Feb. 3, 1953 E. C. KIEKHAEFER 2,627,256

CYLINDER BLOCK FOR INTERNAL-COMBUSTION ENGINE COOLING

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Fig. 1

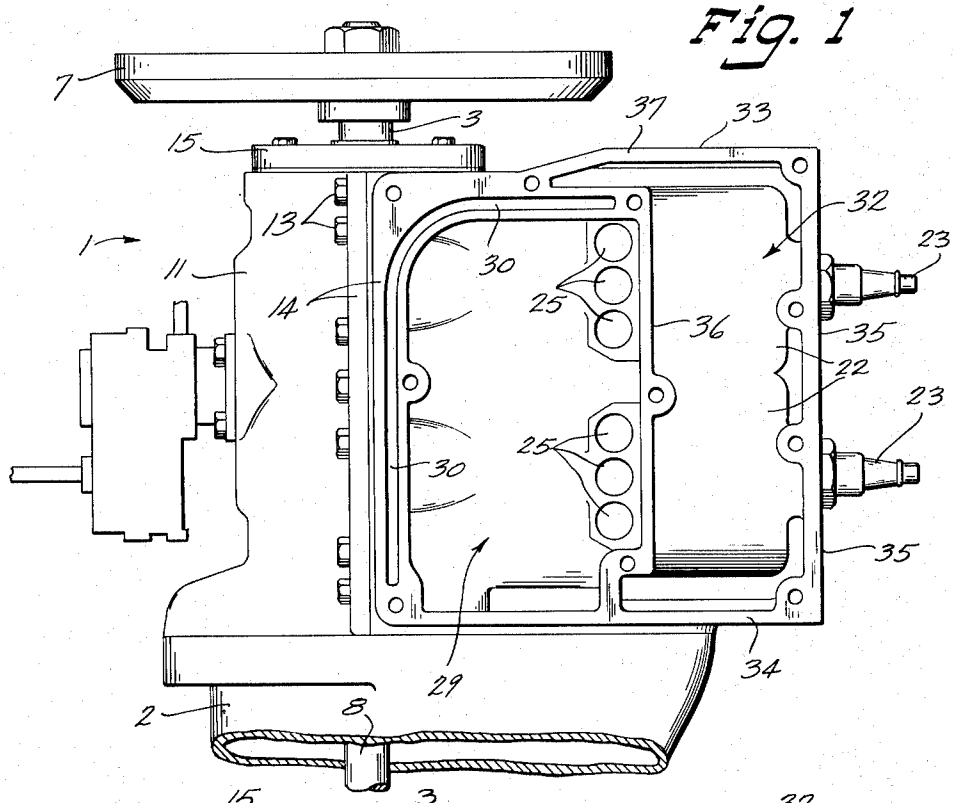
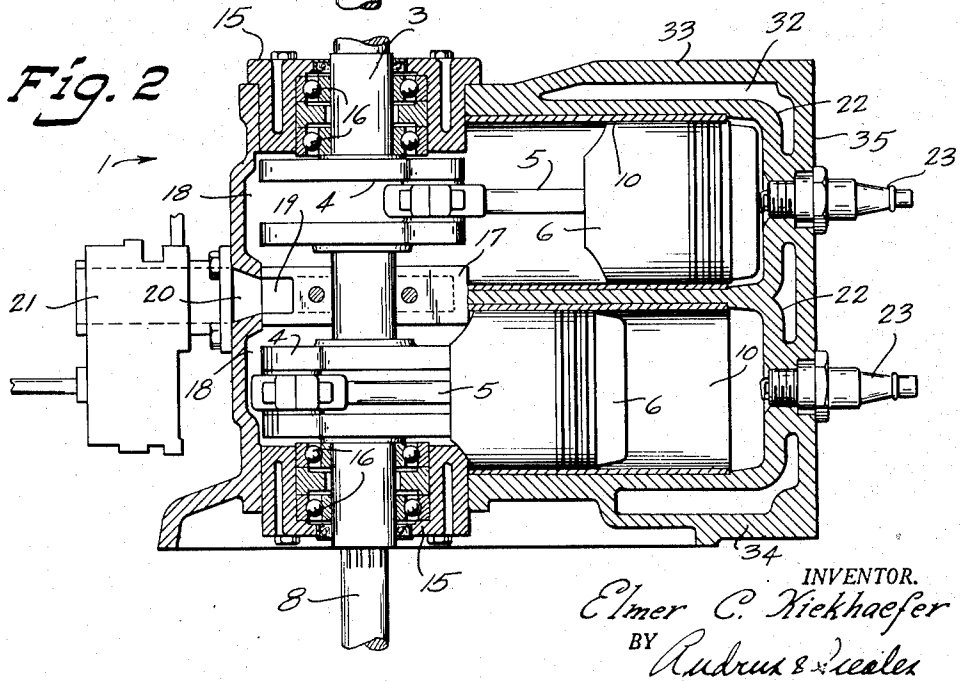


