

Aug. 25, 1964

G. W. CONOVER ET AL

3,145,695

CYLINDER BLOCK FOR AN INTERNAL COMBUSTION ENGINE

Original Filed June 8, 1960

4 Sheets-Sheet 1

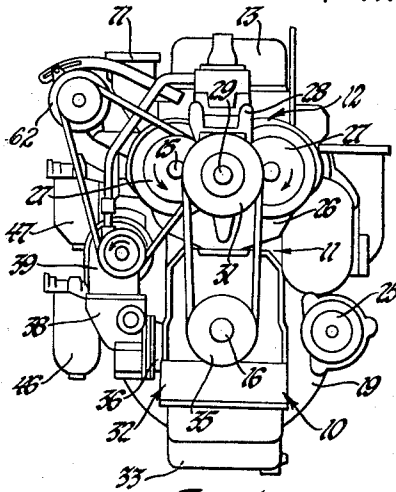


Fig. 1

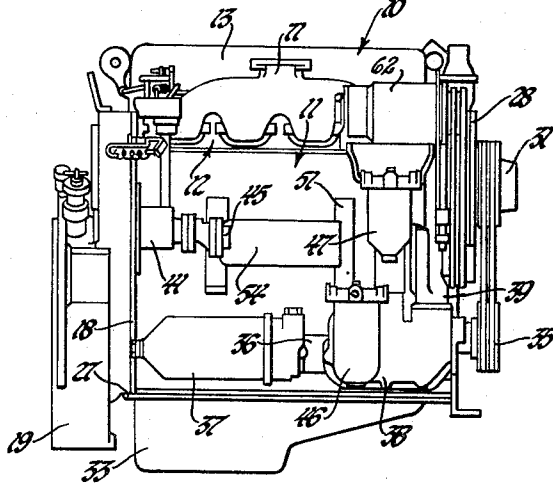


Fig. 2

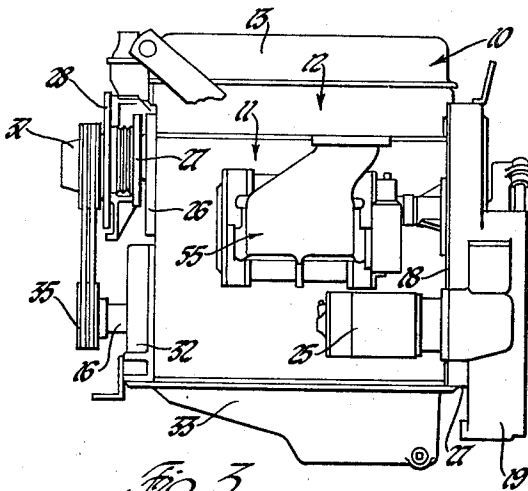


Fig. 3

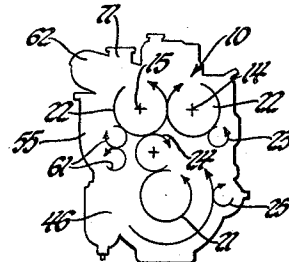


Fig. 4

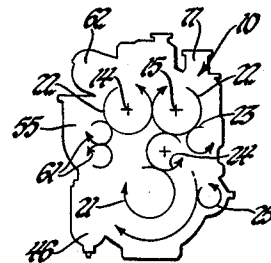


Fig. 5

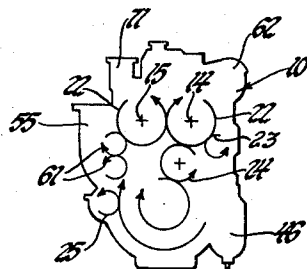


Fig. 6

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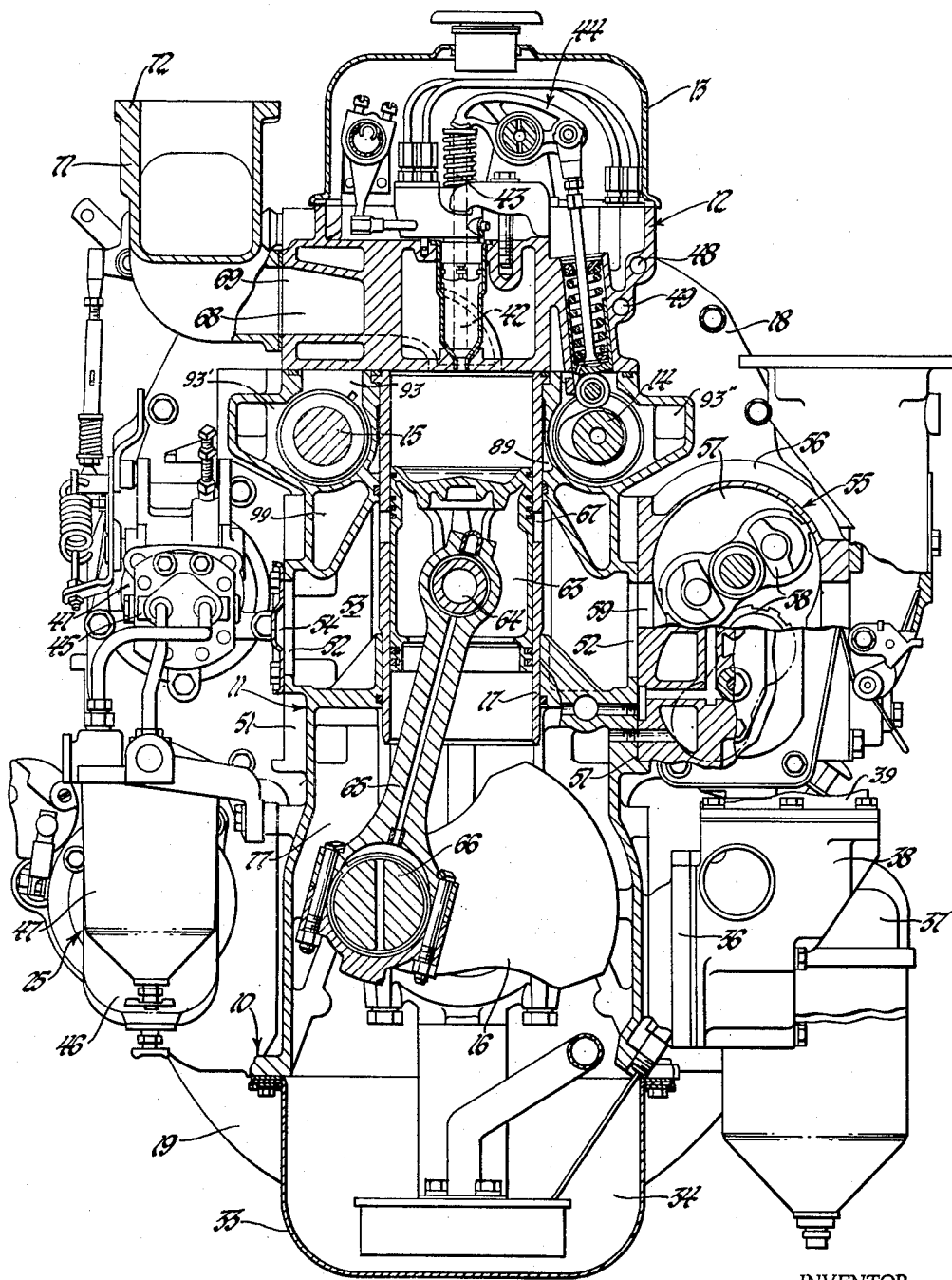


