Jan. 9, 1940. L. S. SHELDRICK 2,186,080

INTERNAL COMBUSTION ENGINE

Original Filed July 9, 1936 2 Sheets-Sheet 1

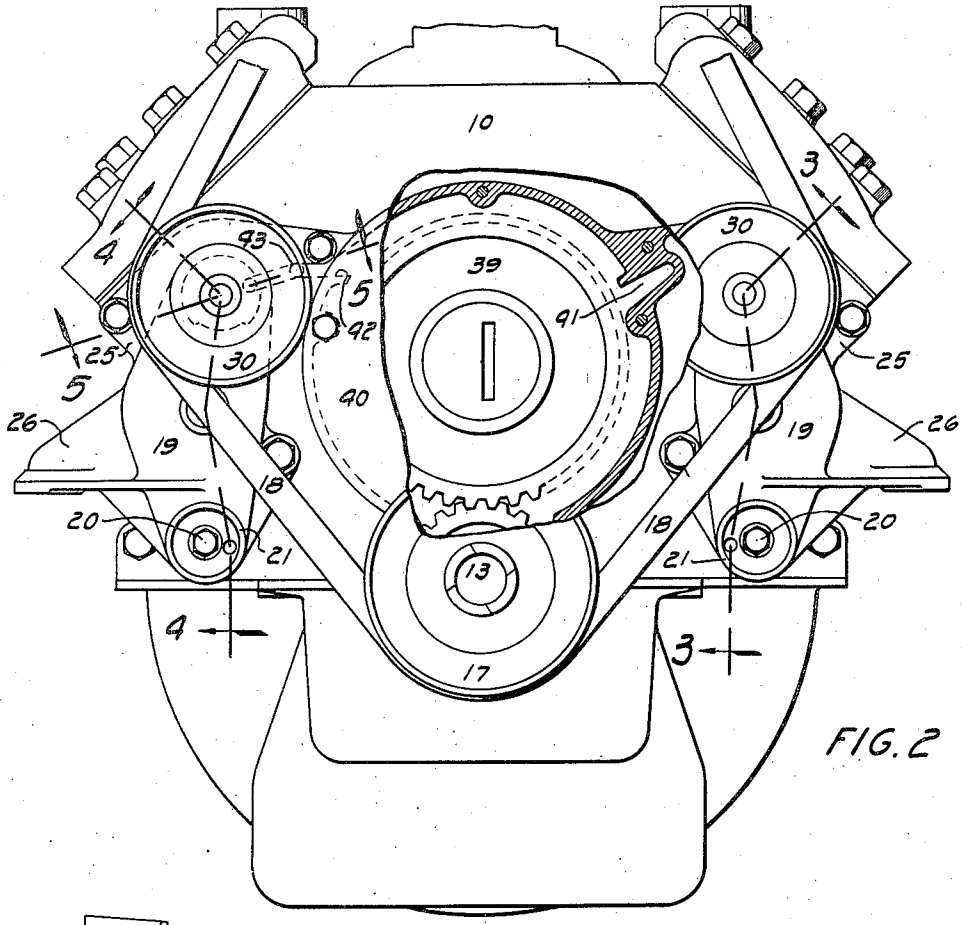


FIG. 2

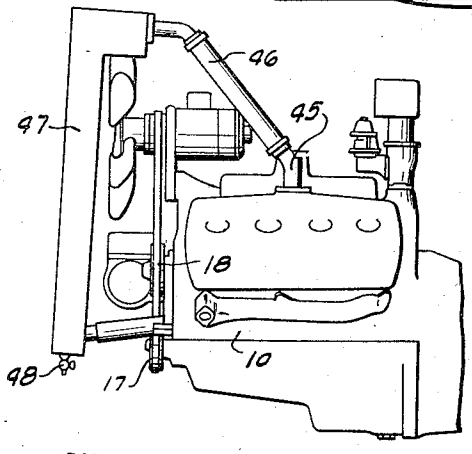


FIG. 1

WITNESS
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INTERNAL COMBUSTION ENGINE