Fig. 2



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Fig. 3

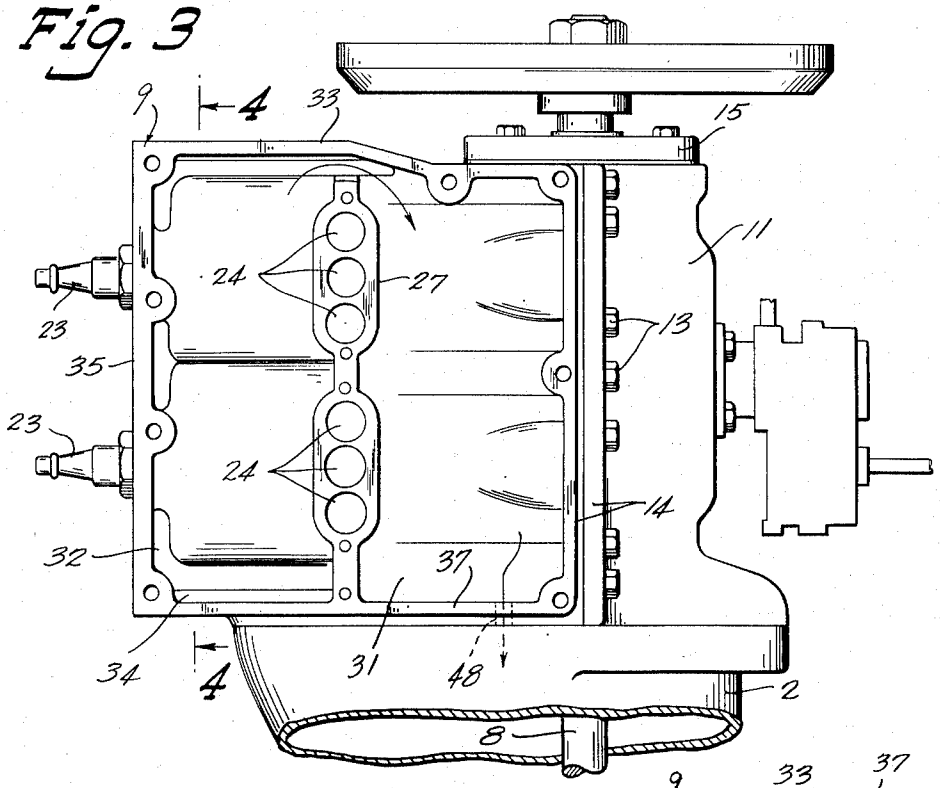
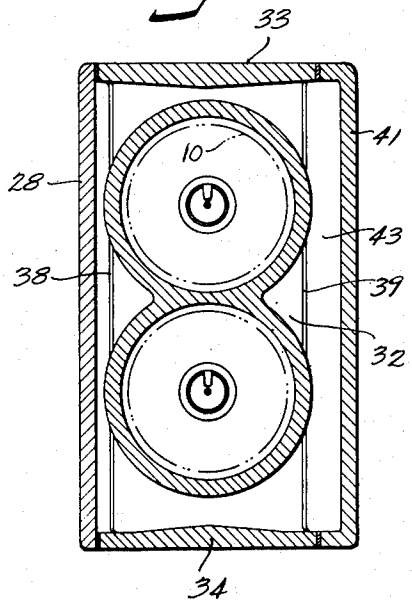