Fig. 7

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4 Sheets-Sheet 3

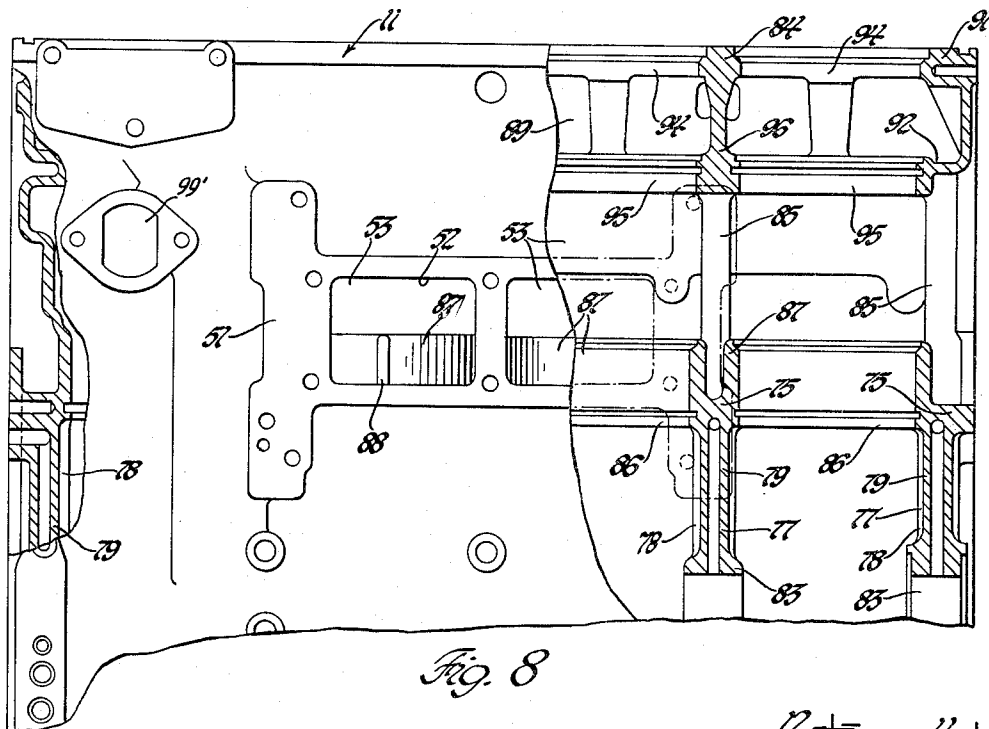


Fig. 8

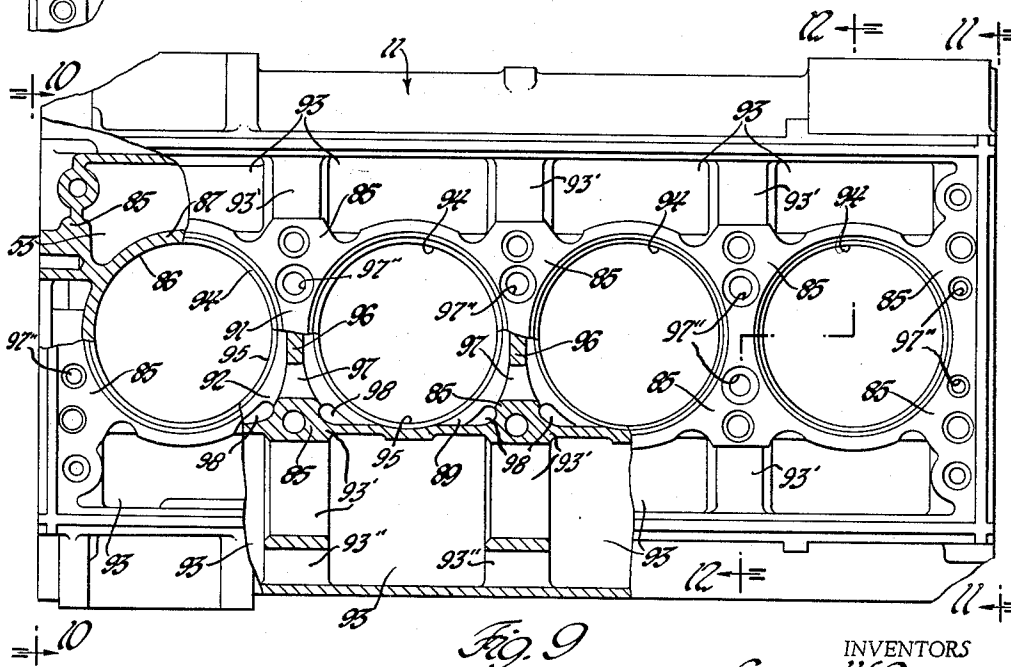


Fig. 9

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4 Sheets-Sheet 4

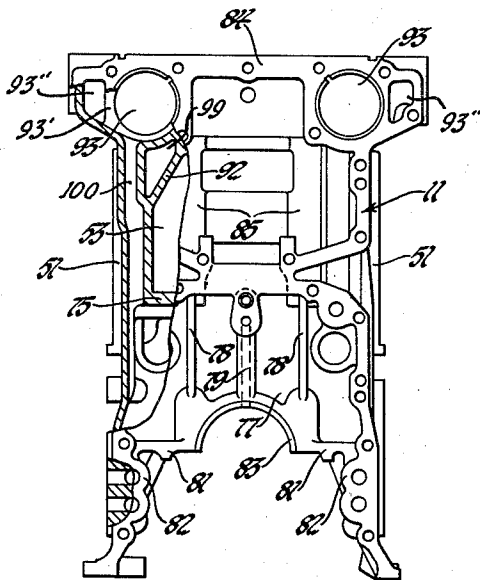


Fig. 10

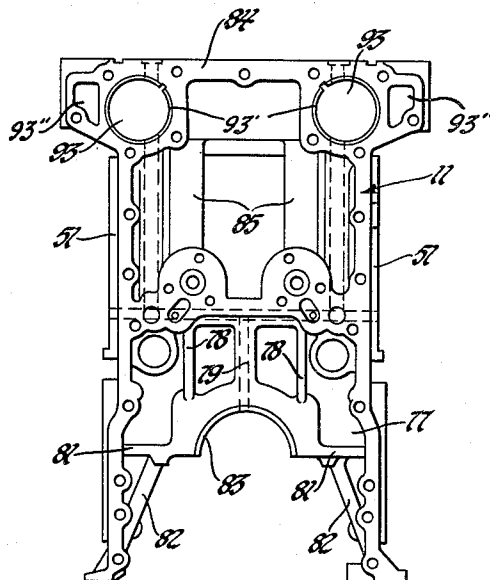


Fig. 11

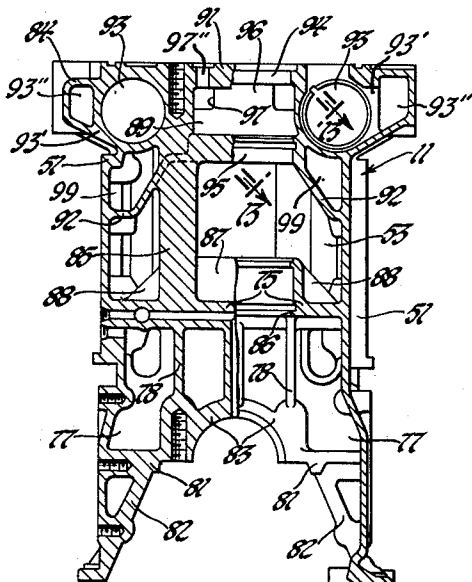


Fig. 12

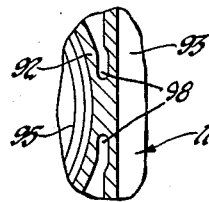


Fig. 13

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CYLINDER BLOCK FOR AN INTERNAL COMBUSTION ENGINE

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Original application June 8, 1960, Ser. No. 34,728, now Patent No. 3,094,190, dated June 18, 1963. Divided and this application June 17, 1963, Ser. No. 288,376 30 Claims. (Cl. 123—41.74)

This invention relates generally to internal combustion engines, and more particularly to the design and construction of the several engine components and associated accessory mechanisms so that the various elements may be assembled to provide a multiplicity of configurations meeting different engine installation requirements.

This is a divisional application of the copending United States application, Serial No. 34,728, filed June 8, 1960, now Patent No. 3,094,190, issued June 18, 1963, in the names of George W. Conover, Kenneth L. Hulsing and Joseph Koehler, and entitled "Internal Combustion Engine."

In the design, manufacture and use of internal combustion engines, it is often desirable to provide a construction that is easily adaptable to a wide variety of space limitations, accessory locations and the like. For example, in marine use it might be desirable to locate two engines side by side with the accessories for each engine in an easily accessible place, such as between the two engines. This requires an engine construction permitting reversibility in the assembly and mounting of various engine components and accessories.

The invention contemplates a series of multicylinder engines incorporating improved cylinder block constructions symmetry about the longitudinal vertical plane of the engine and providing alternative accessory mounting locations on either side of the engine. Two counterdriven cam and balance shafts are journaled in the cylinder block in spaced parallel relation and are interchangeable to permit a cylinder head having substantial symmetry about its transverse median plane to be reversed end-for-end in its mounting on the cylinder block thus providing alternative exhaust manifold locations. This block and head symmetry minimizes tooling requirements for the several engines of the series and provides maximum accessory versatility to meet various installation requirements.

