Aug. 28, 1956 J. DOLZA 2,760,468

ENGINE COOLING SYSTEM

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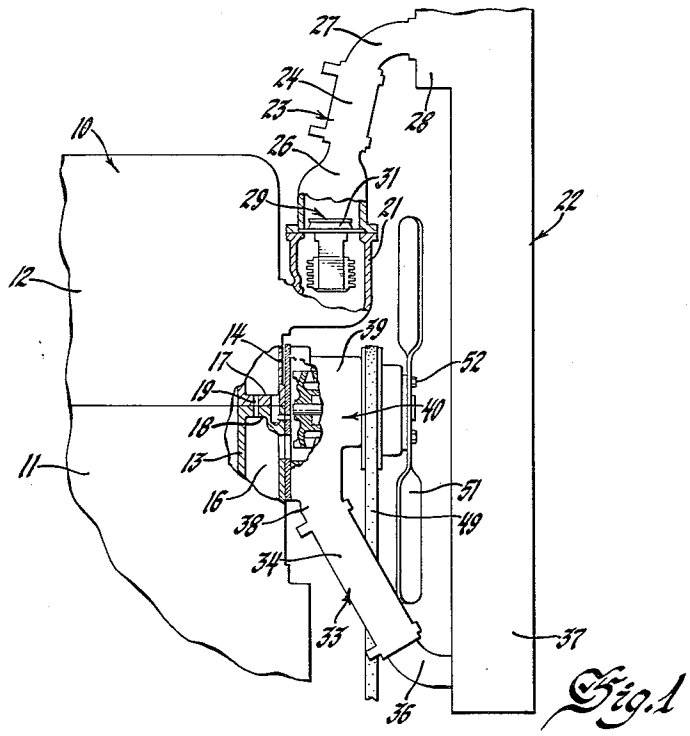


