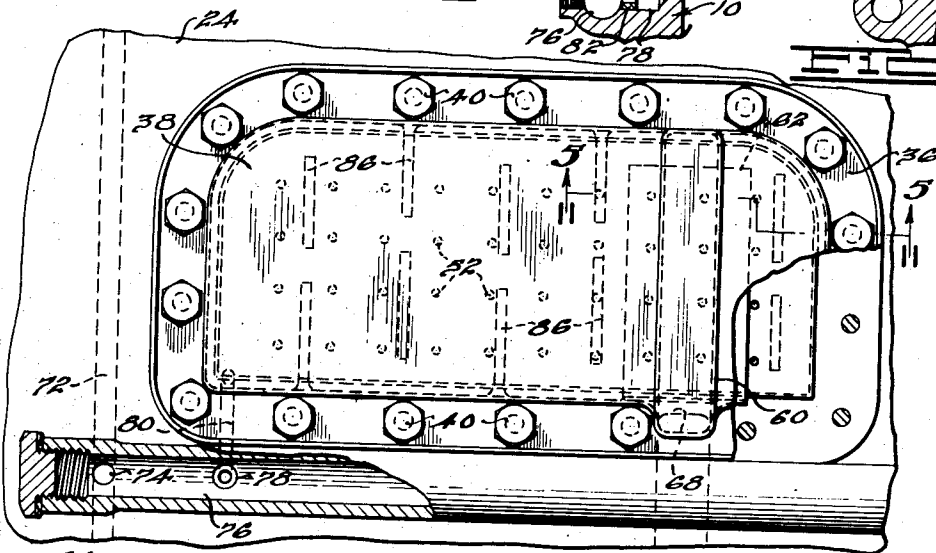


FIG. 4.

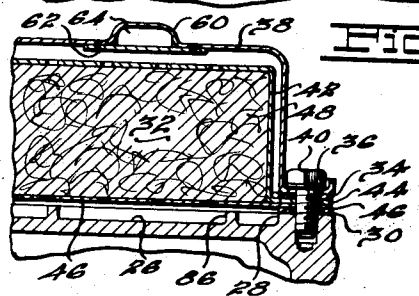


FIG. 5.

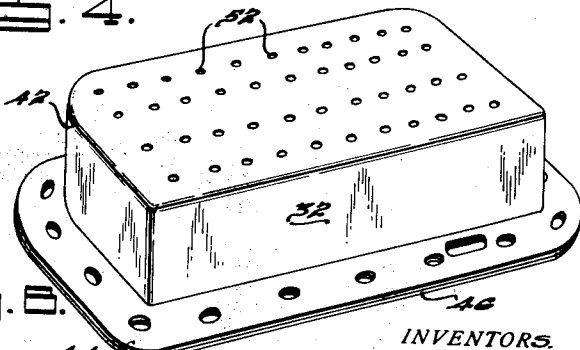


FIG. 6.

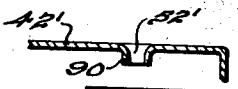


FIG. 7.

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OIL COOLER AND FILTER

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3 Claims. (Cl. 210—131)

This invention relates to internal combustion engines and particularly to means for effecting a transfer of heat between the lubricating oil for the engine and the fluid circulated through the cooling system for the engine, as well as to filter such lubricating oil in order to remove impurities therefrom, the principal object being the provision of means of this type that is simple in construction, efficient in operation and economical to produce.

Objects of the invention include the provision of means including a chamber having a wall thereof common to the cooling fluid circulating system for an internal combustion engine whereby to effect a transfer of heat between the lubricating oil and the cooling fluid through such wall; the provision of a construction as above described in which the water jacket for the engine serves as a common wall between the circulating cooling fluid for the engine and a chamber for reception of lubricating oil, such water jacket being so constructed and arranged over the area of the chamber as to enhance the transfer of heat there-through; the provision of a structure as above described in which the chamber for the lubricating oil is formed mainly by a pan-like device secured to the outer face of the engine water jacket; the provision of a device of the type described in which the lubricating oil is introduced into the lubricating chamber at a point adjacent the bottom thereof, and is discharged therefrom at a point adjacent the top thereof by means of a duct formed integrally with the pan-like member; the provision of a construction as above described in which a filtering element is removably mounted within the lubricating oil chamber and in a position to necessitate the flow of lubricating oil through the chamber passing therethrough; the provision of a unitary filtering element for a device of the type described having certain novel features of construction; and the provision of an internal combustion engine having a combined oil filter and oil cooler mounted thereon and including certain novel features of construction.

The above being among the objects of the present invention the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawing, and then claimed, having the above and other objects in view.