The improved cylinder block and head components of the invention may be cast to provide a relatively light rigid girder-box construction, easy and inexpensive to core, cast, clean and to machine. Such components further cooperate to provide improved breathing, cooling and lubrication systems for such engines.

The invention has particular application to internal combustion engines of the two-cycle uniflow scavenged type and is shown and described herein for illustrative purposes as incorporated in several engine installations of this type. However, the invention is not limited in its application to engines of this particular type and is considered to be applicable to internal combustion engines generally.

The foregoing and other objects, advantages and features of the invention will be apparent from the following description having reference to the accompanying drawings, in which:

FIGURES 1, 2 and 3 are elevational views of a two-cycle internal combustion engine illustrating one of the engine accessory mounting and drive arrangements permitted by the basic engine structure of the invention.

FIGURES 4, 5 and 6 are diagrammatic views showing different engine accessory mounting and drive arrange-

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ments permitted by the basic engine structure of the invention.

FIGURE 7 is a transverse sectional view of a two-cycle internal combustion engine showing the location of the various parts and illustrating the reversibility permitted by the basic engine components.

FIGURE 8 is a side elevational view of the cylinder block of the engine of FIGURE 7 with portions broken away and sectioned to show certain structural details.

FIGURE 9 is a top elevational view of the cylinder block of the engine of FIGURE 7 with portions broken away and sectioned to show certain structural details.

FIGURE 10 is a front elevational view of the cylinder block with portions broken away and sectioned in the direction of the arrows indicated at 10—10 in FIGURE 9.

FIGURE 11 is a rear elevational view of the cylinder block taken in the direction of the arrows indicated at 11—11 in FIGURE 9.

FIGURE 12 is a transverse sectional view of the cylinder block and is taken substantially in the direction of the arrows and in the plane of the line indicated at 12—12 in FIGURE 9.

FIGURE 13 is a fragmentary sectional view taken substantially in the direction of the arrows and in the plane of the line indicated at 13—13 in FIGURE 12.

Referring more particularly to the drawings, a four-cylinder inline engine is indicated generally by the reference numeral 10 and is illustrative of a series of two-cycle uniflow scavenged multicylinder engines incorporating the invention. Each of the several engines comprises a cylinder block, indicated generally by reference numeral 11, which is substantially rectangular and has symmetry about a vertical median plane passing longitudinally therethrough. This block symmetry provides a plurality of alternative accessory mounting locations on the opposite side walls thereof as will become hereinafter more apparent. The upper portion of the block 11 encloses several inline cylinders which are closed at their upper ends by a cylinder head 12 mounted on the upper face of the cylinder block. The cylinder head 12 may be of the overhead valve and injector type and is provided with symmetry about its transverse median plane to permit end-for-end reversal on the cylinder block. A cover member 13 is secured to the cylinder head 12 and defines a chamber housing the overhead valve and injector actuating mechanisms. A camshaft 14 and a balance shaft 15 are journaled in the upper portion of the cylinder block 11 and extend longitudinally thereof in parallel spaced relation flanking the cylinder row. These shafts are counterrotated and carry suitable engine balancing masses adjacent each end thereof. Shafts 14 and 15 may be interchanged to provide a plurality of different engine models by the simple expedient of reversing the cylinder head 12 end-for-end. A crankshaft 16 is rotatably supported in the lower portion of the cylinder block 11 by a plurality of transverse webs 77 and bearing supporting arches 83 and arch secured caps spaced longitudinally of the block.

An end plate 18 and a housing member 19 are secured to the rear of the cylinder block to enclose the usual drive gears between the crankshaft and the cam and balance shafts. These gears are indicated diagrammatically in FIGURES 4-6 by arcuate arrows indicating direction of rotation and approximate relative size. The main gear 21 is secured to the end of crankshaft 16 and gears 22 are secured to the ends of the cam and balance shafts 14 and 15. Gears 22 are interengaged to provide counterrotation of the shafts 14 and 15. Accessory drive gears 23 are disposed on opposite sides of the rear face of the block and are driven by the adjacent gears 22. One of the gears 22 is drivingly connected to the crankshaft gear 21 through an idler gear 24 suitably journaled

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on the rear of the cylinder block 11. Idler gear 24 may be mounted on either side of the vertical centerline of crankshaft gear 21 for opposite directions of crankshaft rotation to provide proper camshaft timing and driving rotation for alternative mountings of the various accessory components.

The lower portion of the gear housing member 19 defines a bell chamber wherein the usual flywheel may be drivingly secured to the rear end of the crankshaft. This bell housing portion of the member 19 further cooperates with the end plate to close the rear crankcase portion of the cylinder block 11. A ring gear carried by the flywheel in the usual manner is drivingly engageable with the pinion gear of a starter drive mechanism 25. This starter mechanism is preferably of a conventional electric or hydraulic motor type and may be mounted on either side of the engine.

At the front of the engine, an end plate 26 is secured to and mates with a finished end face formed on the upper portion of the cylinder block. Camshaft 14 and balance shaft 15 extend through this front end plate. A combined balance weight and V-belt pulley member 27 is secured to the forwardly projecting end of each of these shafts. A vertically adjustable bracket 28 is secured to the front end plate 26 and bridges the pulleys 27 forwardly of the engine and journals a stub shaft 29. A V-belt pulley member 31 is carried by the stub shaft 29 and provides a hub to which a suitable fan may be attached.

The lower crankcase portion of the cylinder block 11 is closed at the front by a combined cover and gear pump assembly 32 which is secured to and mates with the lower front face of the cylinder block. An oil pan 33 is secured to the lower crankcase defining side walls of the cylinder block 11 and to coextensive bottom surfaces on the gear housing member 19 and to pump assembly 32, respectively, and cooperates therewith to define a crankcase and oil sump chamber 34. The combined cover and gear pump assembly 32 embraces the crankshaft 16 adjacent its forward end with the gear pump unit being driven directly by the crankshaft to supply pressurized oil for lubrication and cooling of the various engine components and accessories. A pulley member 35 is secured to the forward end of the crankshaft 16 and is drivingly connected by V-belts to the fan mounting pulley 31.

The intake of the pump 32 is located in the sump chamber 34 as shown in FIGURE 7. Alternative outlets from the pump discharge chamber are connectable laterally through alternative passages in the crankcase side walls and a support or adapter member 36 to an oil filter unit 37 and an oil cooler unit 38 mountable by the adapter on either crankcase side wall, depending on desired oil filter and cooler location. The adapter further provides return passage means from the filter and cooler back through the crankcase side wall to a distribution passage formed in the pump cover. This pump distribution passage extends transversely of the block and has several outlet ports mating ports opening on the lower front end face of the block. These last-mentioned ports lead to several oil distribution passages extending through the cylinder block.

A centrifugal coolant pump 39 is supported by the oil cooler unit 38 and is drivingly connected by V-belts to the driven pulley of a pivotally and adjustably mounted generator 62 and to the balance weight pulley member 27 carried by the adjacent cam or balance shaft. The suction inlet of the pump 39 is connectable to the thermostatically controlled valve coolant outlet of the cylinder head, either directly or through a suitable heat exchanger, not shown. To accommodate mounting of the oil cooler, filter and coolant pump assembly on either side of the engine, the discharge of the coolant pump is connectable through the oil cooler to an adjacent one of two alternate coolant inlet ports 99' symmetrically disposed in the opposite side walls of the cylinder block. Each of these ports open to one of two distribution gal-

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leries 99 extending longitudinally of the block in symmetrical flanking relation to the cylinder row.

An engine governor 41 may be alternatively mounted on either side of the rear end plate 18 on the block 11 and driven by the adjacent accessory drive gear 23. The governor may be of any suitable type and is connected in a conventional manner to adjust the fuel supply regulating means of several overhead mounted fuel injectors 43. The fuel injectors 43 are mounted in the cylinder head 12 in coaxial relation with the several inline cylinders 17 and are sequentially operable to supply measured quantities of fuel to their respective cylinders. Such injector operation is provided by camshaft actuation of the several injector plungers through suitable cam follower linkages 44 of the overhead rocker type.

A fuel circulating pump 45 is mounted with the governor 41 on either side of the cylinder block 11. The fuel pump 45 has a fluid inlet connection through a filter unit 46 to the fuel supply tank, not shown, and an outlet connection through a second filter unit 47 to a fuel distribution manifold 48 (FIGURE 7) extending longitudinally of the cylinder head 12. From the manifold 48 the pump supplied fuel is circulated through the several injector units by suitable fluid connections for fuel supply and injector cooling purposes. The several fuel connections are connected through a return manifold 49 extending longitudinally of the cylinder head 12 to the fuel supply tank.