Fig. 1

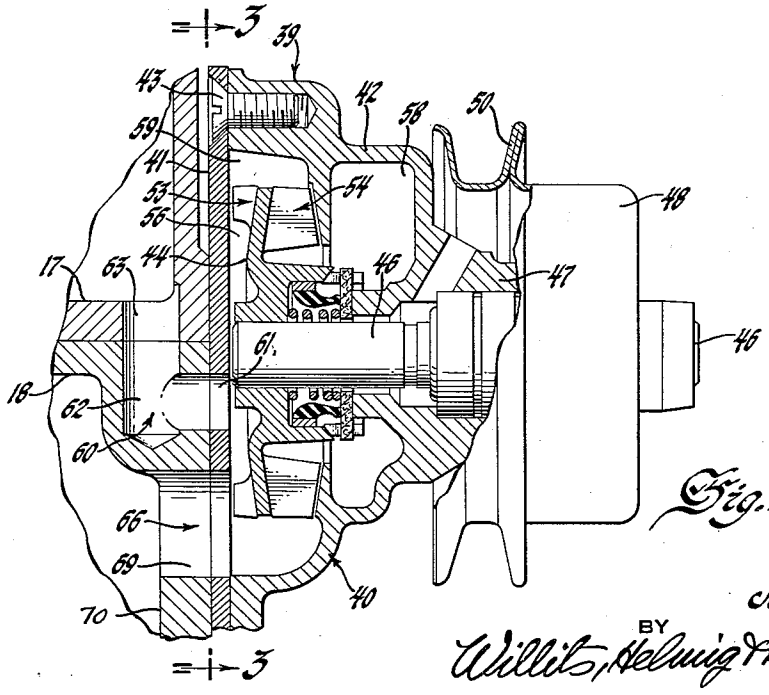


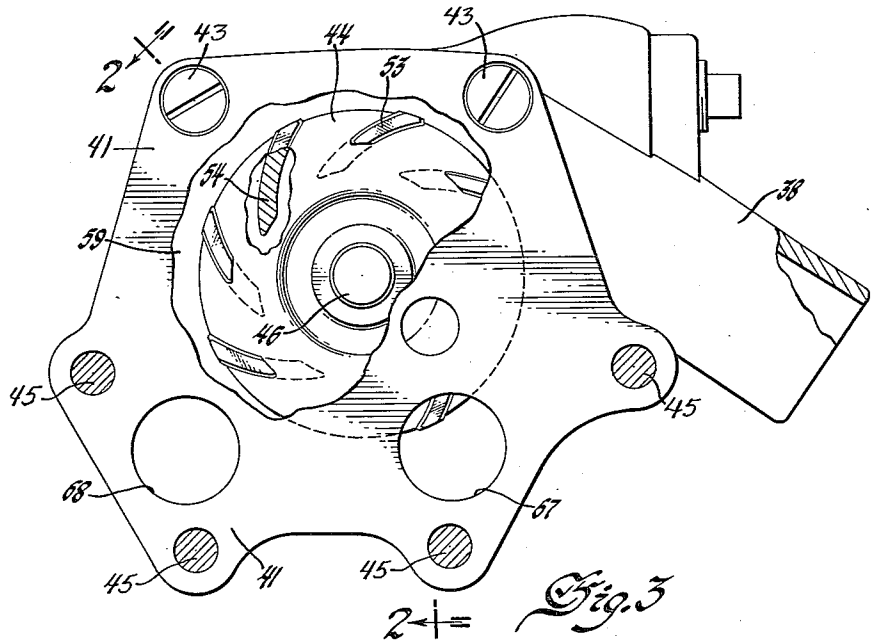
Fig. 2

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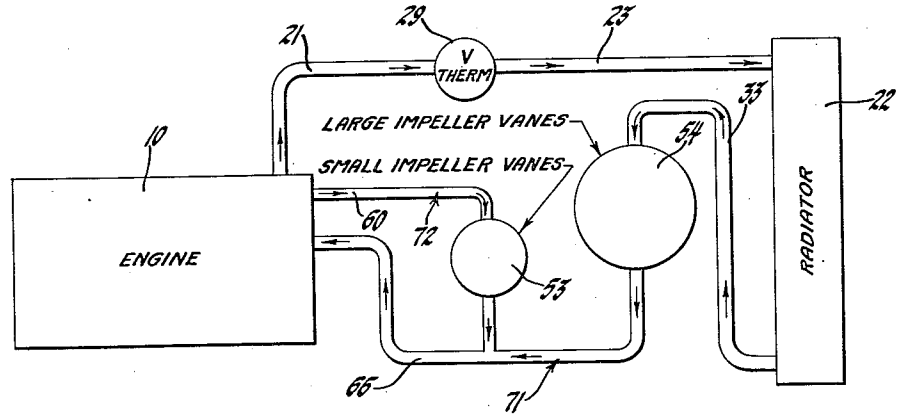


Fig. 4

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ENGINE COOLING SYSTEM

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7 Claims. (Cl. 123—41.1)

This invention relates to engine cooling systems and has particular relation to an engine cooling system especially applicable for automotive and other uses.

Engine cooling systems for automotive and other uses now have engine thermostats for controlling the flow of cooling fluid in a conduit extending between the head of the engine and the radiator. Such thermostats either cut off or greatly restrict the circulation between the engine jacket and the radiator when the temperature of the cooling fluid decreases in cold weather or at other times. It is now customary to provide a by-pass between the inlet passage leading to the cooling fluid circulating pump and the outlet conduit anterior to the thermostat. This by-pass passage will cause circulation of cooling fluid between the engine head and the engine block when the thermostat cuts off or restricts the flow of cooling fluid from the engine head to the radiator.

It is now proposed to simplify and to improve the practice referred to by providing a cooling fluid circulating pump with impeller means of different capacities. Such impeller means of different capacities actually provide cooling fluid circulating pumps of different capacities which can be employed for the foregoing and other purposes useful in engine construction. These pumps may be constructed as a unitary structure, may be driven by the engine fan driving pulley and may be mounted in a casing on the front end of the engine as is now the practice in constructing engines for automotive and other uses.