In the accompanying drawing which shows a suitable embodiment of the present invention and in which like numerals refer to like parts throughout the several different views,

Figure 1 is a partially broken side elevational

view of an internal combustion engine having a combined oil filter and cooler mounted upon a side wall thereof in accordance with the practices of the present invention;

Fig. 2 is an enlarged, fragmentary, vertical sectional view taken transversely of the engine shown in Fig. 1 as on the line 2—2 thereof and showing the construction of the oil cooler and filter and of the adjacent portion of the engine in greater detail;

Fig. 3 is a view similar to Fig. 2 but taken on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragmentary, partially broken, partially sectioned side view of the engine shown in Fig. 1 and particularly that portion thereof embodying the oil cooler and filter constituting the subject-matter of the present invention;

Fig. 5 is a fragmentary horizontal sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a perspective view of the oil filtering unit employed in the construction shown in the preceding views;

Fig. 7 is an enlarged fragmentary sectional view taken through a portion of the wall of an oil filter unit or cartridge such as indicated in Fig. 6 but embodying a slightly modified form of construction.

The present invention relates to that type of devices adapted to cool and filter the lubricating oil of an internal combustion engine, the desirability of which is well recognized in connection with modern internal combustion engines of the high speed type such as are commonly employed in connection with automobiles. For ease of description only the device will be hereinafter mainly referred to as an oil cooler, as one of its main functions will be the abstraction of heat from the lubricating oil, but it will be understood both in the description and the claims that under certain conditions of operation there will be a transfer of heat from the circulating cooling fluid for the engine to the lubricating oil, this particularly occurring in cold weather and particularly in connection with internal combustion engines having a thermostatically controlled cooling fluid circulating system wherein the cooling fluid within the usual water jacket of the engine will be relatively quickly brought up to operating temperatures while the oil may still remain sufficiently cold under certain conditions to be sluggish in its action and under which circumstances it is desirable to effect a transfer of heat from the cooling fluid to the lubricating oil.

Referring to Fig. 1, an internal combustion en-

gine is shown including a combined cylinder block and crank case indicated generally at 10, a cylinder head indicated generally at 12 which for the purpose of illustration may be considered as being provided with an overhead cam shaft (not shown) enclosed by a cover 14. It is also provided with a conventional oil pan 16, exhaust manifold 18 and chain cover or chain housing 20. It will, of course, be understood that the engine shown in Fig. 1 is of the multiple cylinder type and, accordingly, the combined crank case and cylinder block 10 is interiorly provided with a plurality of cylinders a portion of one of which is indicated at 22 in Fig. 2, and that a water jacket 24 is arranged in surrounding and generally spaced relation with respect to the various cylinders 22 for the purpose of enabling suitable cooling liquid, such as water, to be circulated about the cylinders 22 by means of a pump (not shown) in accordance with conventional practice.

In accordance with the present invention a portion of the area of the water jacket 24, preferably at one side of the engine and preferably adjacent the lower edge thereof, is provided with a shallow pocket 26 formed therein. The area of the pocket 26 is not at all critical but inasmuch as the transfer of heat between the lubricating oil and the cooling fluid for the engine is to be transmitted through the bottom or inner wall of the pocket its area should be sufficient, when taken in connection with the heat conductivity of that portion of the water jacket forming the bottom of the pocket and the expected difference in temperatures of the cooling water and the lubricating oil, to permit the desired rate of heat transfer from the oil to the water in the jacket 24. As will be obvious it is not necessary that the pocket 26 be actually projected into a wall of the water jacket 24 as the same effect will be provided by forming a rib such as the rib 28 on the exterior face of the water jacket 24 around the margins of the pocket which it is desired to form. The effect, however, obtained by forming the pocket 26 by means of a rib such as 28 will, of course, be identical to that obtained by actually depressing the bottom 26 inwardly with respect to the general plane of the water jacket 24 except that there will be no restriction over such area in the water jacket to the flow of the cooling water therepast. The outer face of the rib 28 is preferably machined to give it a smooth flat condition necessary to provide a suitable seating surface and received thereon is the correspondingly shaped gasket 30 which in turn receives the marginal flanges of a cartridge type filtering unit indicated generally at 32, followed by a second gasket 34 identical to the gasket 30 and which in turn receives the marginal flange portion 36 of a sheet metal pan-like cover or housing member 38 which encloses the filtering element 32, the flange 36 being sealed to the marginal flanges of the filtering unit 32, and the marginal flanges of the filtering unit 32 being sealed to the outer face of the rib 28 by means of a plurality of cap screws 40 projecting through the marginal flanges and gaskets and threaded into the water jacket 24.