Fig. 4



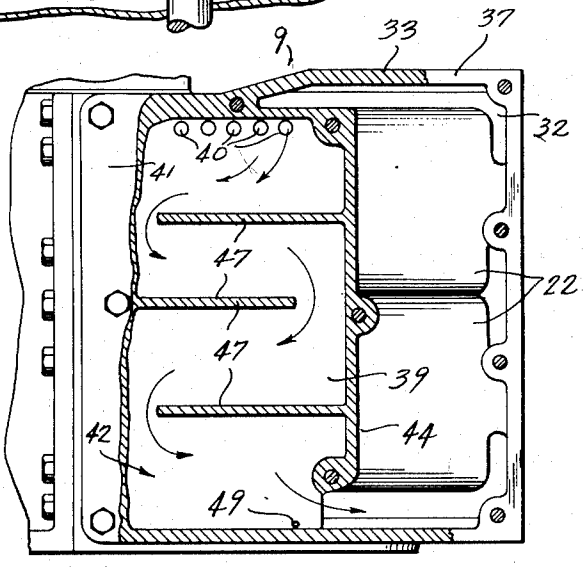


Fig. 5

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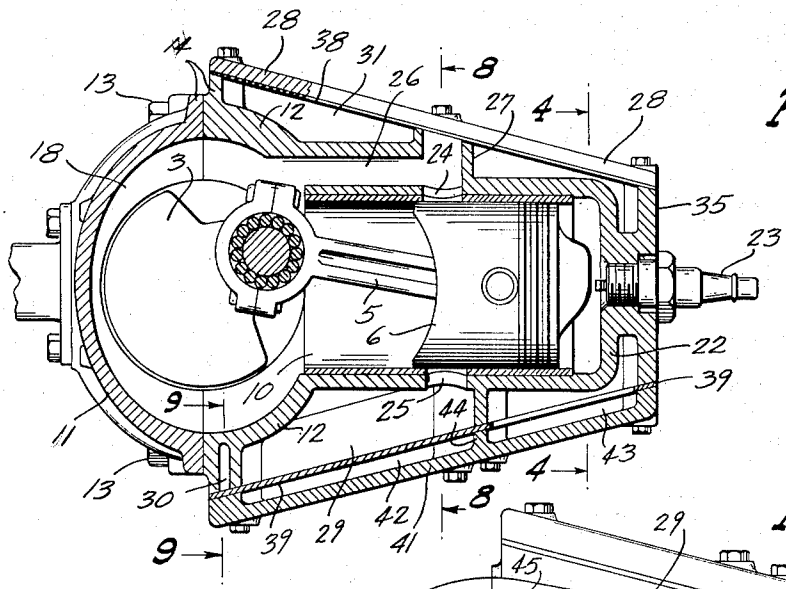