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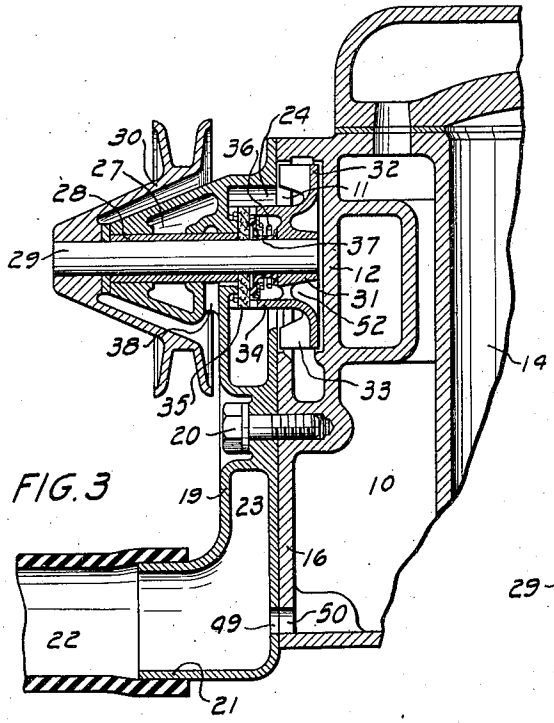


FIG. 3

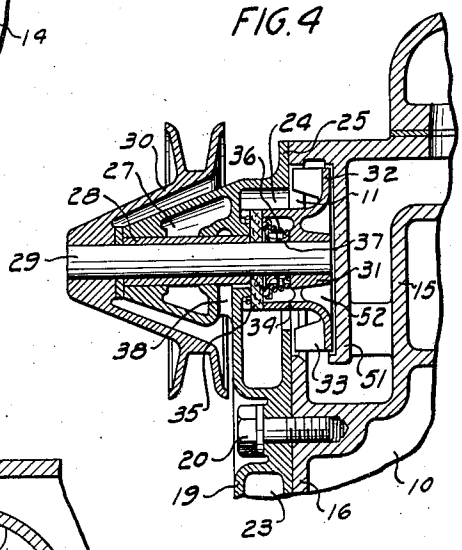


FIG. 4

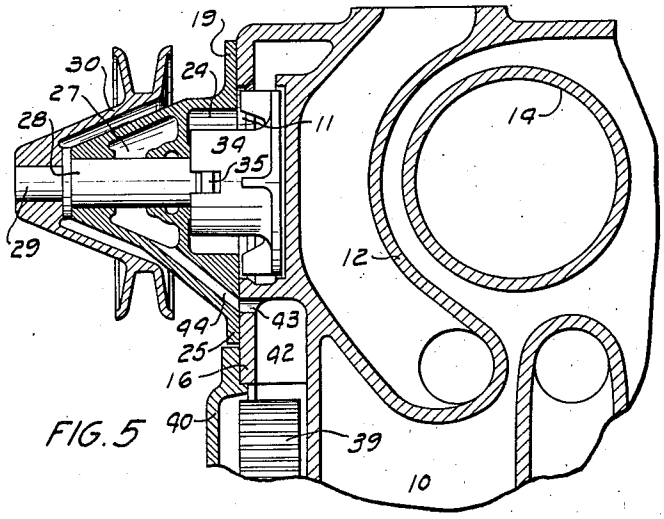


FIG. 5

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UNITED STATES PATENT OFFICE

2,186,080

INTERNAL-COMBUSTION ENGINE

Laurence S. Sheldrick, Dearborn, Mich., assignor to Ford Motor Company, Dearborn, Mich., a corporation of Delaware

Original application July 9, 1936, Serial No. 89,784. Divided and this application October 31, 1938, Serial No. 237,825

5 Claims. (Cl. 123—175)

This is a division of application, Serial No. 89,784, filed July 9, 1936, by Laurence S. Sheldrick on an Internal-combustion engine.