One of the pumps referred to is formed on the back and the other on the front of the impeller means so that one may be employed in the usual manner for circulating cooling fluid between the engine jacket and the radiator of the engine while the other may be employed in by-passing cooling fluid between the head and the block of the engine. Since the pump at the rear of the impeller means is directly in front of the region between the head and the block where such cooling fluid circulating pumps are now mounted, it is a simple matter to provide a by-pass from the head and leading to the inlet side of the pump referred to.

The two pumps are provided with a common outlet passage connected to the jacketed space within the block so that whether the flow of fluid from the head to the radiator is or is not restricted there will be a circulation of cooling fluid in the jacket space within the engine and between the engine head and the engine block.

In the drawings:

Figure 1 is a fragmentary side elevational view of an engine having a cooling system embracing the principles of the invention.

Figure 2 is a vertical sectional view of a part of the engine, taken substantially in the planes of lines 2—2 on Figure 3 looking in the direction of the arrows thereon, and illustrating particularly the front of the engine block and head and the cooling fluid circulating pump means employed in the system and supported on the front of the engine.

Figure 3 is a view taken from the back of the pump casing employed in the structure disclosed by Figure 2 and taken substantially in the plane of line 3—3 on Figure 2. A part of the back wall of the pump casing is broken away in Figure 3 so as better to illustrate the pump impeller means employed therein.

Figure 4 is a diagrammatical illustration of the engine cooling system embraced in the structure disclosed by the preceding figures.

In the structure disclosed by Figure 1 the engine 10 comprises an engine cylinder block 11 and an engine head 12 bolted or otherwise secured together in a conventional manner. The engine 10 comprises a plurality of aligned cylinders 13 which are jacketed as at 14 within the head and as at 16 within the block for the purpose of circulating cooling water or other fluid for cooling the cylinders 13 of the engine. The jackets 14 and 16 of the head and block are provided with lower and upper walls 17 and 18 respectively. Openings such as that indicated at 19 are formed through the walls 16 and 17 around the various cylinders 13 of the engine to provide restricted flow of cooling fluid between the cavities formed within the jackets 14 and 16 of the head and block 12 and 11 respectively.

The cooling cavity within the jacket 14 is provided with an outlet 21 from which cooling fluid is adapted to flow through a conduit indicated at 23 from the head 12 to the engine radiator 22. The conduit 23 comprises a hose coupling 24 adapted to be connected between a flanged coupling 26 secured to the outlet 21 and an inlet tube 26 which opens into the upper tank 27 of the radiator 22. Heated cooling fluid within the head 12 is adapted to flow to the upper part of the radiator 22 through the conduit 23. However, such flow of fluid may be interrupted or greatly reduced by an engine thermostat or a thermostatic valve which is indicated generally at 29. The thermostat 29 is secured between the coupling 21 and the member 26 in such manner that the valve part of the thermostat 29 which is indicated by the numeral 31 may restrict or prevent the flow of fluid through the conduit 23 when actuated by expansion or contraction of the bellows 32 by which the valve 31 is actuated.

The cooling fluid return conduit 33 by which cooling fluid may return from the bottom part of the radiator 22 to the pump 41 of the engine 10 comprises a flexible hose or conduit 34 adapted to be secured between an outlet tube 36 communicating with a tank 37 at the bottom of the radiator 22 and an inlet conduit 38 which leads to the interior of a casing 39 of the cooling fluid circulating pumping means 40.