Fig. 6

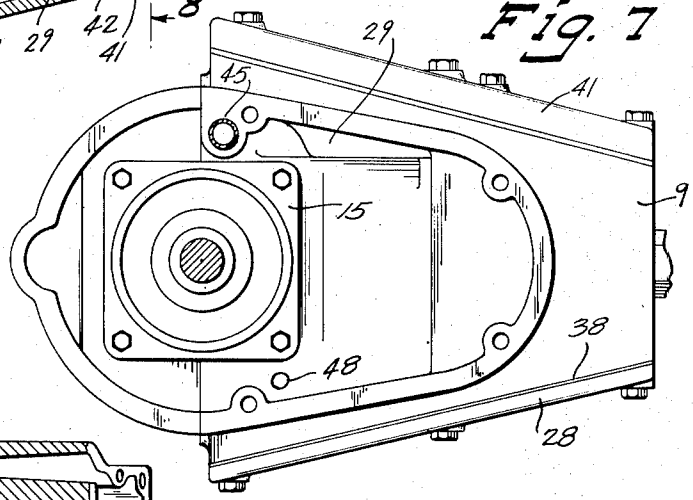
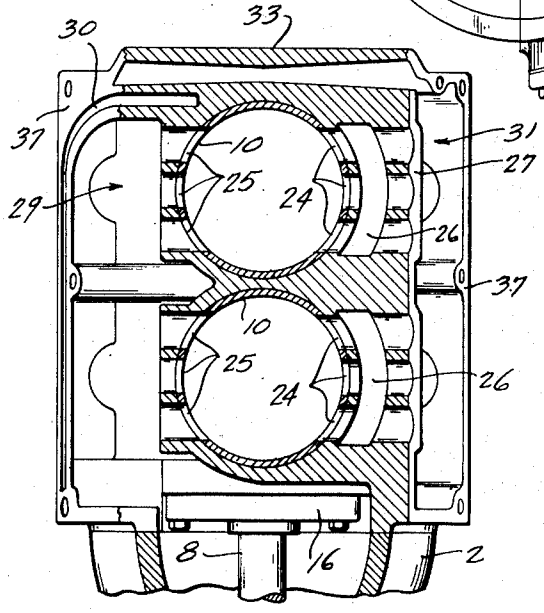


Fig. 7

Fig. 8



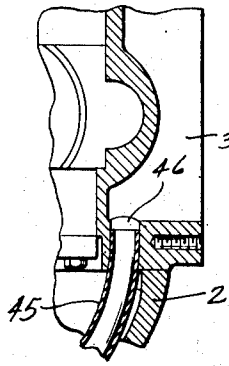


Fig. 9

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CYLINDER BLOCK FOR INTERNAL-COMBUSTION ENGINE COOLING

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Application November 30, 1949, Serial No. 130,289

8 Claims. (Cl. 123—41.79)

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This invention relates to two-cycle internal combustion engines and particularly to the construction of the engine block.

The invention provides an easily formed cast block which includes several coolant cavities, transfer and exhaust passages, and part of the crank chambers in a single block.

An object of the invention is to increase the size and effective coolant capacity of the engine.

A further object is to prevent overheating of the crankcase of the engine.

Another object is to provide an engine block which is easily die-cast, employing a number of easily retractable cores which form substantially the entire embodiment of the block to reduce or eliminate machining and other working.

Another object is to provide a lighter-weight engine block.

Another object is to simplify the engine construction.

These and other objects and advantages will be more fully set forth in the following description of a preferred embodiment of the invention as illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a side elevation of an outboard motor engine showing the upper end of the outboard motor drive shaft housing and the engine cylinder block with the side cover plate removed to show the exhaust and coolant cavities;

Fig. 2 is a longitudinal vertical section of the engine shown in Fig. 1 taken centrally thereof;

Fig. 3 is a side elevation showing the reverse side of the engine;

Fig. 4 is a section taken on line 4—4 of Figs. 3 and 6.

Fig. 5 is a side elevation similar to Fig. 1 of the engine block with part of the jacket broken away and sectioned to show the exhaust plate;

Fig. 6 is a horizontal section of the engine shown in Fig. 1 taken through the center line of the upper cylinder thereof;

Fig. 7 is a bottom plan view of the engine shown in Fig. 1;

Fig. 8 is a section taken on line 8—8 of Fig. 6; and

Fig. 9 is a section taken on line 9—9 of Fig. 6.