The filtering or cartridge unit 32 which is illustrated alone in perspective in Fig. 6 and which, of course, is applicable to and removable from its normal position as a unit, comprises a pan-like member 42 preferably formed from relatively thin sheet metal and provided with an integral continuous outwardly projecting marginal flange portion 44 around its open face. The open face

of the pan-like portion 42 is closed by a preferably flat plate 46 whose contour is preferably identical to the outer margins of the flange 44 of the pan-like member 42 and is arranged in matching relation with respect thereto. The plate 46 may be secured to the flange 44 in any suitable manner such as spot welding and preferably so as to maintain the plate 46 and pan-like member 42 permanently fixed together. The interior of the chamber thus formed between the pan-like member 42 and the cover 46 is preferably completely filled with a suitable filtering material 48 which may be of a fibrous nature, such as cotton or the like, or any other suitable nature permeable to the flow of oil therethrough and of a character favorable to separation and retention of foreign particles carried by the lubricating oil flowing through it. The cover member 46 over that area thereof commensurate with the internal dimensions of the pan 42 is provided with a plurality of apertures or perforations 50 therethrough and the bottom or inner side wall of the pan-like member 42 is provided with a corresponding number of apertures or perforations 52 therethrough, it being understood that the apertures or perforations 50 and 52 are preferably arranged in such numbers and spacing over their respective members as to permit a substantially uniform filtration of lubricating oil through the filtering member 48.

It will be noted that the pan-like member 42 is materially smaller than the pan-like member 38 so that an ample space for the flow of oil between them exists between all of their major surfaces. Additionally it will be noted particularly from an inspection of Figs. 3, 4 and 5 that the pan-like cover member 38 is provided adjacent one end thereof in its bottom or vertically disposed wall and in its lower side wall with a trough 60 pressed outwardly therein and the inner face of the trough 60, except as hereinafter described, is closed by a plate or strip of metal 62 overlying the inner wall surfaces of the pan-like member 38 along the opposite margins of the trough 60 so as to form with the trough 60 a duct 64 which serves as a sort of a standpipe for the overflow and discharge of oil from the cooler and filter. The strip 62 stops short of the top wall of the cover member 38, as illustrated best in Figs. 3 and 4, so as to form an inlet opening 66 leading into the upper end of the duct 64. As best illustrated in Figs. 3 and 6 the flange 36 of the pan-like member 38 at the bottom of the member 38 where the duct 64 connects with it is perforated as at 68 to provide an outlet for the duct 64, and the gaskets 34 and 30, the flange 44 on the pan-like member 42 of the filter element, and the margin of the plate 46 are correspondingly apertured in alignment with the aperture 68 so as to permit the flow of oil therethrough. As indicated in Fig. 3 the cylinder block 10 is provided with a passage 70 formed therein in alignment with the aperture 68 and matching apertures above mentioned and which passage 70 extends downwardly in the block 10 and opens into the crank case portion thereof.

Although any suitable means may be provided in accordance with the present invention for supplying lubricating oil under pressure to the interior of the pocket 26, the following described means is illustrative of the suitable construction. A usual and suitably driven oil pump 70 is positioned in the lower portion of the oil pan 16 and is driven in any suitable or conventional manner. As indicated in Fig. 4 the pump 70 is provided

with a vertically directed oil discharge passage 72 which is connected by means of a cross-passage 74 with an oil gallery 76 extending longitudinally of the engine and in the particular case shown within a side wall thereof. It will be understood that the oil gallery 76 is provided with branch passages (not shown) leading to various bearing surfaces, such as the crank shaft bearings, for instance, of the engine for the purpose of supplying the same with lubricant. As indicated in Figs. 2 and 4, adjacent that end of the pocket 26 remote from the end of the pan-like cover member 38 in which the duct 64 is provided, passages 78 and 80 communicate the interior of the oil gallery 76 with the bottom of the pocket 26. The size of either the passage 78 or 80 may be such as to permit the desired flow of oil from the gallery 76 to the pocket 26 but it will ordinarily be found preferable to make these passages larger than required and to insert a removable orifice member such as the member 82 in one of them to control the flow of lubricant to the volume desired and which volume may be, for instance, 10% of the total volume of lubricating oil delivered by the pump 70 under conditions of normal operation and at a predetermined speed of the engine.