While the pump casing 39 may be constructed in any desired manner, in the present instance the casing 39 comprises a back wall 41 upon which the pumping means 40 may be secured in any suitable manner to the front of the engine 10 as by bolts 45 extending through aligned openings in the casing 39, the back wall 41 and into threaded openings formed in the block 11. The back wall 41 may be secured to the front part 42 of the casing 39 in any suitable manner as for example by screws 43. The interior of the casing 39 adjacent the back wall 41 may be formed to provide a cavity adapted to receive a centrifugal impeller or pump indicated generally by the numeral 44. The pump or impeller 44 is rigidly secured on the rear end of a shaft 46 mounted in a bearing 47 formed in casing 39 adjacent the front end thereof. Externally of the casing 39 the front end of the shaft 46 has rigidly secured thereto the hub 48 of a pulley 50. The pulley 50 may be driven by a belt 49 from a pulley secured to the front end of the crankshaft of the engine 10. The front end of the hub 48 of the pulley 50 is ordinarily positioned directly behind the central part of the engine radiator 22 and may therefore be employed for driving an engine fan 51. The fan 51 may be secured to the hub

of the pulley by any suitable means such as screws indicated at 52. The side of the impeller 44 adjacent the back wall 41 may be formed in such a way as to provide impeller vanes indicated at 53 which actually provide a centrifugal pump on the rear of the impeller 49 and which in the present instance is also indicated by the numeral 53. Impeller 44 on the front side thereof is also formed in such manner as to provide impeller vanes 54 which likewise provides a centrifugal pump which in the present instance is also indicated by the numeral 54. The vanes 53 and 54 may be formed in any suitable manner although in the present instance they are spaced from one another and disposed spirally upon the opposite surfaces of the impeller 44 within the circular peripheral edge of the impeller 44. The vanes 53 are shorter in length than the vanes 54 so that the pump 53 is of less cooling fluid circulating capacity than the pump 54. The casing 39 and the impeller 44 are formed in such a way as to provide annular inlet passages 56 and 58 respectively communicating with the inlet sides of the pumps 53 and 54. The inlet passages 56 and 58 in the present instance are annular passages surrounding the shaft 46 and concentrically disposed with respect thereto. The casing 39 is also formed in such a way as to provide an annular outlet or fluid collecting passage 59 which is disposed in the casing 39 around the impeller 44 and in open communication with the outlet sides of the pumps 53 and 54. The annular inlet passage 58 communicates with the return passage 38 leading from the radiator 22 of the engine. The annular inlet passage 58 also supplies cooling fluid to the inlet side of the pump 54. The annular inlet passage 56 communicates with the interior of the jacket 14 surrounding the head 10. This communication is provided by a passage 60 formed by an opening 61 in the back wall 41 which then communicates with an opening 62 formed in the front corner of the block 11 and which in turn communicates with an opening 63 formed in the lower wall 17 of the head 12.

The annular inlet passage 56 therefore will tend to supply cooling fluid from the interior of the head 12 to the inlet side of the pump 53. The collecting passage 59 will receive the fluid delivered by the two pumps 53 and 54. Since the vanes 53 and 54 on the impeller 44 are spirally formed adjacent the peripheral edge of the impeller 44 it will be apparent that the fluid within the collecting passage 59 will be under a static fluid pressure determined by the capacity of the pumps 53 and 54. Since the vanes 54 are considerably larger than the vanes 53 and since the passage 59 is not large in comparison to the size of the vanes 54 it will be apparent that the pressure developed by the vanes 54 in the passage 59 will be great enough to prevent any substantial pumping of fluid by the vanes 53 when a relatively unrestricted quantity of cooling fluid is supplied to the inlet passage 58. Such unrestricted supply of fluid will be provided in the inlet passage 58 when the valve 31 of the thermostat 29 is in fully open position. Under such circumstances it will be apparent that the flow of fluid from the interior of the head 12 to the collecting passage 59 and delivered by the pump 53 will be of a negligible quantity.

However when the valve 31 of the thermostat 29 either closes or materially restricts the flow of fluid through the conduit 23 then it will be apparent that the supply of fluid to the inlet passage 58 will be restricted. Under such conditions the capacity of the pump 54 to deliver fluid to the collecting passage 59 will be reduced and the pump 53 thereupon will pump fluid from the interior of the head 12 to the collecting passage 59 through the passage 60.