The engine 1 is shown in the drawings as mounted on the upper open face of the drive shaft housing 2 of an outboard motor and includes the vertical crankshaft 3 having the two opposite cranks 4 which are connected by rods 5 to the respective pistons 6. The engine flywheel 7 is carried by the upper end of the crankshaft.

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The lower end of the crankshaft is disposed to receive the splined upper end of the drive shaft 8 which extends downwardly to the lower underwater unit of the outboard motor, not shown.

The block 9 of engine 1 is preferably die-cast of lightweight alloy and includes the iron or steel cylinder sleeves 10 which are separately formed and then cast in the block.

The crankcase pan member 11 and the skirt portions 12 of block 9 are joined on a parting line passing through the axis of crankshaft 3 and transversely of the engine, by the bolts 13 passing through the complementary flanges 14 of the block and crankcase member.

The end closure members 15 with the double rows of ball bearings 16 carry the upper and lower ends of crankshaft 3 and close the upper and lower ends of the crankcase.

The center main crankshaft bearing member 17 intermediate cranks 4 divides the crankcase into the separate crank chambers 18 and includes several valve means, not shown, which control the induction of the gas mixture into the respective crank chamber 18 from the central passage 19 formed in the bearing member and communicating through the opening 20 in crankcase member 11 with the carburetor 21 to receive the fuel mixture therefrom.

The lower ends of the cylinders 10 carrying the corresponding pistons 6 open into the respective crank chambers 18.

The upper end of each cylinder is closed by a dome 22 which is fitted to receive the spark plugs 23.

The transfer ports 24 and exhaust ports 25 are drilled respectively from opposite sides of each cylinder through block 9 and the cylinder sleeves 10 and are disposed to be covered and uncovered by pistons 6 as in conventional two-cycle engine operation.

The transfer passages 26 providing for communication between corresponding crank chambers 18 and cylinders 10 through ports 24 extend in block 9 from the crankcase alongside the sleeves 10 and up to ports 24 and the vertical rib 27 formed in the block.

In practice, passages 26 are preferably formed in the casting of block 9 by retractable cores, not shown, and ports 24 may be formed by drilling into rib 27 and across the passages and into the cylinders. The outside holes left in the face of rib 27 may be plugged individually if desired, or closed, as will be more fully described by the plate 28.

The exhaust ports 25 open into the exhaust

chamber 29 formed on the opposite side of engine 1 in block 9, as will also be more fully described. In the outboard motor application shown, chamber 29 extends substantially the height of the block and downwardly thereof beneath the lower cylinder to open into the upper adjacent end of drive shaft housing 2.

In the construction of engine block 9, the block is cast around sleeves 10 to close one end of each to form the domes 22, and also to form the transfer passages 26 alongside the sleeves, the flanged skirts 12 forming a part of the crankcase, and a number of cavities opening on opposite sides of the block which comprise the exhaust chamber 29 and a series of coolant cavities extending around the cylinders and adjacent crank chambers 18 to receive and circulate coolant around the same, as will be described.

The narrow cored cavity 30 extends along the side of chamber 29 adjacent the engine crankcase and the top of the chamber. On the opposite side of block 9 the cavity 31 overlies the transfer passages 26 and crank chambers 18. The large cavity 32 extends through the block or joins at the top and bottom of the block and over the domes 22 and provides a chamber which surrounds the entire upper ends of the engine cylinders.

Cavities 29, 30, 31 and 32 as formed in corresponding sides of block 9 are defined by the several integral outer walls and include flanges 14 of the block, previously described, the upper and lower walls 33 and 34, respectively, and the end wall 35 which joins upper and lower walls 33 and 34 and the domes 22.

The rib 36 formed between chamber 29 and cavity 32 on the exhaust side of the engine block extends vertically generally oppositely of rib 27.

The sides of block 9 are provided with machined planiform substantially rectangular faces 37 which form the general outer dimensions of the block. The end elevation of the block may also be rectangular, or as shown, may be V-shaped and of reduced size and weight by reason of the larger dimensions of the crankcase and relatively smaller size of the upper end of the cylinders.

Plate 28 is secured by bolts to one face 37 of block 9 to close cavity 31 and one side of cavity 32, and against rib 27 formed by block 9 and dividing cavities 30 and 32 to close the outside holes formed in drilling ports 24 as described. If desired, the gasket 38 may be employed between block 9 and plate 28.

The plate 39 is seated against the opposite face 37 of block 9 and closes the narrow cavity 30 and exhaust chamber 29. Plate 39 overlies the entire side of block 9 and is provided with a series of holes 40 which register with the upper length of cavity 30, and a large opening which corresponds with the dimensions of cavity 32.

The coolant jacket plate 41 is secured over plate 39 to the side of block 9 by bolts extending through plate 39 into the block and is provided with two inwardly-facing shallow recesses 42 and 43 of dimensions corresponding to the dimensions of chamber 29 and cavity 32, respectively.

The center rib projection 44 in plate 36 between recesses 42 and 43 is broken away at its lower end to provide communication between the lower levels of the recesses.

The water coolant for engine 1 is supplied through the pipe 45 by a pump, not shown, driven by the engine and operating from drive shaft 8. The upper end of pipe 45 is carried in hole 46 in the lower end of block 9 which communicates immediately with the lower end of the narrow cavity 30 to deliver water immediately to the cavity.

In the operation of the engine the water fills to the upper end of cavity 30 and passes through holes 40 in plate 39 into recess 42 adjacent exhaust chamber 29.

In passing through cavity 30 and over plate 39 the water is exposed to the heat of the exhaust gases in chamber 29 and is heated as it circulates downwardly through recess 43. If desired, a series of baffles 47 in recess 43 formed integrally with jacket plate 41 may be provided, as shown only in Fig. 5, which will prevent the water from passing directly and immediately through the recess.

The water from recess 42 enters the single coolant chamber formed by recess 43 and cavity 32 beneath rib 44 to circulate around the cylinders and leaves at the upper level of the chamber over rib 27 into the upper end of cavity 30. From cavity 30 the water is discharged through the lower hole 48 into the upper end of drive shaft housing 2.

The small bleed hole 49 in plate 39 opens from the lower end of recess 42 into exhaust chamber 29 and provides for the draining of the water from recesses 42 and 43 and cavity 32 when the motor is not in use.

The construction of block 9 permits the use of permanent mold casting means, not shown. Each of the cylinders with sleeves 10, the transfer passages 26, and the cavities 29, 30, 31 and 32, may be formed by cores carried by the corresponding parts of the die and retractable therewith.

The cavities receiving coolant as described embrace the greater part of the cylinders, and the exhaust chamber, and the adjacent parts of the engine as well which also require cooling.

The block provides a compact unitary structure of inherent strength which is derived in large part in the integral construction of the several walls with the crankcase portion of the block. The block by reason of the same may be of less wall thicknesses and weight.

Various embodiments of the invention may be employed within the scope of the following claims.

I claim:

1. In an engine of the class described, a crankcase member, a cylinder block of substantially rectangular outer dimensions and having flanged skirt portions adapted to be joined to said member to comprise therewith the engine crankcase, adjacent cored cavities in opposite sides of said block overlying the engine cylinders and a substantial part of the engine crankcase and adapted to receive a coolant in the operation of the engine, and plates secured to the outer faces of said flanged skirts and over the sides of said block closing said cavities and defining therewith a complete enclosure of the engine cylinders.

2. In an engine of the class described, a crankcase member, a cylinder block having flanged skirt portions adapted to be joined with said member to comprise therewith the engine crankcase, wall members cast integrally with said block forming cavities from opposite sides of said block, said wall members and corresponding flanged skirt portions having planiform end faces, defining the lateral dimensions of the block, and plates secured to said block and seated on said end faces to close said cavities.

3. In a two-cycle engine of the class described including a crankcase member, an integrally formed cylinder block having flanged skirt por-

tions adapted to be joined with said member to comprise respectively opposite half sections of each crank chamber and a number of cylinders opening into corresponding chambers, a transfer passage extending alongside each cylinder from the corresponding crank chamber and opening through transfer ports into the cylinder, cavities formed in one side of said block alongside said cylinder and crank chambers, said cylinders having exhaust openings into one of said cavities, at least one other of said cavities being adapted to receive coolant and disposed between said exhaust cavity and said crank chambers, and a single flat closure member secured to said side of the block and closing all of said cavities.

4. In an engine of the class described, a substantially rectangular block having a pair of oppositely extending flanges at one end and adapted to be joined with a complementary member to comprise equally therewith the engine crank chamber, a cylindrical cavity formed in said block from said end and between said flanges to comprise an engine cylinder opening into the crank chamber, a second cavity similarly formed in said block parallel and adjacent to said cylindrical cavity and opening into the same through ports in the wall thereof to comprise the transfer passage of the engine, a third cavity opening on opposite sides of the block adjacent said flanges and extending immediate to the portions of the block comprising the crankcase, the cylinder and the transfer passage, cover members secured to said sides of the block including said flanges and closing said third cavity, wall members formed integrally with said block dividing said third cavity into a number of adjacent chambers, and exhaust ports opening from the cylinder into one of said chambers, said last named chamber having an opening from one side of said block and at least one other chamber being adapted to receive coolant for controlling the temperature of said block.

5. In an engine of the class described, a substantially rectangular block adapted to be joined at its lower end with a complementary member to form therewith the engine crank chamber, a domed cylinder formed in the block and opening therefrom into the crank chamber, a transfer passage formed in said block and disposed to communicate with the crank chamber and opening into the cylinder, a number of cavities opening on opposite sides of the block and forming substantially uniform wall portions throughout the same, said cylinder having ports opening into one of said cavities, said last named cavity opening from another side of said block, at least one other cavity being adapted to receive coolant for controlling the temperature of the engine, and cover members closing said cavities on said opposite sides of the block.

6. In an engine of the class described, a substantially rectangular block adapted to be joined at its lower end with a complementary member

to form therewith the engine crankcase, a domed cylinder formed in said block opening into said crankcase, a blind transfer passage formed in said block extending from said crankcase alongside said cylinder, said block having a number of holes drilled in one side thereof through said passage and into said cylinder, a number of coolant cavities opening on one side of said block and adjacent said ports, and a cover member secured to said side of the block over said cavities and closing said holes to complete said transfer passage.

7. In an engine of the class described, a substantially rectangular block adapted to be joined at its lower end with a complementary member to form therewith the engine crankcase, a domed cylinder formed in said block opening into said crankcase, a blind transfer passage formed in said block extending from said crankcase alongside said cylinder, said block having a number of holes drilled in one side thereof through said passage and into said cylinder, a number of coolant cavities opening on one side of said block and adjacent said ports and other similar cavities opening on the other opposite side of said block, one of said last named cavities communicating with said cylinder to receive the exhaust therefrom and opening from said block to discharge the exhaust therefrom, said other cavities being adapted to receive coolant for controlling the temperature of the engine, and cover members secured to said opposite sides of said block and closing said cavities and said holes to complete said transfer passages.

8. An engine of the class described comprising a crankcase member, a cylinder block of substantially rectangular outer dimensions and having flanged skirt portions adapted to be joined to said member to comprise therewith the engine crankcase, a number of adjacent cored cavities in each opposite side of said block overlying the engine cylinders and a substantial part of the engine crankcase and communicating with each other in series and adapted to receive a coolant for circulation therethrough, and plates secured to the outer faces of said flanged skirts and over the sides of said block closing said cavities and defining therewith a complete enclosure of the engine cylinders.

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