Each side wall of the cylinder block 11 has a boss 51 thereon. These bosses are finished to provide alternative blower mounting locations on opposite sides of the engine. These bosses further define ports 52 which extend through the side walls of the block and open to an air box 53 extending longitudinally of the block immediately above the crankcase. The ports 52 in the side wall opposite the blower provide inspection access to the engine air box and are normally closed by a cover member 54.

A blower assembly illustrated generally by the numeral 55 is of a positive displacement type such as shown and described in United States Patent No. 3,059,835 issued October 23, 1962, to Kenneth L. Hulsing and George P. Hanley and entitled "Rotary Blower," and need not be described in complete detail. Briefly, the blower assembly includes a housing 56 defining a blower chamber 57 and journaling two lobed impellers 58 having pumping interengagement and rotative sealing clearances with the adjacent side walls of the chamber 57. The blower housing has an outlet port 59 mating with the air box inlet ports 52 and an inlet port connectable to a suitable air cleaner assembly, not shown. The lobed impellers 58 are synchronously driven by two gears illustrated diagrammatically at 61 in FIGURES 4-6, which in turn are driven by the adjacent accessory gear 23.

It will be noted from the illustrative engine configuration so far described that the engine blower 55 and the started mechanism 25 might be alternately mounted on the right side of the engine, as viewed in FIGURE 1, opposite the mounting of the engine accessory group comprising the oil cooler and filter assembly 36-38, the coolant pump 39 and the generator 62. In this engine configuration, the engine governor 41, the fuel pump 45 and the fuel filters 46 and 47 would be mounted on the same side of the engine as the oil cooler and filter units. In an alternate engine configuration, the oil cooler and filter assembly, the coolant pump and the generator are mounted on the same side as the blower, the right hand side of the engine as viewed in FIGURE 1, and the starter mechanism 25 is mounted on the left hand side of the engine together with the governor, the fuel pump and the fuel filter units.

As shown in FIGURE 7, the upper portions of the cylinder block 11 mount the several cylinder liners 17 which are inline and closed at their upper ends by the cylinder head 12. Pistons 63 are reciprocally mounted in each of the several cylinders and cooperate with the closed ends thereof to form expansible combustion cham-

bers therebetween. Each piston is connected by a wrist pin 64 and a connecting rod 65 to the adjacent crankpin or throw 66 of the crankshaft. The several crank throws 66 carry balancing masses which acts in a conventional manner to counterbalance the rotating and reciprocating engine unbalance and to reduce the loads imposed on certain of the main bearings.

A belt of inlet ports 67 is formed circumferentially intermediate the ends of each liner 17. These ports open to the air box 53. Reciprocation of the several pistons serves to control the admission of scavenging and charging air through these inlet ports into their respective cylinders. Uniflow scavenging of the exhaust gases is accomplished by the simultaneous camshaft timed opening of overhead exhaust valves 42. These exhaust valves are reciprocally mounted in the cylinder head in the usual manner and control valve seating ports opening to exhaust passages 68. The exhaust passages 68 are formed integrally of the cylinder head and terminate in ports 69 opening in the side face of the cylinder head 12 opposite the fuel manifolds and the camshaft 14. The several ports 69 are connectable to an exhaust manifold 71 having a single outlet at 72 and formed symmetrically about the transverse median plane of the cylinder head 12. This symmetry permits the exhaust manifold to be secured to the cylinder head with its outlet directed either upwardly or downwardly and on either side of the engine with reversal of the cylinder head 12 on the block 11.

As shown in FIGURES 7-13, the cylinder block structure includes a partition wall or deck 75 separating the crankcase chamber 76 from the air box chamber 53. This partition deck extends transversely and longitudinally between the front, rear and side walls of the block, intersecting and laterally supporting the several crankshaft bearing supporting webs 77. Vertical ribs 78 and 79 and transverse ribs 81 and 82 further reinforce the bearing supporting webs 77 and terminate in main bearing supporting arches 83. A coolant or water jacket and camshaft gallery defining portion 84 extends longitudinally of the upper portion of the block and supports the upper combustion chamber ends of the several cylinder liners 17 in spaced relation to the partition wall 75. This upper block portion 84 is connected to the crankcase defining partition wall 75 by the front, rear and side walls of the block and by a plurality of columns 85, arranged in pairs and extending therebetween intermediate the several cylinders and adjacent each end of the block. The several columns 85 are coextensive with the ribs 78 of the bearing arch supporting webs 77 and extend upwardly through the upper cylinder supporting portion 84. These columns are suitably bored and tapped adjacent their upper ends to receive bolts securing the cylinder head to the upper face of the cylinder block.

A plurality of ports 86 extend through the crankcase defining partition 75. These ports are defined by cylindrical muffs or flanges 87 which extend upwardly from the partition deck and slidably and sealingly support the lower ends of the cylinder liners 17. These liner supporting muffs are reinforced by radial webs extending to the several adjacent columns 85. The two intermediate cylinder muffs 87 are further reinforced by webs 88 extending radially to the crankcase defining partition wall 75.

The upper block portion 84 defines a longitudinally extending central coolant or water jacket gallery 89 which embraces the upper combustion chamber ends of the several cylinders. This coolant or water jacket gallery is defined between two longitudinally extending decks 91 and 92 and flanked by two longitudinally extending galleries 93 which alternatively mount either the camshaft 14 or the balance shaft 15. These shaft mounting galleries are intersected by annular bosses 93' suitably connected to the oil distributing passages of the block. Thin bearing sleeves supported within those several bosses rotatably mount barrel-type journals spaced longitudinally of the cam and balance shafts. Ports 93'' formed in the block

outwardly of the boss 93' interconnect the several compartments formed by the camshaft journals above a cam lobe immersing, oil retaining level. Vertical drain passages 100 are formed in the side walls of the block intermediate the coolant inlet ports 99' and the blower mounting boss 51 and interconnect the shaft mounting galleries 93 with the lower crankcase defining portion of the block. These drain passages are of a size to vent the upper portions of the engine and de-aerate the oil draining therethrough.

The spaced water jacket defining decks 91 and 92 have a plurality of ports 94 and 95 extending therethrough, respectively. These ports are in coaxial alignment with the ports 86 defined by the lower liner supporting muffs 87 in the partition wall 75. As best seen in FIGURE 7, the ports 94 and 95 slidably support the upper combustion chamber ends of the several cylinder liners 17. The liners are suitably sealed with respect to the ports by O-ring seals or the like. Partition webs 96 extend between the decks 91 and 92 intermediate the several cylinder supporting ports and the columns 85. These partition webs reinforce the upper liner supporting block portion 84 and are provided with ports 97 restricting cooling water flow longitudinally of the central water jacket gallery 89. The partition webs 96 thus divide the central water gallery into a plurality of interconnected water jacket compartments which embrace and equalize coolant flow about the upper ends of the several cylinders. These several compartments are connectable upwardly through ports 97'' to the water jacket gallery of the cylinder head 12. A plurality of ports 98 connect the compartments of the water jacket gallery of the block laterally to the alternate inlet connected water distribution galleries 99 which extend longitudinally of the upper gallery defining portion of the block immediately below the alternate cam and balance shaft galleries. The limited and equalized liquid cooling thus provided serves to minimize the thermal load variations imposed on the upper combustion chamber ends relative to the relatively cooler intermediate and lower portions of the several liners. The cooling applied to these lower liner portions is limited to that effected by air box air flow and conductive heat transfer to the several liner supporting muffs.

As indicated above and shown and described in detail with reference to FIGURES 9-11 in the above-cited Patent No. 3,094,190, the cylinder head 12 is reversible end-for-end to provide alternative engine profile configurations for the several inline engines. Such head reversibility also permits alternative use on either bank of a V-engine derived from the basic inline engine design in the manner shown and described in copending United States patent application Serial No. 1,488, filed January 11, 1960, in the names of Harold H. Albinson, George P. Hanley, Kenneth L. Hulsing, Harvey G. Humphries, and John J. May, and entitled "Two-Cycle Internal Combustion Engine." To provide this end-for-end reversibility, each cylinder head 12 is provided with symmetry about its transverse median plane.