The circulation of cooling fluid through the bypass passage 60, when the coolant is not circulated through the radiator 22, is to prevent parts of the cooling fluid in the engine from becoming hotter than other parts, thereby preventing localized boiling. However, to prevent such localized boiling of the cooling fluid does not require the same rate of coolant circulation needed to pass the coolant through the radiator. Consequently, by providing impeller means of different fluid circulating capacities, a saving in engine power may be realized by employing the impeller means of lesser circulating capacity, impeller 53, when only a slow rate of fluid circulation is required.

It will be apparent that in either event the fluid supplied to the collecting passage 59 by either of the pumps 53 or 54 will be delivered to the interior of the block through the return passages indicated generally at 66. The return passages 66 are formed by a spaced pair of openings 67 and 68 which are formed in the back wall 41 of the pump casing 39 and by aligned openings 69 which are formed in the front wall 70 of the jacket 16 of the block 11.

It will be apparent that the conduit 33, the supply passage 58, the passage through the pump 54, the collecting passage 59 and the passage 66 all constitute return conduit means 71 by which the cooling fluid may be circulated from the radiator 22 to the jacket of the engine 10. It will also be apparent that the passage 60, the inlet passage 56, the passage through the pump 53, the collecting passage 59 and the passages 66 constitute a by-pass passage 72 where cooling fluid may be circulated between the head 12 and the block 11 without passing through the radiator 22. It will also be apparent that the collecting passage 59 and passages 66 are common passages between the return passage 71 and the by-pass passage 72. It will be further apparent that the head 12 may be removed from the engine without disturbing the mounting of the pumping means 40 on the front end of the block 11, and this notwithstanding the fact that the interior of the head is normally connected to the inlet 56 for the by-pass pump 53. The registering passages 63 and 62 formed in the head 12 and the block 11 and leading through the opening 61 in the back wall 41, make this possible.

I claim:

1. An engine cooling system comprising an engine block having a plurality of aligned cylinders therein and a head for said block, said head and said block each having cooling fluid jackets therein in restricted communication with one another, an engine radiator, cooling fluid pump means for said engine, said pump means having centrifugal impeller means of different fluid circulating capacities and a casing for said impeller means, an annular fluid collecting passage formed in said casing around said impeller means and communicating with the outlet side of each of said impeller means, inlet passage means extending through said jacket of said block and connecting the jacket of said head with the inlet side of the one of said impeller means of lesser fluid circulating capacity, a separate inlet passage means connecting said engine radiator with the inlet side of the other of said impeller means having the greater fluid circulating capacity, outlet passage means connecting said collecting passage to the interior of the jacket of said block, a conduit connecting the jacket of said head to said radiator, and a thermostat in said conduit for controlling the flow of fluid therein.

2. A cooling fluid circulating pump comprising a casing having a removable back wall and a rotatable shaft journaled therein and terminating at said back wall, means on said shaft externally of said casing for driving said shaft, rotatable centrifugal impeller means mounted on said shaft within said casing extending radially in parallel relation to said back wall, an annular inlet passage means formed in said casing and around said shaft and at one side of said impeller means, a second annular inlet passage means formed in said casing and around said shaft and on the opposite side of said impeller means, centrifugal impeller vane means formed on opposite sides of said impeller means and having the inlet sides thereof each communicating with one of said inlet passage means, said impeller vane means having different capacities for pumping fluid within said casing, an annular fluid collecting passage formed in said casing around said impeller means and

in directly opposed relation to each of said impeller vane means, conduit means adapted to connect said inlet passage means communicating with said vane means of larger capacity to an engine radiator, conduit means adapted to connect said inlet passage means communicating with said vane means of smaller capacity to the interior of an engine head, and conduit means adapted to connect said collecting passage means to the block of an engine said two last mentioned conduit means being adapted to extend through said back wall.