It will be understood from the foregoing that lubricating oil under pressure is fed from the gallery 76 through the orifice member 82 and passages 78 and 80 to the interior of the pocket 26 and between the bottom or back wall of the pocket and the plate 46, to the filtering element 32. Because of the fact that the discharge opening 66 is adjacent the top of the device, the lubricating oil which enters the pocket 26 must necessarily flow to approximately the top thereof during operation and in event any air is entrapped within the device such air will be forced upwardly by the entrance of the oil and forced out of the discharge opening 66 through the ducts 64 and 70 into the crank case of the engine where it may be disposed of in the usual manner. The oil which thus fills the pocket 26 passes through the various apertures 50 in the plate 46, passes through the filtering material 48 and thence through the apertures 52 in the outer or bottom wall of the pan-like member 42 into the space between the pan-like member 42 and the pan-like member 38 and then flows out of the discharge opening 66 through the ducts 64 and 70 back through the crank case to the oil pan 16, where it commingles with the other oil in the oil pan and is eventually re-circulated by the pump 70. Because of the fact that the oil outlet 66 is positioned at the top of the device and the various apertures 50 and 52 are evenly distributed over their respective surfaces, it will be apparent that a uniform flow of oil is assured through the filtering material 48, thus permitting it to operate under its fullest efficiency. The oil flowing into the pocket 26, because of the shallow nature of the pocket 26, is distributed in a relatively thin film over the bottom or inner wall of the pocket 26 and thus in a form which is favorable to the rapid transfer of heat between the oil and the cooling fluid within the jacket 24 through the bottom wall of the pocket 26. In order to enhance this transfer of heat between the oil and the cooling fluid within the water jacket it is preferable, although not necessary, to provide baffling means in the pocket 26 in the form of a plurality of spaced ribs 86 integral with the water jacket and arranged in generally staggered relation, of a height substantially equal to the depth

of the pocket 26, and so arranged as to cause the oil flowing through the pocket 26 to travel in a tortuous path, thus obtaining a scrubbing action of the oil against the bottom wall of the pocket which, as is well understood in the art will enhance the transfer of heat between the oil and such wall. The ribs 86 also act as fins to increase the area of the water jacket surface exposed to contact with the oil and thus act to increase the transfer of heat from the oil through the water jacket. Additionally it will be noted that the outer surfaces of the pan-like member 28 are exposed to the cooling effects of the air surrounding the engine and, accordingly, an additional heat transfer will occur through the pan-like member 38 between the oil therein and the air surrounding the pan-like member and this effect may be increased if desired by providing the pan-like member 38 with external ribs such as are commonly employed to increase the heat radiating area of a body.

It may be noted that because of the fact that the filtering element 32 when once immersed in oil within the device is subjected to a relatively small differential of pressure between its opposite sides, it may be made of relatively light material. Furthermore, it will be observed that the filtering element 32 is readily removable from the engine so as to permit its ready replacement thereby to permit the presence of a fully operative filtering device in the engine at all times at a relatively small expense.

Where the character of the filtering material 48 employed in the filtering element 32 is such that there may be a tendency for it to pack down in the lower portion thereof, it may be desirable to provide some means for maintaining it in its intended relation at all times. One simple means of providing against the downward packing of the material 48 is illustrated in Fig. 6 in which a portion of a pan-like member 42', corresponding to the pan-like member 42 previously described, is shown as being provided with apertures 52' corresponding to the apertures 52 previously described. In this case the metal which is displaced from the pan-like member 42' in forming the aperture 52' is drawn inwardly as illustrated at 90 to form an inwardly projecting collar surrounding the aperture 52, this collar preferably being of a sufficient length as to project a material distance into the filtering material 48 and thereby act to properly suspend it in intended position within the filtering unit. The opening in the cover for the member 42', corresponding to the cover or plate 46, will, of course, have collars similar to the collars 90 surrounding them for the above mentioned reasons in such case.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What we claim is:

1. An article of manufacture comprising a pressed metal pan-like member having an outwardly directed marginal flange at the open side thereof, the bottom wall and one of the side walls of said member having intercommunicating grooves formed therein, and plate means sealed to said bottom and side in bridging relation with respect to said groove whereby to form, with the walls of said groove, a duct.

2. An article of manufacture comprising an open sided container provided with an outwardly directed marginal flange around the open side

- thereof, the wall remote from said opening side and the bottom wall of said container being provided with a continuous groove therein leading from a point adjacent the top of said container
- 5 to said flange at the bottom thereof, a strip of metal bridging said groove over the entire length thereof except at the topmost portion thereof and sealed to the walls in which said groove is formed whereby to provide with said groove a duct open
- 10 to the interior of said container at the top end thereof and terminating at said flange at the bottom thereof, and said flange being grooved in continuation of said wall groove to provide communication with the interior of said duct.
- 15 3. As an article of manufacture a sheet metal pan having a bottom wall provided with a multiplicity of openings therethrough, an inwardly projecting collar portion integral with said wall

about each of said openings, a flange integral with said pan and surrounding the marginal portions of the open side thereof, a relatively flat cover for said pan overlying the open side thereof and fixed to said flange, said cover having a multiplicity of openings therethrough opening into said pan, collars formed integrally with said cover and projecting inwardly thereof with respect to said pan around each of said openings therein, and a mass of relatively loose fibrous material filling said pan, the inter-engagement between the aforementioned collars and said fibrous material tending to maintain said fibrous material against packing in said pan when said pan is arranged with the plane of the open side thereof in a generally vertical direction.

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