The several engine and accessory components thus permit a number of different engine arrangements or configurations determined by the desired direction of crankshaft rotation; by cylinder head orientation relative to the block thereby locating the exhaust manifold 71 and the camshaft 14; by the mounting of the various timing gear driven accessories including the blower 55, the governor 41 and the starter mechanism 25; and by the mounting of the accessory group comprising the oil filter and cooler, the water pump and the generator. Several of the various configurations permitted by possible combinations of these elements are shown in FIGURES 1-3 and indicated diagrammatically in each of FIGURES 4-6. The alternative mounting locations of the various components are indicated in these diagrammatic views by appropriate outlines identified by their respective reference numerals. These several views are taken looking forwardly of the engine from the rear.

FIGURES 1 and 4 show the relative positions of the blower 55, exhaust manifold 71 and camshaft 14 of engines arranged for counterclockwise rotation of the crankshaft 16. FIGURES 5 and 6 show the same respective relative positions between the blower, exhaust manifold and camshaft as those of FIGURES 1 and 4 but in engines arranged for clockwise rotation of the crankshaft. The indicated mounting of the oil filter and cooler and thus of the water pump and generator in FIGURES 5-6, however, is on the opposite side of the engine to that shown in each of the corresponding FIGURES 1 and 4. Thus the several corresponding engines may be paired in multi-engine installations wherein the crankshafts must necessarily be counterrotated, as in a twin screw marine drive. In such installations, it is generally desirable to have the various accessory appurtenances accessible either to a central gallery or outboard of the power package.

For each of the several engines shown in FIGURES 1 and 4-6, an alternative engine configuration may be achieved by mounting the oil filter and cooler, the water pump and generator on the opposite side of the engine thus permitting paired engine installations wherein the crankshafts are required to have the same hand of rotation. Similar variations in engine configurations may be achieved by varying the mounting locations of the engine governor 41 and of the starter unit 25. The indicated versatility in accessory mounting and resultant engine configuration thus permits use of the basic engine to meet a wide range of installation requirements.

From the foregoing description of the several illustrative inline engines and their accessory components, it will be seen that the various objectives and advantages of the invention have been achieved. The resultant engine structures provide a plurality of different engine models and alternative accessory mounting locations, and the improved cylinder block and cylinder head constructions provide two-cycle engines of relatively high power density, provide improved cooling systems for such engines, provide improved lubrication and breathing, and provide improved overall engine efficiency.

It will be apparent to those skilled in the art, that various modifications might be made from the several illustrative embodiments of the invention without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. A cylinder block for a two-stroke uniflow scavenged internal combustion engine having a plurality of inline cylinders, said cylinder block having substantial symmetry about a longitudinally extending median plane and comprising:

- a pair of end walls;
- a pair of side walls structurally connected to said end walls;
- a lower crankcase portion within said walls receiving and supporting said cylinders;
- an upper portion within said walls receiving and supporting said cylinders and having parallel cam and balance shaft mounting galleries extending longitudinally thereof and symmetrically disposed on opposite sides of said cylinders, either of said galleries being adapted to receive a camshaft or a balance shaft;
- and a plurality of paired transversely spaced parallel columns inwardly spaced from said side walls for supporting and connecting said upper and lower portions.

2. A cylinder block for a two-stroke internal combustion engine having a plurality of inline cylinders, said cylinder block comprising:

- a pair of spaced vertical end walls;
- a pair of spaced vertical side walls structurally connecting said end walls;
- a first partition wall extending between and structurally connecting said end walls and said side walls and

being spaced from the upper and lower edges thereof, said first partition wall dividing the space enclosed by said end walls and said side walls into an upper cylinder receiving portion and a lower crankcase portion;

3. A cylinder block for a two-stroke internal combustion engine having a plurality of inline cylinders, said cylinder block having substantial symmetry about a longitudinal median plane and comprising:

- a pair of spaced end walls;
- a pair of side walls structurally connecting said end walls;
- a first longitudinal and transverse partition wall dividing said cylinder block into an upper cylinder portion and a lower crankcase portion;
- a plurality of parallel lateral and transverse structural members disposed between said side walls, said members including crankshaft bearing support webs disposed in said lower crankcase portion and spaced support columns disposed in said upper cylinder portion and spaced inwardly from said side walls;
- a second longitudinal and transverse wall spaced from said first partition wall and structurally connecting said end walls and said side walls;
- means formed in said first partition wall and said second wall for receiving and supporting said cylinders;
- and a pair of longitudinal shaft mounting galleries in said upper portion symmetrically spaced on opposite sides of the longitudinal median plane of said cylinder block and of equal size, either of said galleries being adapted to receive a balance shaft when the other of said galleries receives a camshaft.

3. A cylinder block for a two-stroke internal combustion engine having a plurality of inline cylinders, said cylinder block having substantial symmetry about a longitudinal median plane and comprising:

- a pair of spaced end walls;
- a pair of side walls structurally connecting said end walls;
- a first longitudinal and transverse partition wall dividing said cylinder block into an upper cylinder portion and a lower crankcase portion;
- a plurality of parallel lateral and transverse structural members disposed between said side walls, said members including crankshaft bearing support webs disposed in said lower crankcase portion and spaced support columns disposed in said upper cylinder portion and spaced inwardly from said side walls;
- a second longitudinal and transverse wall spaced from said first partition wall and structurally connecting said end walls and said side walls;
- means formed in said first partition wall and said second wall for receiving and supporting said cylinders;
- and a pair of longitudinal shaft mounting galleries in said upper portion symmetrically spaced on opposite sides of the longitudinal median plane of said cylinder block and of equal size, either of said galleries being adapted to receive a balance shaft when the other of said galleries receives a camshaft.

4. A cylinder block for a two-stroke internal combustion engine having a plurality of inline cylinders, said cylinder block having substantial symmetry about a longitudinal median plane and comprising:

- a pair of spaced end walls and a pair of spaced side walls, said walls being structurally connected and each said side walls having a port formed therein, said ports being symmetrically disposed relative to the longitudinal median plane of said cylinder block;
- a longitudinal and transverse lower partition wall connecting said side walls and said end walls and below said ports, said partition wall forming upper and lower cylinder block portions;
- a plurality of spaced and parallel transverse and lateral bearing supporting webs in said lower portion structurally connecting said partition and said side walls;
- an upper partition disposed longitudinally and transversely in said upper portion and above said ports in said side walls;

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a plurality of pairs of columns in said upper portion disposed above said bearing supporting webs and structurally supporting said upper partition;

a pair of spaced and parallel shaft galleries in said upper portion symmetrically disposed on opposite sides of the longitudinal median plane of said cylinder block, said galleries being of equal size and adapted to receive alternatively a camshaft or a balance shaft for said engine;

and a mounting pad formed on each of said side walls about said ports, both of said pads being adapted to receive an air box charging blower and both of said pads being adapted to receive a closure member, whereby a closure member is mounted on one of said pads when a blower is mounted on the other of said pads.

5. A cylinder block for a two-stroke internal combustion engine having a plurality of inline cylinders, a first accessory group including a blower and a second accessory group including an oil cooler assembly, a water pump and a generator, said cylinder block having substantial symmetry about a longitudinal median plane and comprising:

spaced end walls, one of said end walls having oil and water passages formed therein;

spaced side walls structurally connecting said end walls and having air, water and oil passages formed therein;

internal partition and support means for supporting and strengthening said end walls and said side walls;

a pair of symmetrically spaced shaft galleries extending longitudinally in said cylinder block, said galleries being of the same size and adapted to receive interchangeably a camshaft and a balance shaft to permit rotation of the camshaft in either direction;

and means for mounting said first accessory group on each of said sidewalls and symmetrically disposed with respect to the longitudinal median plane of said cylinder block;

and means for mounting said second accessory group on laterally opposite sides of said one end wall, whereby the first accessory group is mounted on one side of said cylinder block and the second accessory group is mounted on the other side of said cylinder block in accordance with the location and direction of rotation of the camshaft.

6. A cylinder block for a two-stroke internal combustion engine having a plurality of inline cylinders and an air box charging blower, said cylinder block having substantial symmetry about a longitudinal median plane and comprising:

spaced end walls;

spaced side walls structurally connecting said end walls and having air passages formed therethrough;

internal partition and support means for supporting and strengthening said end walls and said side walls;

a pair of symmetrically spaced shaft galleries extending longitudinally of said cylinder block, said galleries being of the same size and adapted to receive interchangeable counterdriven cam and balance shafts;

and means formed outwardly of the air passages on each of said side walls symmetrically of the longitudinal median plane to permit alternative mounting of the blower on either side of said cylinder block in accordance with the location and direction of rotation of the camshaft.