3. An engine cooling system comprising an engine block having a plurality of aligned cylinders therein and a head for said block, said head and said block each having cooling fluid jackets therein in restricted communication with one another, an engine radiator having cooling fluid inlet and outlet means, cooling fluid pump means for said engine, said pump means having centrifugal impeller means therein and a casing enclosing said impeller means, a pair of inlet passage means formed in said casing and communicating with the inlet side of said impeller means, outlet passage means formed in said casing and communicating with the delivery side of said impeller means, cooling fluid conduit means connecting said radiator outlet means to one of said pair of said inlet passage means, cooling fluid conduit means connecting said cooling fluid jacket in said head to said radiator inlet means, an engine thermostat in said last mentioned conduit means for opening the cooling fluid passage through said last mentioned conduit means when the temperature of the cooling fluid in said engine increases to a predetermined value, cooling fluid conduit means connecting said outlet passage means to said cooling fluid jacket in said block, and cooling fluid conduit means connecting the other of said pair of inlet passage means to said cooling fluid jacket in said head, said last mentioned conduit means being in open communication with said cooling fluid jacket in said head in any position of said engine thermostat and throughout the operation of said engine.

4. An engine cooling system as defined by claim 3 and in which said cooling fluid conduit means connecting said other of said pair of inlet passages to said cooling fluid jacket in said head extends throught said block.

5. An engine cooling system as defined by claim 3 and in which said casing enclosing said impeller means has a wall secured to said block, said wall having said cooling fluid conduit means connecting said other of said pair of inlet passage means to said jacket in said head and said cooling fluid conduit means connecting said outlet passage means to said cooling fluid jacket in said block extend through said wall and a wall of said block.

6. An engine cooling system as defined by claim 3 and in which said impeller means includes impeller means of different fluid pumping capacities and said pair of inlet passage means formed in said casing communicate

with the inlet side of said impeller means of different pumping capacities in said casing with the one of said impeller means of the lesser pumping capacity being connected to said cooling fluid conduit means connecting said other of said pair of inlet passage means to said cooling fluid jacket in said head.

7. A cooling fluid circulating pump comprising a casing having a removable back wall and a rotatable shaft journalled therein and terminating at said back wall, means on said shaft externally of said casing for driving said shaft, rotatable centrifugal impeller means mounted on said shaft within said casing and extending radially in paralleled relation to said back wall, annular inlet passage means formed in said casing and around said shaft at one side of said impeller means, a second annular inlet passage means formed in said casing and around said shaft and on the opposite side of said impeller means, centrifugal impeller vane means formed on opposite sides of said impeller means and having the inlet sides thereof each communicating with one of said inlet passage means, said impeller vane means having different capacities for pumping fluid within said casing, an annular fluid collecting passage formed in said casing around said impeller means and in directly opposed relation to each of said impeller vane means, conduit means adapted to connect said inlet passage means communicating with said vane means of larger capacity to an engine radiator, conduit means adapted to connect said inlet passage means communicating with said vane means of smaller capacity to the interior of an engine head, and conduit means adapted to connect said collecting passage means to the block of an engine, said two last-mentioned conduit means being adapted to extend through said back wall, and means for securing said back wall of said casing to the block of an engine with said inlet and said spaced outlet passage means aligned with inlet and outlet opening means formed in said block.

References Cited in the file of this patent

UNITED STATES PATENTS

1,346,331	Muir	July 13, 1920
1,386,787	Kirkham	Aug. 9, 1921
1,519,155	Moorhouse	Dec. 16, 1924
1,623,804	Muir	Apr. 5, 1927
1,687,353	Swanson	Oct. 9, 1928
2,231,939	Nallinger	Feb. 18, 1941
2,309,976	Mueller	Feb. 2, 1943
2,506,547	Findley	May 2, 1950

FOREIGN PATENTS

749,867	France	May 15, 1933
556,489	Great Britain	Oct. 7, 1943