The object of my invention is to provide an internal-combustion engine having a novel water circulating system. My improved system is believed to be more efficient in operation and simpler to construct than the conventional type.

Specifically, the object of my invention is to provide a combined motor support, water pump and water inlet connection, which unit is adapted to be secured to the front end of a V-type motor.

Still a further object of my invention is to provide a water pump which is lubricated by oil from the engine oiling system and which pump has provisions for keeping water which may seep through the pump seal from entering the oil reservoir. Heretofore most water pumps have been lubricated through grease fittings or a separate oil supply which requires periodic servicing. My improved construction requires no attention whatever as the oil reservoir is kept filled by the normal operation of the motor.

Still a further object of my invention is to provide a cooling system wherein a water pump is mounted on each cylinder block of a 90-degree V-type motor, which pumps force the water into the cylinder blocks instead of drawing the water out of same. Thus a higher and more efficient operating temperature for the motor may be maintained without causing the cooling water to boil. While it is not new to pump cooling water into an engine cylinder block, still my improved installation overcomes certain objections which restricted the use of this type of pump on V-type motors of 90 degrees or more included angle.

With such motors it is very desirable to drive both water pumps and the engine fan by a single V-belt which extends around a crank shaft pulley and over the outside of both pump pulleys and around the upper part of a fan pulley which is located at the upper part of the motor. Sufficient arcuate contact between the crank shaft pulley and the belt, substantially 90 degrees, must be maintained to drive these accessories. In order to obtain the required belt contact it has heretofore been necessary to place the water pumps at the upper portions of the cylinder blocks, as a lower position of the pumps reduced the arcuate belt contact to the point where excessive tension was necessary to drive the units. It was therefore much simpler, although not as desirable, to place the pumps in the cylinder heads and to draw the water from the cylinder heads. My improved construction allows the pumps to be placed near the upper ends of the cylinders and still forces the water into the blocks so that efficient thermal operation of the motor is maintained with a simple pump and driving mechanism.

A further objection to placing the water pumps in the inlet water passageways is that it has been necessary to place the pumps at a lower level than the lowest part of the cylinder water jacket in order that the cooling system may be drained by a single valve at the bottom of the radiator. If the pumps were placed at the top of the blocks a drain valve for each block, besides the radiator valve, was heretofore required. Such valves are dangerous to use as an inexperienced operator may only open the radiator drain or one of the cylinder block valves to empty the cooling system and thereby crack one cylinder block if the engine should freeze. With my improved construction, the pumps are placed in the inlet line and near the top of the cylinder blocks and still the opening of a single valve or pet cock at the bottom of the radiator will drain the entire cooling system.

Still a further object of my invention, although of lesser importance and perhaps not entirely new, is to provide a water pump which will have a uniform discharge for each speed, irrespective of the shape of the chamber into which the water is discharged. This feature is especially important in connection with V-type motors where a pump is provided for each cylinder block of the motor. Thus, with my construction both blocks are uniformly cooled to the same temperature.

Still a further object of my invention is to provide a centrifugal pump having a single annulus of propeller vanes, and which pump is free from end thrust, due to the pressure developed on the fluid. In the ordinary pump which is inserted into a water jacket, the pressure developed by the pump is impressed upon the body of the impeller to produce end thrust. The applicant uses a thrust type of fluid pressure seal which functions correctly only with a small variation in load upon the seal and consequently, the elimination of end thrust allows a predetermined load to be applied with a spring or like means.

With these and other objects in view, my invention consists in the arrangement, construction and combination of the various parts of my improved device, as described in this specification,

claimed in my claims and illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of a V-type motor having my improved water circulating system installed thereon.

Figure 2 is a front view of the motor shown in Figure 1, a portion of the timing gear cover being broken away to better illustrate the oiling system employed therein.

Figure 3 is a sectional view, taken on the line 3—3 of Figure 2.

Figure 4 is a sectional view, taken on the line 4—4 of Figure 2, and

Figure 5 is a sectional view, taken on the line 5—5 of Figure 2.

Referring to the accompanying drawings, I have used the reference numeral 10 to indicate the cylinder block casting of a V-type internal-combustion engine, which casting has two banks of cylinders formed therein in the conventional manner. Each cylinder block is provided with a conventional water jacket, the front ends of which are aligned with each other. Each water jacket has a circular opening 11 extending therethrough over which my improved pumps are mounted.

As shown in Figures 3, 4 and 5, an exhaust conduit 12 is cast in each block 10. Figure 3 shows the exhaust conduit as positioned in the left hand cylinder block wherein this conduit is disposed quite close to the front wall of the water jacket. These exhaust conduits conduct the exhaust gas from the firing chambers to the outside of the motor where it is discharged into a suitable manifold not shown in the drawings. It will be noted that the cylinders, numbered 14, of one cylinder block and spaced a substantial distance forwardly from the cylinders in the other cylinder block and consequently, the exhaust conduit 15 of the right hand block is spaced a considerable distance rearwardly from the position of the conduit 12, as shown in Figure 3. The front face of the conduit 12 is machined to a flat disc-shaped surface, while a plate 51 is cast in the other cylinder block in position spaced forwardly from the conduit 15, the front face of the plate 51 being machined to a flat disc-shaped surface. Impellers about to be described are rotatably mounted adjacent to these surfaces.

The engine is provided with a driving pulley 17 which is secured to the front end of the crank shaft 13 and over which a V-belt 18 is drawn. The water pumps associated with this engine are adapted to be driven by the belt 18 and must consequently be longitudinally aligned with each other. For this reason the front face of the engine is formed as a flat plate 16 across both banks of cylinders so that the water pumps may be both secured in alignment with the pulley 17.

Each water pump comprises a housing 19, which is secured to the front wall 16 by five cap screws 20. It will be noted from Figure 3 that the housings 19 are each provided with a cylindrival sleeve 21 over which an inlet hose 22 is secured. The sleeves are aligned with the lowermost parts of the cylinder block water jackets and connect with vertically extending passageways 23 in the housings 19, which passageways 23 terminate in openings 24 which are aligned with the openings 11 in the cylinder blocks. Thus water may enter through the sleeve 21 and then circulate upwardly through the passageway 23 and then through the aligned openings 24 and 11 so as to enter each cylinder block. It will be noted that a suitable flange 25 extends outwardly from each housing 19 through which three of the screws 20 are secured, while the other two screws extend through the center portion of each housing. Five cap screws are used to secure each housing 19 to the cylinder block in order that these housings may support the front end of the motor. In order to so support the motor, a bracket 26 is cast integrally with each housing 19 which brackets extend laterally from the castings and form the motor supports.

An oil reservoir 27 is cast integrally with the upper end of each pump housing 19, the reservoir 27 projecting forwardly therefrom and having a chamber therein in which oil is received. A bushing 28 is pressed through suitable openings in the walls of the reservoir and extends therethrough in substantial alignment with the openings 24. The bushings 28 are formed of porous bronze which is constructed so that lubricant applied to the outside of the bushing filters through and lubricates the shaft which is supported thereby. A pump shaft 29 is rotatably mounted in the bushing 28 and projects from each end of the bushing, the forward end of the shaft 29 having a pulley 30 fixed thereto which is in substantial alignment with the pulley 17. The other end of the shaft 29 is provided with an impeller 31, this impeller comprising a hub member having a radially extending flange 32 extending therefrom. It will be noted that the flange 32 is positioned inwardly through the opening 11 in the respective cylinder block and that vanes 33 are cast integrally with each flange 32 so that water will be drawn in the conventional manner through the opening 24 and discharged radially by the vanes 33. A cylindrical sleeve 34 projects inwardly from the hub member of the impeller and drives a carbon disc 35 which forms the water seal for this pump. The disc 35 is resiliently urged against the end of the housing 19 by means of a spring 36. A suitable rubber water seal sleeve 37 coacts with the shaft 29 and disc 35 to prevent water from leaking around the shaft. The water seal just described forms no part of this invention and is merely illustrated to show a suitable means of preventing water from leaking from the pump.

Referring to Figures 3, 4 and 5, it will be noted that a passageway 38 is provided between the outer wall of the housing 19 and the reservoir 27 through which the bushing 28 is pressed. The purpose of the passageway 38 is to allow water which may leak between the inner end of the bushing 28 and the housing 19 to drain out of the pump and thus prevent such water from entering into the oil reservoir 27. Water that may leak or pass the disc 35 and which travels along the shaft 29 will be thrown outwardly at the pulley end of the shaft to prevent its entering into the oil reservoir at this point.

Means will now be described whereby the oil reservoir 27 is kept filled with oil by the normal action of the motor.

Referring to Figure 2 it will be noted that a cam shaft gear 39 is rotatably mounted within the engine in the conventional manner and that a cam shaft gear cover plate 40 is secured to the front wall 16 of the cylinder block to form a closure for the timing gears of the motor. The casting 10 is provided with a passageway 41 aligned with the gear 39 which extends towards the right hand water pump while a second passageway, shown by dotted lines 42, extends radially from the other side towards the left hand water pump. A pair of drilled holes 43 extend through

the wall 16 and communicate with the ends of the passageways 41 and 42, these openings being aligned with drilled openings 44 in each of the pump housings 19. The openings 44 extend from the chambers within the reservoir 27 to the adjacent openings 43 so that these chambers are in direct communication with the passageways 41 and 42, respectively. During the normal operation of the engine, oil is thrown centrifugally by the timing gear 39, some of which oil is thrown into the passageways 41 and 42 and eventually flows through the holes 43, openings 44 and into the chambers within the reservoirs 27. The lubricant then fliters through the bushings 28 to lubricate the shafts 29.

When the motor is running the cooling medium is drawn through each hose 22, then through the passageways 23 and is then forced by the impeller vanes 33 into the water jacket around the cylinders. The water then flows through the cooling passageways in the cylinder heads of the motor to a pair of outlet flanges 45 from which it is conducted by means of a hose 46 to the upper portion of a conventional radiator 47.

It will be noted from Figure 1 that I have provided a pet cock 48 which is disposed in the bottom of the radiator 47. When it is desired to drain the cooling system the pet cock is opened. The water pumps are located at the upper portion of the cylinder blocks, as shown in Figures 2 and 3 so that water will not drain through the openings 24 from the lower part of the water jacket. In order that a separate pet cock will not be required for each water jacket I have provided aligned openings 49 and 50, in the lower part of the housings 19 and front face 16, respectively. These openings are relatively small so that even though they allow some water from the block to flow back into the pump inlet, the loss resulting from this is negligible. It is believed that the gain in being able to place the pumps at the upper part of the block and to force the water into the blocks with a simple belt drive much more than offsets the loss resulting from the use of the drain holes 49 and 50.

It will be noted that an axial opening 52 is provided through the hub of each impeller 31 within the sleeve 34. Fluid pressure which may develop between the plate 51 and the impeller will thereby be relieved by discharging the fluid into the inlet passageway from in back of the carbon disc 35. There is only a small clearance space between the impeller and the plate 51 so that even in the absence of vanes on the back of the impeller, the fluid will be forced centrifugally by the skin friction of the impeller disc and thus prevent the fluid from developing a pressure in back of the impeller. The openings 52, being connected to the inlet passageway, equalize any slight difference in pressure so that no end thrust develops. This result is believed unique in internal-combustion engine pumps, the impellers of which are adapted to be inserted into the water jackets of the engine.

Among the further advantages arising from the use of my improved construction, it may be well to mention that I have provided a water circulating system which is especially desirable for use on V-type motors of 90 degrees or more included angle. The simplicity of the drive, together with the increased engine efficiency and the fact that the system may be drained by the opening of one pet cock, has not heretofore been incorporated in any V-type engine known to the applicant.