7. A cylinder block for a two-stroke internal combustion engine having a plurality of inline cylinders, an air box charging blower, a starter, a governor and a fuel pump, said cylinder block having substantial symmetry about a longitudinal median plane and comprising:

spaced end walls;

spaced side walls structurally connecting said end walls and having air passages formed therethrough;

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internal partition and support means for supporting and strengthening said end walls and said side walls;

a pair of symmetrically spaced shaft galleries extending longitudinally of said cylinder block, said galleries being of the same size and adapted to receive interchangeably a camshaft and a balance shaft to permit rotation of the camshaft in either direction;

means for mounting the starter laterally of said side walls and symmetrically of the longitudinal median plane to permit mounting of the starter on either side of said cylinder block;

mounting bosses formed on each of said side walls outwardly of said air passages and adapted to mount the air box charging blower, said bosses being symmetrically disposed on said side walls relative to the longitudinal median plane to permit mounting of the blower on either side of said cylinder block;

and means for mounting the governor and fuel pump disposed symmetrically of said side walls and of the longitudinal median plane to permit mounting of the governor and the fuel pump on the side of said cylinder block opposite to the side on which the blower is mounted.

8. A cylinder block for a two-stroke uniflow scavenged internal combustion engine, said cylinder block having substantial symmetry about a longitudinally extending median plane, said block comprising

a lower portion defining a crankcase chamber and having a plurality of axially aligned crankshaft journal bearings supported in spaced parallel relation by webs and reinforcing struts extending transversely of said crankcase chamber,

said lower crankcase defining portion further having an inline row of ports extending therethrough intermediate the several bearing supporting webs and defined in part by cylindrical flanges,

a plurality of cylinder liners each supported at its lower end by one of said flanges and each having a plurality of air inlet ports therein spaced circumferentially above its supporting flange,

an upper portion of said block extending longitudinally of said cylinder rows in parallel spaced relation to said lower portion and supporting the upper ends of said liners above the inlet ports,

said upper support portion defining two parallel galleries extending longitudinally of the cylinder row rotating cam and balance shafts,

said upper and lower portions being structurally interconnected by end and side walls integral and co-extensive therewith and by a plurality of paired transversely spaced parallel columns extending therebetween intermediate the several cylinders and adjacent the front and rear end walls, said columns being spaced from the side walls of said block and co-extensive with said crankcase web and reinforcing struts,

and said upper and lower block portions, walls, liners and liner supporting flanges defining a scavenging air receiving chamber extending longitudinally of the block and around the liner supporting flanges and the portions of the several cylinder liners intermediate the supported ends thereof.

9. In a two-stroke uniflow scavenged internal combustion engine including a cylinder block as set forth in claim 8,

said side walls having alternative air inlet ports extending therethrough and symmetrically disposed with respect to said median plane,

said air inlet ports each being defined by a peripheral boss adapted to mount and support a compressor unit and including two end boss portions extending between said upper and lower block portions.

10. A cylinder block structure for a two-stroke uniflow scavenged internal combustion engine, said cylinder block

structure having substantial symmetry about a longitudinally extending median plane and comprising

a lower portion defining a crankcase chamber, a plurality of axially aligned crankshaft journal bearings supported in spaced parallel relation by webs and reinforcing struts extending transversely of said crankcase defining portion;

said crankcase portion having an inline row of ports extending therethrough intermediate the bearing supporting webs and defined in part by cylindrical flanges,

a plurality of cylinder liners each supported at its lower end by one of said flanges, each of said liners having a plurality of air inlet ports formed circumferentially thereof intermediate its ends,

an upper portion of said block extending longitudinally of said cylinder rows in parallel spaced relation to said lower portion and sealingly supporting the upper ends of said liners above the inlet ports, said upper support portion defining

two parallel shaft mounting galleries symmetrically flanking and extending longitudinally of the cylinder row, said shaft mounting galleries each having a plurality of spaced bearing supporting bosses dividing the gallery into a plurality of compartments and having aligned ports outboard of said bosses interconnecting the several shaft gallery compartments,

a water jacket gallery extending longitudinally between said shaft mounting galleries and embracing the upper supported ends of the several cylinder liners and

two water distribution galleries symmetrically flanking and extending longitudinally of the cylinder row immediately below said shaft mounting galleries, said water jacket and distribution galleries being interconnected through a plurality of ports extending therebetween,

said upper and lower portions being structurally interconnected by end and side walls integral and coextensive therewith and by a plurality of paired transversely spaced parallel columns extending therebetween intermediate the several cylinders and adjacent the front and rear end walls, said columns being spaced from the side walls of said block and coextensive with said crankcase web and reinforcing struts,

partition webs extending through said upper portion between the several cylinders and dividing said water jacket gallery into a plurality of compartments embracing the upper supported ends of the several liners, said partition webs further cooperating with said columns to define ports intermediate the several water jacket compartments,

and said portions, walls, liners and liner supporting flanges defining a scavenging air receiving chamber extending longitudinally of the block and extending around the liner supporting flanges and the portions of the several cylinder liners intermediate the water jacketed and crankcase flange supported ends thereof.

11. A cylinder block for a two-stroke uniflow scavenged internal combustion engine, said cylinder block having substantial symmetry about a longitudinally extending median plane comprising

a lower portion defining a crankcase chamber, a plurality of axially aligned crankshaft journal bearings supported in spaced parallel relation by webs and reinforcing struts extending transversely of said crankcase defining portion,

a plurality of inline cylinders extending upwardly through said crankcase portion intermediate the bearing supporting webs, each of said cylinders having a plurality of air inlet ports formed circumferentially thereof intermediate its ends,

an upper portion extending longitudinally of said cylinder row in parallel spaced relation to said lower portion and supporting the upper ends of said cylinders above the inlet ports, said upper support portion defining

two parallel cam and balance shaft mounting galleries symmetrically flanking and extending longitudinally of the cylinder row,

a water jacket gallery extending longitudinally between said shaft mounting galleries and embracing the upper ends of the several cylinders

and two water distribution galleries symmetrically flanking and extending longitudinally of the cylinder row immediately below said shaft mounting galleries,

said water jacket and distribution galleries being interconnected by a plurality of ports extending therebetween,

said upper and lower block portions being structurally interconnected by end and side walls integral and coextensive therewith and by a plurality of paired transversely spaced parallel columns extending therebetween intermediate the several cylinders and adjacent the front and rear end walls, said columns being spaced from the side walls of said block and coextensive with said crankcase webs and reinforcing struts,

and said upper and lower block portions, walls, and cylinders defining a scavenging air receiving chamber extending longitudinally of and extending around the several cylinders intermediate the water jacketed and crankcase supported ends thereof.

12. In a two-stroke uniflow scavenged internal combustion engine including a cylinder block as set forth in claim 11,

a crankshaft journaled in said crankcase supported bearings,

a camshaft rotatably mounted in one of said shaft mounting galleries and having longitudinally spaced cam lobes thereon,

a balance shaft rotatably mounted in the other of said shaft galleries, phased engine balancing masses secured to opposite ends of said cam and balance shafts,

timing gear means associated with one end of said block and drivingly interconnecting said cam and balance shafts for counter rotation in phased relation to the rotation of said crankshaft,

the upper portions of said block side walls having alternative air inlet ports opening to the scavenging air receiving chamber, said alternative air inlet ports being symmetrically disposed with respect to said median plane and defined by a peripheral boss including two parallel and boss portions extending between said upper and lower block portions and adapted to mount and support an engine driven compressor unit alternatively mountable on either side of the engine,

said compressor unit being mounted on one of said side walls in mating relation with the air inlet port thereof and having a driving connection through said timing gear means to effect air pumping displacement to said receiving chamber for a given hand of crankshaft rotation.

13. In a two-stroke uniflow scavenged internal combustion engine including a cylinder block as set forth in claim 11,

a crankshaft journaled in said crankcase supported bearings,

a camshaft rotatably mounted in one of said shaft mounting galleries and having longitudinally spaced cam lobes thereon operable to sequentially actuate associated valve and injector mechanisms,

a balance shaft rotatably mounted in the other of said shaft galleries, phased engine balancing masses se-

cured to opposite ends of said cam and balance shafts,
 timing gear means associated with one end of said block and drivingly interconnecting said cam and balance shafts for counterrotation in phased relation to the rotation of said crankshaft,
 the lower crankcase defining portions of said block side walls defining alternative oil cooler and filter mounting locations adjacent one end thereof and having oil distribution passages extending longitudinally and transversely thereof,
 a combined oil filter and cooler assembly alternatively mounted on one of said side wall locations,
 an oil pump unit mounted on and closing the end of said block opposite said timing gear means and having fluid connection with the block defined oil distribution passages, said pump unit being drivingly connected to said crankshaft for fluid pumping displacement from said crankcase chamber through said oil filter and cooler assembly to the oil distribution passages defined by said block,
 the upper portions of said block side walls having alternative water inlet ports opening to said water distribution galleries symmetrically of said median plane, said oil cooler and filter unit having a cooling water outlet connected to the water inlet port of the adjacent block side wall,
 and a water circulating pump mounted on said combined oil cooler and filter unit and having a discharge connection therethrough to the adjacent water inlet port, said circulating pump including water displacing means drivingly connected to the adjacent one of said cam and balance shafts for rotation therewith.

14. In a two-stroke uniflow scavenged internal combustion engine including a cylinder block as set forth in claim 11,

- a crankshaft journaled in said crankcase supported bearings,
- a camshaft rotatably mounted in one of said shaft mounting galleries and having longitudinally spaced cam lobes thereon operable to sequentially actuate associated valve and fuel injector mechanisms,
- a balance shaft rotatably mounted in the other of said shaft galleries, phased engine balancing masses secured to opposite ends of said cam and balance shafts,
- timing gear means associated with one end of said block and drivingly interconnecting said cam and balance shafts for counterrotation in phased relation to the rotation of said crankshaft,
- the lower crankcase defining portions of said block side walls defining alternative oil cooler and filter mounting locations and oil distribution passages extending longitudinally and transversely thereof,
- a combined oil filter and cooler assembly alternatively mounted on one of said side wall locations,
- an oil pump unit mounted on the end of said block opposite said timing gear end, said pump unit having fluid connection and being drivingly connected to said crankshaft for fluid pumping displacement from said crankcase chamber through said oil filter and cooler assembly to the oil distribution passages defined by said block,
- the upper portions of said block side walls having alternative water inlet ports opening to said water distribution galleries and alternative air inlet ports opening to the scavenging air receiving chamber, said alternative water and air inlet ports being symmetrically disposed with respect to said median plane, said air inlet ports each being defined by a peripheral ring between said upper and lower block portions and boss including two parallel end boss portions extended adapted to mount and support an engine driven compressor unit mountable on either side of the engine, said compressor unit being mounted on one of said side walls in mating relation with the air inlet port there-

of and having a driving connection through said timing gear means to effect air pumping displacement to said receiving chamber for a given hand of crankshaft rotation,

- the other of said air inlet ports being closed by a cover member secured to the port defining peripheral boss, said oil cooler and filter unit having a cooling water outlet connected to the water inlet port of the adjacent block side wall,
- and a water circulating pump mounted on said combined oil cooler and filter unit and having a discharge connection therethrough to the adjacent block inlet, said circulating pump including water displacing means drivingly connected to the adjacent one of said cam and balance shafts for rotation therewith.

15. A cylinder block for a two-stroke uniflow scavenged internal combustion engine, said cylinder block having substantial symmetry about a longitudinally extending median plane and comprising

- a lower crankcase defining portion,
- a plurality of inline cylinders supported by and extending upwardly from said crankcase portion, said cylinders each having a plurality of air inlet ports circumferentially formed intermediate its ends,
- an upper portion of said block extending longitudinally of said cylinder row and supporting the upper ends of said cylinders above their air inlet ports, said upper support portion defining
- two parallel cam and balance shaft mounting galleries symmetrically flanking and extending longitudinally of the cylinder row,
- a water jacket gallery extending longitudinally between said shaft mounting galleries and embracing the upper ends of the several cylinders
- and two water distribution galleries symmetrically flanking and extending longitudinally of the cylinder row immediately below said shaft mounting galleries, said water jacket and distribution galleries being interconnected by a plurality of ports extending therebetween,
- said upper and lower block portions being structurally interconnected by
- end and side walls integral and coextensive therewith and
- by a plurality of paired transversely spaced parallel columns extending therebetween intermediate the several cylinders and adjacent the front and rear end walls,
- said columns being spaced from the side walls of said block
- and said upper and lower block portions, walls and cylinders defining a scavenging air receiving chamber embracing the several cylinders intermediate the water jacketed and crankcase supported ends thereof.

16. In a cylinder block for a two-stroke uniflow scavenged internal combustion engine as set forth in claim 15, said cylinder block having

- a plurality of cylindrical bearing supporting bosses spaced longitudinally of the shaft mounting galleries, said bosses being located between the several cylinders and adjacent each end of the cylinder block and dividing the camshaft gallery into a plurality of lubricant receiving compartments,
- and said cylinder block further defining a plurality of aligned ports outwardly of the several bearing supporting bosses, said aligned ports interconnecting the several gallery compartments and being of a size to vent and drain the several camshaft gallery compartments longitudinally of the cylinder block above a cam lobe immersing lubricant level.

17. In a two-stroke uniflow scavenged internal combustion engine including a cylinder block as set forth in claim 15, said block having

- a plurality of cylindrical bearing supporting bosses

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spaced longitudinally of and dividing said galleries into a plurality of lubricant receiving compartments adjacent the several cylinders,
 said cylinder block defining drain passages connecting each of said shaft mounting galleries to the crankcase adjacent one end of the block,
 said block further having a plurality of longitudinally aligned drain ports formed outwardly of and extending through the several bearing supporting bosses to interconnect the several lubricant receiving compartments of each shaft mounting gallery,
 said drain ports being located slightly above the bearing supporting surfaces of the adjacent bosses and being of a size to drain and vent the several shaft mounting gallery compartments longitudinally above a cam lobe immersing level and through said drain passages to said crankcase chamber
 and said block further defining lubricant supplying passage means operable to meter lubricant to the several bearing bosses and lubricant receiving compartments.

18. In a two-stroke uniflow scavenged internal combustion engine including a cylinder block as set forth in claim 15,
 the lower crankcase defining walls of said block defining alternative oil cooler mounting locations and having oil distribution passages extending longitudinally and transversely of the block,
 an oil cooler alternatively mounted on one of said crankcase defining side walls,
 an oil pump mounted on said block and drivingly connected to said engine to effect oil pumping displacement from said crankcase through said oil cooler to the oil distribution passages of said block,
 said oil cooler having a cooling water outlet connected to the water distribution gallery on the adjacent side of the block,
 and a water circulating pump mounted on said oil cooler and drivingly connected to said engine to effect water pumping displacement through said cooler to the adjacent water distribution gallery.

19. In a cylinder block as set forth in claim 15,
 said cylinder block side walls having alternative air inlets opening to the scavenging air receiving chamber symmetrically of said median plane,
 each of said air inlets being defined by a peripheral boss and two parallel bosses extending between said upper and lower block portions and adapted to mount and support an engine driven compressor unit alternately on either side wall of the engine.

20. In a two-stroke uniflow scavenged internal combustion engine including a cylinder block as set forth in claim 15,
 a crankshaft journaled in said crankcase,
 a camshaft rotatably mounted in one of said shaft mounting galleries and having cam lobes thereon operable to sequentially operate associated valve and injector actuating mechanisms,
 a balance shaft rotatably mounted in the other of said shaft galleries,
 phased engine balancing means secured to opposite ends of said cam and balance shafts,
 timing gear means drivingly connecting said cam and balance shafts for counterrotation in phased relation to said crankshaft,
 a cylinder head mounted on said upper block portion and closing the upper outwardly disposed ends of said cylinders, said cylinder head being symmetrical about its transverse median plane for end-to-end reversible mounting on the cylinder block and having struts extending therethrough alignable with the columns of said block and adapted to receive mounting bolts securing said head to the columns of said block,
 said cylinder head having exhaust passages and over-

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head valve means associated therewith operable to control exhaust gas flow through said exhaust passages,
 overhead valve actuating means mounted on said head, and said head being oriented in its mounting on said block to provide operable connections between said valve actuating means and the lobes of the camshaft.