Still a further advantage results from the simplified oiling system for the pumps wherein the operation of the engine maintains lubricant in the oil reservoirs of the pumps without the attention of the operator.

Some changes may be made in the arrangement, construction and combination of the various parts of my improved device without departing from the spirit of my invention, and it is my intention to cover by my claims such changes as may reasonably be included within the scope thereof.

I claim as my invention:

1. In combination, an internal-combustion engine cylinder black having a water jacket thereabout, said jacket having an opening therethrough at a point spaced upwardly from the bottom thereof, a pump housing secured to said water jacket over said opening, said housing extending from the bottom of the water jacket to a point above said opening, an impeller adapted to force water from the pump housing into the water jacket, and an inlet port in said housing positioned in horizontal alignment with the bottom of said water jacket, said water jacket and pump housing having a restricted passageway extending therethrough in position vertically aligned with the bottom of said water jacket, whereby cooling water may flow from the bottom of a water jacket to the inlet port for the purpose described.

2. In combination, an internal-combustion engine cylinder block having a water jacket thereabout, said water jacket having an opening therethrough in its upper portion, a pump housing secured to said water jacket over said opening, said housing extending from the bottom of the water jacket to a point above said opening, an impeller rotatably mounted in said housing, so as to force water from the housing into the water jacket, and an inlet sleeve projecting outwardly from the lower portion of said housing in horizontal alignment with the bottom of said water jacket, said water jacket and pump housing having a restricted passageway extending therethrough in position vertically aligned with the bottom of said water jacket, whereby cooling water may flow from the bottom of the water jacket to the inlet sleeve, for the purpose described.

3. In combination, an internal-combustion engine cylinder block having a water jacket thereabout, one end of said block having a machined surface extending substantially the full height thereof, and said machined portion of the water jacket having an opening extending therethrough near the upper portion of said jacket, a pump housing adapted to be fixedly secured to said machined surface in position over said opening, said housing extending the full height of said machined surface, an impeller rotatably mounted in said housing and extending into the water jacket through said opening, so that upon rotation of said impeller water will be drawn from said housing and forced into the water jacket, an inlet sleeve formed integrally with said housing and projecting outwardly therefrom in horizontal alignment with the bottom of said water jacket, said water jacket and housing having aligned restricted openings therein in position vertically aligned with the bottom of said water jacket, whereby cooling water may flow from the bottom of the water jacket to the inlet sleeve, for the purpose described.

4. A V-type internal-combustion engine wherein each cylinder block is provided with a water

jacket, each of said jackets having an opening therethrough in its upper portion, a pump housing secured over each of said openings, each housing extending from the bottom of the adjacent water jacket to a point above said openings, an impeller rotatably mounted in each of said housings which upon rotation forces water from the housing into the adjacent water jacket, and an inlet sleeve projecting outwardly from the lower portion of each housing in substantial horizontal alignment with the bottom of the adjacent water jacket, each of said water jackets and adjacent pump housings having a restricted passageway extending therethrough in position vertically aligned with the bottom of the water jacket, whereby cooling water may flow from the bottom of the water jacket to the adjacent inlet sleeve, a driving pulley disposed on the crank shaft of said engine, and a pulley fixed to each of said impellers, and a belt extending around said crank shaft and water pump pulley, for the purpose described.

5. A water circulating system for a cylinder block comprising, a water jacket disposed around said block having an opening in an outer wall thereof spaced upwardly from the bottom thereof, a circulating pump having a housing secured to said wall over said opening, said housing extending from the bottom of the water jacket to a point above said opening, said pump circulating water through said opening into said water jacket, an inlet port for said housing disposed at the level of the bottom of said water jacket, and a restricted passageway extending between said water jacket and said housing at the level of the bottom of said water jacket, whereby water may be drained from the bottom of the water jacket through said inlet port of the pump housing.

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