21. A cylinder block for a two-stroke uniflow scavenged internal combustion engine, said cylinder block having substantial symmetry about a longitudinally extending median plane and comprising
 a lower crankcase defining portion,
 a plurality of inline cylinders supported by and extending upwardly from said crankcase portion, said cylinders having each a plurality of air inlet ports formed circumferentially between its ends,
 an upper portion of said block extending longitudinally of said cylinder row and supporting the upper ends of said cylinders above the air inlet ports, said upper support portion defining
 two parallel cam and balance shaft mounting galleries symmetrically flanking and extending longitudinally of the cylinder row
 a water jacket gallery extending longitudinally between said mounting galleries and embracing the upper ends of the several cylinders
 and two water distribution galleries symmetrically flanking and extending longitudinally of the cylinder row immediately below said shaft mounting galleries,
 said water jacket and distribution galleries being interconnected by a plurality of ports extending therebetween,
 said upper and lower block portions being structurally interconnected by end and side walls integral and co-extensive therewith,
 and said upper and lower block portions, walls and cylinders defining a scavenging air receiving chamber embracing the several cylinders intermediate the water jacketed and crankcase support ends thereof.

22. In an internal combustion engine, a cylinder block comprising
 a lower crankcase defining portion,
 a plurality of inline cylinders supported by and extending upwardly from said crankcase portion,
 an upper portion of said block extending longitudinally of said cylinder row and supporting the upper ends of said cylinders above the crankcase portion,
 said upper and lower block portions being structurally interconnected by end and side walls integral and coextensive therewith,
 said upper support portion defining
 a camshaft mounting gallery extending longitudinally of the inline cylinder row
 and a water jacket gallery embracing the upper ends of the several cylinders,
 a plurality of bearing bosses intersecting the shaft mounting gallery longitudinally between the several cylinders and adjacent each end thereof and dividing said gallery into a plurality of lubricant receiving compartments, said bearing bosses defining
 a plurality of axially aligned cylindrical surfaces adapted to support the spaced journal bearings of a camshaft rotatably mountable therein and further defining
 a plurality of ports spaced outwardly of the cylinder row and of the cylindrical bearing supporting surfaces therethrough and longitudinally aligned to interconnect the several lubricant receiving compartments above a cam lobe immersing level.

23. In an internal combustion engine,
 a cylinder block having an inline row of cylinders and defining a camshaft mounting gallery extending longitudinally of the inline cylinder row,
 a plurality of bearing bosses intersecting the shaft mounting gallery longitudinally between the several

cylinders and adjacent each end thereof and dividing said gallery into a plurality of lubricant receiving compartments, said bearing bosses defining

a plurality of axially aligned cylindrical surfaces adapted to support the spaced journal bearings of a camshaft mountable therein and further defining

a plurality of ports spaced outwardly of the cylinder row and of the cylindrical bearing supporting surfaces therethrough and longitudinally aligned to interconnect the several lubricant receiving compartments above a cam lobe immersing level.

24. In an internal combustion engine as set forth in claim 23, said cylinder block further defining

a lubricant drain passage connected to said camshaft between two of the bearing supporting bosses therein,

and said aligned ports and passage being of a size to continuously vent and drain the supplied lubricant longitudinally from the several camshaft gallery compartments and through said passage.

25. In an internal combustion engine, a cylinder block having substantial symmetry about a longitudinally extending median plane and comprising

a lower block portion defining a crankcase chamber, a plurality of inline cylinders supported by and extending from said lower crankcase portion,

and an upper block portion supporting said cylinders in spaced relation to the lower crankcase portion and defining two parallel cam and balance shaft mounting galleries symmetrically flanking and extending longitudinally of the aligned cylinder row,

a plurality of bearing bosses dividing the shaft mounting galleries longitudinally between the several cylinders and adjacent each end thereof into a plurality of lubricant receiving compartments,

and said bearing bosses further defining a plurality of longitudinally aligned drain ports outwardly reinforcing and interconnecting the several lubricant receiving compartments above a cam lobe immersing level.

26. In an internal combustion engine, a cylinder block having substantial symmetry about a longitudinally extending median plane and comprising

a lower block portion defining a crankcase chamber, a plurality of inline cylinders supported by and extending from said lower crankcase portion,

and an upper block portion supporting said cylinders in spaced relation to the lower crankcase portion and defining

two parallel cam and balance shaft mounting galleries symmetrically flanking and extending longitudinally of the aligned cylinder row,

a water jacket gallery embracing the upper ends of the several cylinders,

and two water distribution galleries symmetrically flanking and extending longitudinally of the cylinder row immediately below said shaft mounting galleries, said upper and lower block portions being structurally interconnecting by end and side walls integral and coextensive therewith,

said upper block portion having a plurality of longitudinally spaced bearing bosses dividing the shaft mounting galleries into a plurality of lubricant receiving compartments and transversely reinforcing said upper block portion,

and said upper block portion further having a plurality of longitudinally aligned drain ports interconnecting the several lubricant receiving compartments outwardly of said bearing bosses above a cam lobe immersing level.

27. In an internal combustion engine as set forth in claim 26, said cylinder block further defining

passages connecting said crankcase chamber to each of said galleries between two of the bearing supporting bosses therein,

and said aligned ports and passages being of a size to continuously vent and drain the supplied lubricant longitudinally from the several gallery compartments and through said passage to the crankcase chamber.

28. A cylinder block for a two-stroke internal combustion engine having substantial symmetry about a longitudinally extending median plane and comprising

a lower block portion defining a crankcase chamber, a plurality of aligned cylinders each supported by and extending upwardly from said lower crankcase portion,

and an upper block portion supporting said cylinders in spaced relation to the lower crankcase portion above their inlet ports and defining

two parallel cam and balance shaft mounting galleries symmetrically flanking and extending longitudinally of the aligned cylinder row,

a plurality of cylindrical bearing supporting bosses longitudinally dividing the shaft mounting galleries into a plurality of lubricant receiving compartments, and further defining a plurality of longitudinally aligned ports interconnecting the several gallery compartments outwardly of the bearing supporting bosses and being of a size to vent and drain the several camshaft gallery compartments longitudinally of the cylinder block above a cam lobe immersing level.

29. In an internal combustion engine as set forth in claim 28, said cylinder block further defining

passages connecting said crankcase chamber to each of said galleries between two of the bearing supporting bosses therein,

and said aligned ports and passages being of a size to continuously vent and drain the supplied lubricant longitudinally from the several gallery compartments and through said passage to the crankcase chamber.

30. A cylinder block for a two-stroke uniflow scavenged internal combustion engine, said cylinder block having substantial symmetry about a longitudinally extending median plane and comprising

a lower crankcase defining portion,

a plurality of inline cylinders supported by and extending upwardly from said crankcase portion, said cylinders each having a plurality of air inlet ports formed circumferentially between its ends,

an upper portion of said block extending longitudinally of said cylinder row and supporting the upper ends of said cylinders above the crankcase portion, said upper support portion defining

two parallel cam and balance shaft mounting galleries symmetrically flanking and extending longitudinally of the cylinder row,

a water jacket gallery extending longitudinally between said shaft mounting galleries and embracing the upper ends of the several cylinders,

and two water distribution galleries symmetrically flanking and extending longitudinally of the cylinder row immediately below said shaft mounting galleries, said water jacket and distribution galleries being interconnected by a plurality of ports extending therebetween,

said upper and lower block portions being structurally interconnected by end and side walls integral and coextensive therewith and said upper and lower block portions, walls and cylinders defining a scavenging air receiving chamber embracing the several cylinders intermediate the water jacketed and crankcase supported ends thereof,

said upper block portion further having a plurality of cylindrical bearing supporting bosses longitudinally dividing the shaft mounting galleries between the several cylinders and adjacent each end of the cylinder block into a plurality of lubricant receiving compartments,

lubricant supply means operable to continuously meter

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lubricant to certain of said bearing supporting bosses and therefrom to the several lubricant receiving compartments, and the several bearing supporting bosses further defining a plurality of longitudinally aligned ports outwardly interconnecting the several gallery compartments and being of a size to vent and drain the several camshaft gallery compartments longitudinally

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of the cylinder block above a cam lobe immersing level.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,145,695

August 25, 1964

George W. Conover et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 36, before "symmetry" insert -- having substantial --; column 2, line 63, strike out "indicating", second occurrence; column 3, line 57, after "mating" insert -- with --; line 75, after "two" insert -- coolant --; column 5, line 4, for "acts" read -- act --; column 10, line 46, after "row" insert -- and adapted to interchangeably mount counter- --; column 13, line 57, for "bear" read -- gear --; line 71, after "extend-" insert -- ing between said upper and lower block portions and --; column 15, line 49, for "it-" read -- al- --; column 16, line 39, for "support" read -- supported --.

Signed and sealed this 22nd day of December 1964.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents