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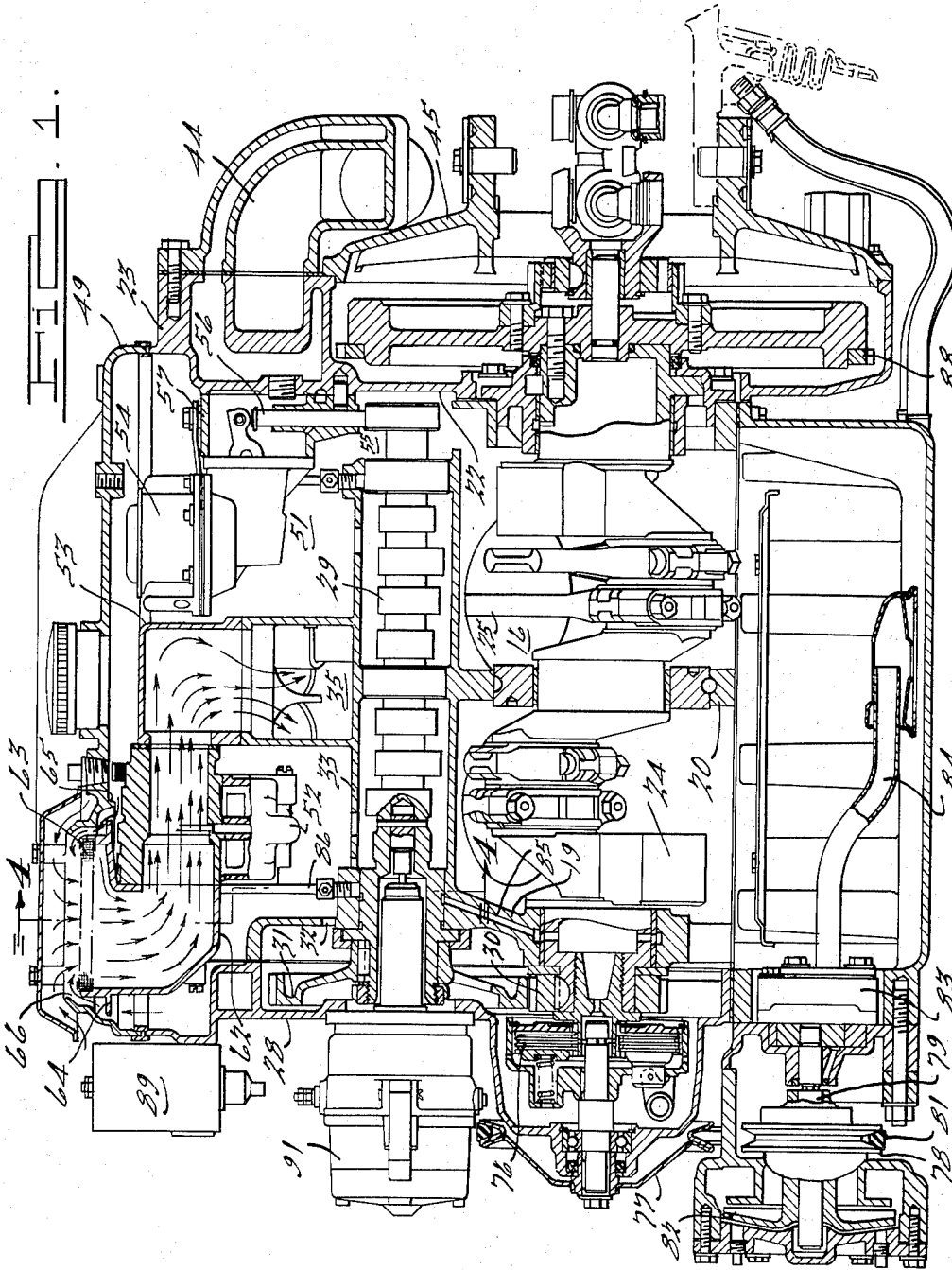
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3,233,598

MARINE ENGINE

Filed Oct. 28, 1964

4 Sheets-Sheet 1



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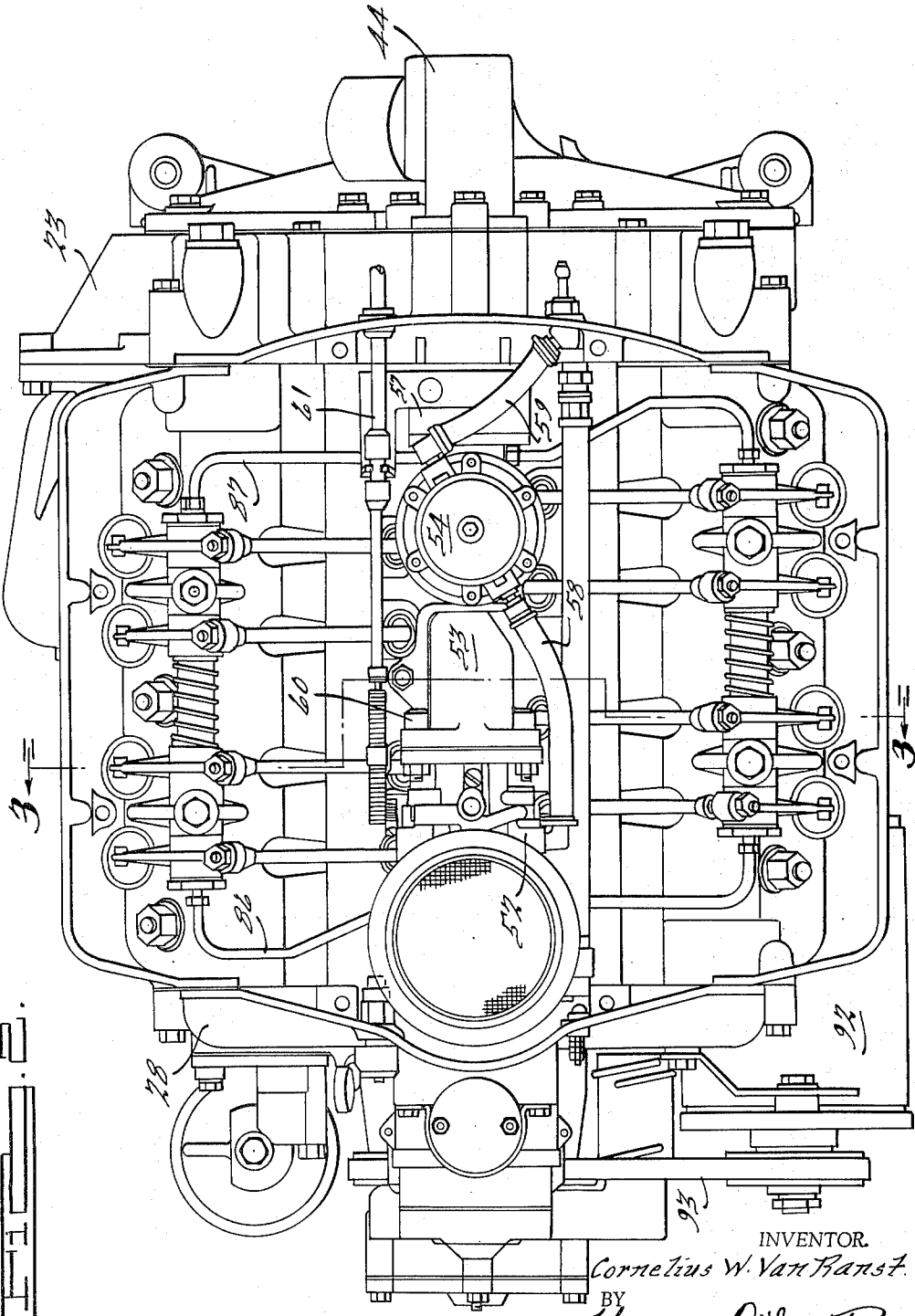
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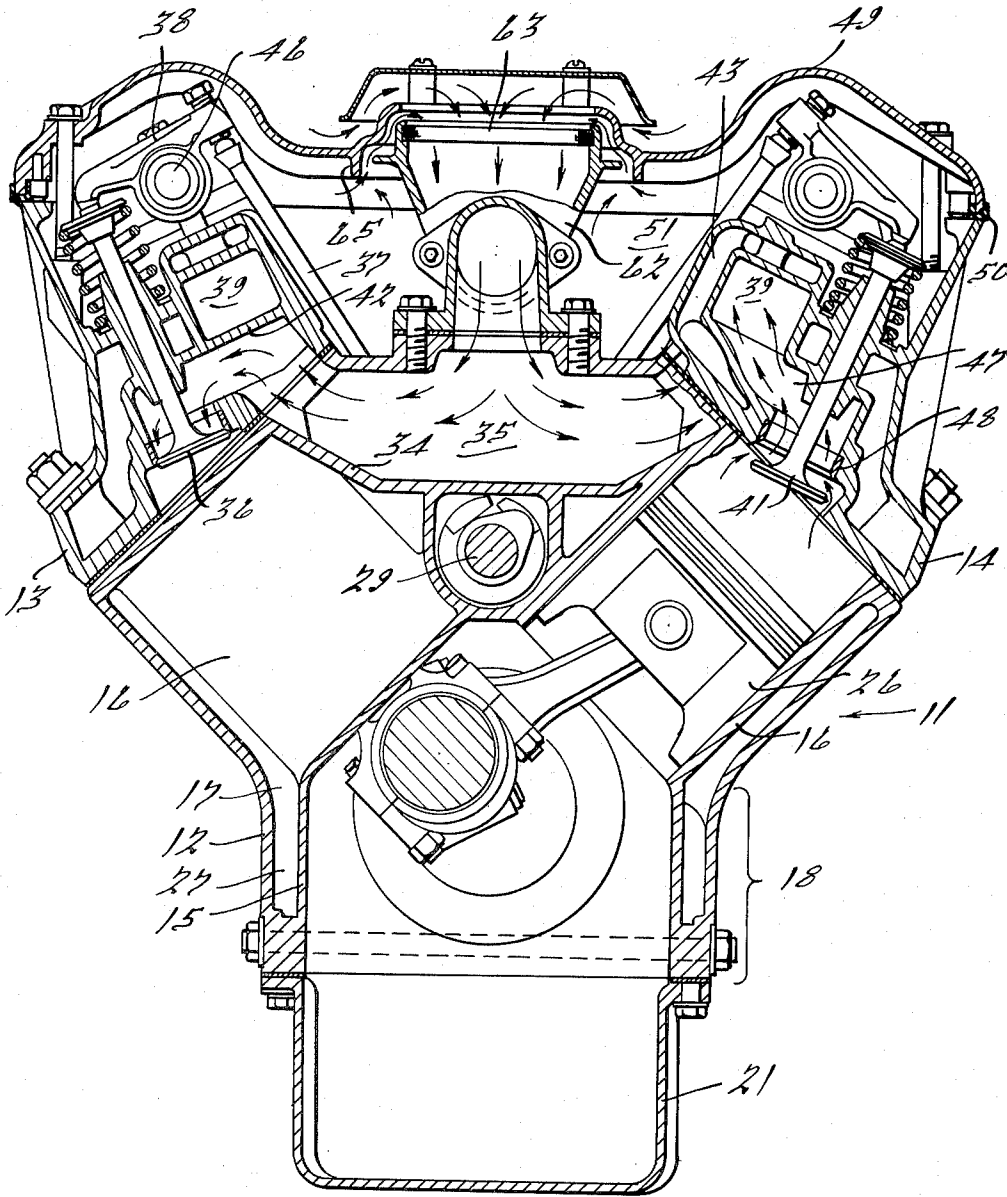


FIG. 3.

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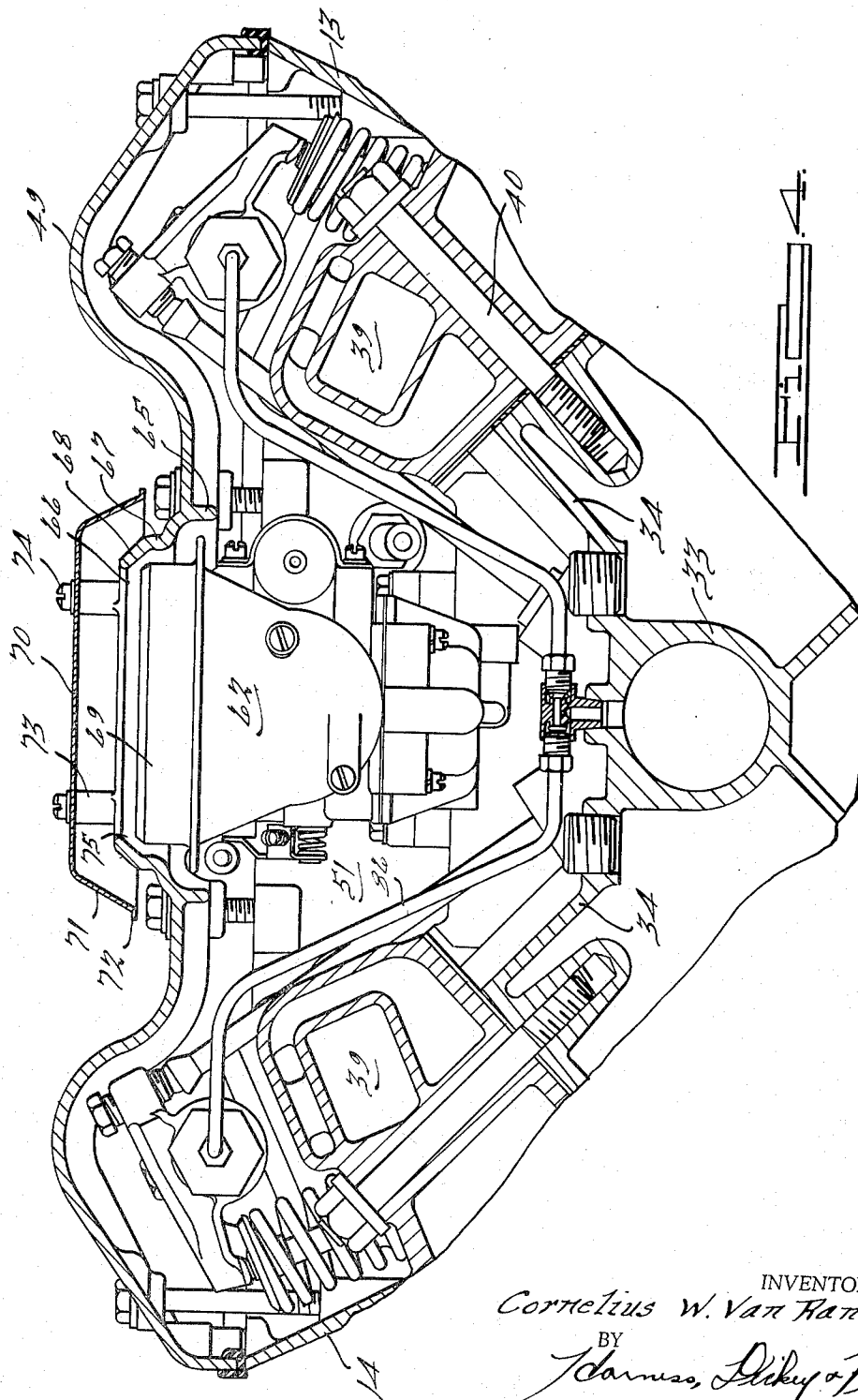
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MARINE ENGINE

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This invention relates to marine internal-combustion engines, and more particularly to inboard engines which are capable of use in inboard-outboard drive systems.

It is an object of the present invention to provide a novel and improved marine engine which incorporates features of construction adding to the compactness as well as the safety of the unit and minimizing the possibility of explosive gasoline vapor collection.

It is another object to provide an improved marine engine of this character which minimizes oil leakage in the vicinity of the crankcase.

It is a further object to provide an improved marine construction of this nature with features which are especially advantageous for multiple or V-bank engines.

It is also an object to provide an improved marine engine of this character which eliminates the need for a separate jacketed exhaust manifold and facilities heat exchange between the exhaust and intake manifolds while providing a relatively narrow V-type engine permitting closer spacing of the propeller shaft in twin screw installations.

It is another object to provide an improved marine engine having these characteristics which eliminates the necessity of a separate heat transfer unit for oil cooling.

It is also an object to provide an improved marine engine of this character which insures sufficient oil pressure at idle speeds to actuate an outboard drive lifting cylinder and at the same time furnishes sufficient water pressure to circulate cooling water at idle speeds.

Other objects, features and advantages of the present invention will become apparent from the subsequent description, taken in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is a side elevational view in cross section of a preferred embodiment of the engine;

FIGURE 2 is a top plan view of the engine with the cover removed;

FIGURE 3 is a cross sectional view in elevation taken along the line 3-3 of FIGURE 2; and

FIGURE 4 is a fragmentary cross sectional view in elevation taken along the line 4-4 of FIGURE 1.

Briefly, the illustrated embodiment of the invention comprises a cylinder block and cylinder heads which together form a main engine housing, there being four cylinders in the housing arranged in two oppositely inclined banks with a central compartment therebetween. The carburetor, fuel pump and associated connections are mounted in this central compartment between the cylinder banks, with a unitary cover above them sealed to and forming part of the housing. Drainage connections are provided from this compartment to the ventilated crankcase so that gasoline vapors emitted from the components in the compartment or any leakage from their connections will be confined to the engine interior, leaking fuel draining into the ventilated crankcase. The gear box and starting mechanism are partitioned from the engine housing so that any sparks created during engagement of the starting pinion and gear will not be in contact with fumes within the engine housing.

The crankcase vent connection extends to the area immediately above a horizontally disposed flame arrester screen at the air intake. A domed cover is mounted above the flame arrester and vent outlet under which the intake air must pass in order to enter the intake air horn

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through the flame arrester. The eductive effect on crankcase fumes created by this construction will result in a subatmospheric pressure in the crankcase which minimizes oil leakage. The arrangement will also prevent fumes which rise through the vent after the engine is shut off from dropping into the bilge, and the cover will prevent water from entering the flame arrester.

Each exhaust manifold is integrally formed within its cylinder head and is inboard of the valves, parts of the intake manifold being formed in the heads below the exhaust manifolds so that heat exchange may take place. This arrangement has the additional advantage of eliminating the need for a separate jacketed exhaust manifold and contributes to the compactness of the engine in a lateral direction.

The water jacket is extended to the bottom of cylinder block portion of the crankcase, eliminating the necessity of a separate heat transfer unit for oil cooling. The oil and water pumps are constructed as a single coaxial assembly driven by a single belt through a speed-limiting drive. This arrangement has the advantage of insuring sufficient water and oil pressures even at idling speeds, so that the oil pressure may be used to actuate an outboard drive lifting cylinder, the water pressure being utilized of course to circulate cooling water. This eliminates the need for a separate electric pump to create sufficient oil pressure at low engine speeds.

Referring more particularly to the drawings, the engine housing is generally indicated at 11 and comprises a cylinder block 12, cylinder heads 13 and 14, and a crankcase 15. Cylinder block 11 has four cylinders 16, arranged in pairs on opposite sides thereof, the cylinders extending upwardly and outwardly to form a V-type engine. A water jacket 17 is formed in block 12 and surrounds cylinders 16. Block 12 has a vertical portion indicated by the bracket 18 in FIGURE 3, this vertical portion supporting and extending below crankshaft bearing support webs 19 and 20, as seen in FIGURE 1, and having a crankcase pan 21 suspended therebelow. An additional crankshaft bearing support 22 forms a part of a rear cover 23 for the engine block, seen in FIGURE 1. Crankshaft 24 is rotatably mounted in bearings carried by the bearing supports and is connected to piston rods 25 carried by pistons 26 within cylinders 16. Crankshaft 24 is of the two-throw type with two piston rods 25 being connected to each throw, as seen in FIGURE 1. It will be noted that portions 27 of the water jacket extend a substantial distance into the vertical portion 18 of engine block 12, thus aiding in cooling of the crankcase oil. A forward cover 28 is mounted on the cylinder block, this cover being spaced from web 19.

A cam shaft 29 is rotatably mounted above the crankshaft 24 and is connected thereto by gears 30 and 31 mounted on the crankshaft and cam shaft respectively. Wall 19 of the housing is provided with a plurality of apertures 32, seen in FIGURE 1, immediately above the portion 33 of the housing which supports the cam shaft bearings. These apertures serve to permit drainage of any leaking gasoline or gasoline vapors to the crankcase, as will later be seen. Inclined walls 34 extend from housing portion 33 to the upper ends of cylinder heads 13 and 14.

Inlet manifold 35 is disposed above cam shaft 29, as seen in FIGURE 3, the central portion of the manifold being disposed between cylinder heads 13 and 14 with the manifold having branches leading to the inlet valves 36 carried by the cylinder heads. These valves are connected by links 37 and rocker arms 38 to the cam shaft and are disposed toward the outer portions of the cylinder heads, being inclined downwardly and inwardly, as seen in FIGURE 3. Exhaust manifolds 39 are integrally formed within each cylinder head 13 and 14. Bolts 40

are used to secure heads 13 and 14 to the cylinder block, the exhaust manifolds being disposed inwardly of bolts 40, inlet valves 36 and exhaust valves 41 and extending along the length of the heads. The exhaust valves, like the intake valves, are disposed at the outer portions of the cylinder banks and are inclined downwardly and inwardly. Exhaust manifolds 39 are of rectangular cross-sectional shape, and the lower walls 42 of the exhaust manifolds are disposed between the exhaust manifolds and the intake manifolds, so that heat transfer may take place from the exhaust to the intake manifolds.

Portions 43 of the water jacket extend into the cylinder heads and partially surround the exhaust manifolds. The exhaust manifolds lead to an exhaust manifold header 44 which is part of the rear cover 45 of the starting gear compartment, as seen in FIGURE 1. The side walls of exhaust manifolds 39 are substantially parallel to the axes of valves 36 and 41, the pivots 46 of rocker arms 38 being disposed above the exhaust manifolds and inwardly of the valves. Exhaust passages 47 lead upwardly and inwardly from exhaust valve seats 48 to exhaust manifolds 39, as seen in FIGURE 3. A top cover 49 is bolted and secured by means of a continuous seal 50 above the exhaust and intake valves and the central compartment 51 disposed between heads 13 and 14. Seal 50 is disposed between the downwardly facing outer edge of cover 49 and the upwardly facing edges of cylinder heads 13 and 14 as well as rear cover 23 and forward cover 28 of the engine, compartment 51 thus being formed by these components together with walls 34 of cylinder block 12. It will be seen that the arrangement, including the positioning of the exhaust manifolds, provides an extremely compact construction for the V-engine, especially in the lateral direction.

A carburetor 52, seen in FIGURE 1, is disposed within chamber 51 and is connected to intake manifold 35 by an elbow 53. The carburetor is spaced above cam shaft enclosure 33 and is supplied with gasoline by a fuel pump 54 which is also disposed in the central compartment 51 between the cylinder heads. Fuel pump 54 is located rearwardly of connection 53, and a passage 55 extends downwardly from chamber 51 past cam shaft housing 33 to the crankcase immediately below fuel pump 54, the fuel pump being operated by the cam shaft by means of a reciprocating rod 56. Pump 54 is mounted in space 51 by means of a bracket 57, seen in FIGURE 2, and supplies carburetor 52 with fuel through a fuel line 58, the fuel delivered to the pump by a line 59 also located within space 51. The carburetor is secured to connection 53 by mating flanges and bolts 60, also seen in FIGURE 2. A throttle operating linkage 61 extends past fuel pump 54 to the throttle of carburetor 52. An air horn 62 is secured to the forward end of carburetor 52 and extends forwardly and upwardly therefrom, the upper end of the air horn having a flame arrester screen 63, as seen in FIGURES 1 and 3. Air horn 62 is upwardly flared and has an annular oil particle baffle 64 formed on its outer surface. This baffle is adjacent another downwardly extending oil particle baffle 65 formed on cover 49. These oil particle baffles will tend to keep oil particles drawn upwardly from the crankcase through passages 32 and 55 and compartment 51 from being carried into the entering intake air.

Cover 49 is provided with a circular opening 66 around and above flame arrester 63. This opening is formed by an annular upward extension 67 of cover 49, as seen in FIGURE 4, and an upwardly and inwardly inclined annular lip 68. These two parts of the cover are spaced from but generally conform with the shape of the upper portion 69 of air horn 62, so as to form an annular passage leading from compartment 51 to the space immediately above the flame arrester. A dome-like cover 70 is mounted above opening 66, this dome having a flat central portion and downwardly and outwardly flared annular flange 71 terminating in a radial lip 72. The dome is sup-

ported on four posts 73 formed on and extending upwardly from cover 49 adjacent portions 67 and 68 thereof, the dome being secured to the posts by bolts 74.

The annular passage 75 formed by portions 67 and 68 of cover 49 on the one hand and portion 69 of air horn 62 on the other hand, is of sufficient cross-sectional area to provide relatively low velocity for air which is drawn by eductive action from the crankcase through passages 32 and 55 and compartment 51 to the space above the flame arrester. The eductive action is created by the flow of air between dome 70 and portion 68 of housing cover 49 as it is drawn inwardly from the atmosphere past the upper edge of portion 68 of the cover into the space above the flame arrester and then down through the flame arrester into the air horn. Although the velocity of the air in passage 75 is low enough to prevent oil from being drawn out, the pressure drop created in the crankcase chamber will be sufficient to minimize oil leakage therefrom. The arrangement will also prevent fumes which may rise through passage 75 after engine shutoff from dropping into the bilge, since these fumes will tend to drop through the flame arrester instead. Dome 70 will serve the additional purpose of preventing water from entering the flame arrester.

A constant speed drive 76 is mounted on the forward end of crankshaft 24, this drive being of a known type which has means for controlling or limiting the output speed. Drive 76 carries a pulley 77 which is connected to a pulley 78 on a shaft 79 by a belt 81. Shaft 79 is mounted below and parallel to crankshaft 24 and drives a water pump 82 and an oil pump 83. These pumps are mounted on opposite sides of the pulley 78, the oil pump being on the side toward the crankcase and being connected thereto by a line 84. The relative sizes of pulleys 77 and 78 are such that they have a 1:2 speed ratio, that is, pulley 78 will rotate twice as fast as pulley 77. The construction is such that at relatively low or idle speeds of the engine, both the water and oil pumps will be driven with sufficient speed to provide circulating cooling water and sufficient oil pressure to operate an outboard drive lifting cylinder (not shown).

In operation, air will be drawn into the space between dome 70 and portions 67 and 68 of cover 49 and down through flame arrester 63 to carburetor 52 where it will be mixed with fuel particles, the fuel-air mixture passing through elbow 53 to intake manifold 35. The exhaust gases will pass through exhaust gas manifolds 39 to exhaust outlet 44. Lubricating oil will be pumped from the crankcase through oil pump 83 and oil passages such as those indicated at 85, 86 and 87 in FIGURES 1, 2 and 4, to the various engine bearings.

During operation, heat from the exhaust manifolds 39 will flow through separating wall 42 between the exhaust and intake manifolds, thereby heating the entering fuel-air mixture. Any gasoline or gasoline vapors leaking from fuel pump 54, carburetor 52, elbow 53, intake manifold 35, or the adjacent parts and connections disposed within compartment 51, will drop to the bottom of this compartment and will be drained down through passages 32 and 55 to the crankcase. It should be noted that the starting gearing 88 is separated from compartment 51 by rear cover 23 so that there will be no danger of sparks created during engagement of the starting pinion and gear from contacting fumes within the engine housing. It might be mentioned that a spark coil 89 and distributor 91 are also mounted outside the engine housing on the forward portion of the engine, as seen in FIGURE 1, the distributor being coaxial with the cam shaft and keyed thereto, while the spark coil is mounted above the distributor. A generator 92, seen in FIGURE 2, is mounted on one side of the engine outside the engine housing and is connected to the crankshaft by a belt 93.

Pressure in the crankcase will be reduced by the eductive action of intake air flowing past lip 68 of cover 49, thus drawing air from compartment 51 through passage

75 and into the flame arrester, compartment 51 being connected to crankcase 20. When the engine is stopped any fumes rising from crankcase 20 or compartment 51 will pass through passage 75, being led inwardly to the space above the flame arrester 63, so that these fumes will drop to the flame arrester rather than outwardly into the bilge within which the marine engine is mounted.

While it will be apparent that the preferred embodiment of the invention disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. An internal-combustion engine comprising a cylinder block, first and second banks of cylinders in said block, said banks being upwardly and outwardly inclined, a pair of cylinder heads secured to said block, a cover extending across and sealed to said cylinder heads and cylinder block, whereby a compartment is formed between said cylinder heads by the cylinder heads, cylinder block and cover, a crankcase at the lower portion of said cylinder block, drain passage means leading from said compartment to said crankcase, an intake manifold for said engine having an entrance portion in said compartment, a carburetor in said compartment and connected to the entrance of said intake manifold, and a fuel pump in said compartment and connected to said carburetor.

2. An internal-combustion engine comprising a cylinder block, first and second banks of cylinders in said block, said banks being upwardly and outwardly inclined, a pair of cylinder heads secured to said block, a cover extending across and sealed to said cylinder heads and cylinder blocks, whereby a compartment is formed between said cylinder heads by the cylinder heads, cylinder block and cover, a crankcase at the lower portion of said cylinder block, drain passage means leading from said compartment to said crankcase, and intake manifold for said engine having an upwardly facing entrance in said compartment, a carburetor in said compartment, an elbow connecting the exit of said carburetor and the entrance of said intake manifold, and a fuel pump in said compartment and connected to said carburetor, said elbow being disposed between said fuel pump and said carburetor.

3. An internal-combustion engine comprising a cylinder block, first and second banks of cylinders in said block, said banks being upwardly and outwardly inclined, a pair of cylinder heads secured to said block, a cover extending across and sealed to said cylinder heads and cylinder block, whereby a compartment is formed between said cylinder heads by the cylinder heads, cylinder block and cover, a crankcase at the lower portion of said cylinder block, drain passage means leading from said compartment to said crankcase, an intake manifold for said engine having an entrance portion in said compartment, a carburetor in said compartment and connected to the entrance of said intake manifold, an air horn connected to the entrance of said carburetor and having an upwardly open entrance, a flame arrester mounted in said air horn entrance, said engine cover having an annular opening surrounding said air horn entrance with portions spaced from the air horn entrance to form an annular space therebetween connected to said compartment, and a dome mounted above said flame arrester and having a downwardly extending flange spaced from said annular portion of the engine cover, whereby air flowing into said flame arrester will have an eductive effect with respect to said compartment.

4. An internal-combustion engine comprising a cylinder block, first and second banks of cylinders in said block, said banks being upwardly and outwardly inclined, a pair of cylinder heads secured to said block, a cover extending across and sealed to said cylinder heads and cylinder block, whereby a compartment is formed be-

tween said cylinder heads by the cylinder heads, cylinder block and cover, a crankcase at the lower portion of said cylinder block, drain passage means leading from said compartment to said crankcase, a cam shaft enclosure formed in said cylinder block above said crankcase, said drain passage means comprising passages located adjacent the forward and rear ends of said cam shaft enclosure, an intake manifold for said engine having an entrance portion in said compartment, a carburetor in said compartment and connected to the entrance of said intake manifold, and a fuel pump in said compartment and connected to said carburetor.

5. An internal-combustion engine comprising a cylinder block, first and second banks of cylinders in said block, said banks being upwardly and outwardly inclined, a pair of cylinder heads secured to said block, a cover extending across and sealed to said cylinder heads and cylinder block, whereby a compartment is formed between said cylinder heads by the cylinder heads, cylinder block and cover, a crankcase at the lower portion of said cylinder block, drain passage means leading from said compartment to said crankcase, an intake manifold for said engine having an entrance portion in said compartment, lateral passages in said intake manifold leading to intake ports within said cylinder heads, intake and exhaust valves mounted in said cylinder heads adjacent the outer portions thereof, exhaust manifolds formed integrally with and extending along said cylinder heads inwardly of said valves, a heat transmitting wall separating said exhaust manifolds and said intake manifold passages leading to the intake valves, a carburetor in said compartment and connected to the entrance of said intake manifold, and a fuel pump in said compartment and connected to said carburetor.

6. The combination according to claim 5, further provided with bolts extending through said cylinder heads outwardly of said exhaust manifolds and securing the cylinder heads to the cylinder block, rocker arms pivotally mounted above said exhaust manifolds and engageable with said valves, a cam shaft rotatably mounted below said engine compartment, and links connecting said cam shaft with said rocker arms, said links being disposed in said engine compartment.

7. An internal-combustion engine comprising a cylinder block, first and second banks of cylinders in said block, said banks being upwardly and outwardly inclined, a water jacket formed in said cylinder block, the cylinder block having a downwardly extending vertical section below said cylinder banks, a crankcase pan secured to the bottom of said cylinder block, said water jacket extending downwardly through the major portion of the vertically extending section of the cylinder block, a pair of cylinder heads secured to said block, a cover extending across and sealed to said cylinder heads and cylinder block, whereby a compartment is formed between said cylinder heads by the cylinder heads, cylinder block and cover, a crankcase at the lower portion of said cylinder block, drain passage means leading from said compartment to said crankcase, an intake manifold for said engine having an entrance portion in said compartment, a carburetor in said compartment and connected to the entrance of said intake manifold, and a fuel pump in said compartment and connected to said carburetor.

8. In an internal-combustion engine, a crankcase, a carburetor, an air horn for said carburetor for having an upwardly open entrance, an engine housing having an annular portion surrounding said air horn entrance and forming an annular passage therewith, a dome mounted above and spaced from said air horn entrance, said dome having a downwardly extending flange whereby air drawn under said dome for entrance into said air horn will create an eductive effect on said annular passage, and means connecting said annular passage with said crankcase, whereby said eductive effect will reduce the pressure in said crankcase.

9. The combination according to claim 8, further provided with an oil particle baffle formed on said air horn and extending outwardly therefrom, and a second oil particle baffle formed on the portion of the engine housing interior adjacent said first baffle.

10. In a V-type internal-combustion engine, a cylinder block having two banks of cylinders and a crankcase, a pair of cylinder heads mounted on said cylinder block, cover means forming an enclosed compartment between said cylinder heads, passages connecting the lower portion of said compartment and said crankcase, an air intake passage having an upwardly open entrance, a wall surrounding said entrance and forming an annular passage therewith, and a dome mounted above said entrance and forming a passage with said wall for intake air flowing to said entrance, the relative positions of said passages being such that said entering air will create an eductive effect with respect to said annular passage thereby lowering the pressure in said compartment and said crankcase.

11. A V-type internal-combustion engine, a cylinder block having a pair of upwardly and outwardly inclined cylinder banks, a crankcase formed in the lower portion of said block, a pair of cylinder heads mounted on said block and extending upwardly therefrom, cover means mounted on said cylinder heads and serving to form an enclosed compartment therebetween, a carburetor mounted within said compartment, an L-shaped air horn connected to the entrance of said carburetor and having an upwardly facing entrance with a flame arrester, an upwardly extending annular wall formed in said cover means to define an opening therein and surrounding said air horn entrance in spaced relation therewith so as to form an annular passage, the upper portion of said passage being inclined upwardly and inwardly, a dome mounted in spaced relation above said flame arrester and secured to said cover, said dome having a downwardly and outwardly extending flange in spaced relation with the upwardly extending wall of said cover, and connecting means between said engine compartment and said crankcase, whereby the eductive effect created on said annular passage by air passing under said dome and into said flame arrester will lower the pressure in said compartment and said crankcase, the shape of the upper lip of said annular engine cover wall being such that fumes rising through from said compartment through said annular passage will be directed to the space immediately above said flame arrester.

12. The combination according to claim 11, further provided with an outwardly extending oil particle baffle on said air horn below said annular passage.

13. In a V-type internal-combustion engine, a cylinder block having a pair of upwardly and outwardly inclined cylinder banks, cylinder heads mounted on the upper portions of said cylinder banks, an intake manifold

formed in the upper portion of said engine block and having laterally extending portions connected with intake passages in said cylinder heads, intake and exhaust valves slidably mounted in the outer portions of said cylinder heads, and exhaust manifolds extending along said cylinder heads and integrally formed therewith, said exhaust manifolds being disposed inwardly of said valves.

14. The combination according to claim 13, said exhaust manifolds having lower walls, said walls also being exposed to said intake manifold passages, whereby heat may be transferred from the exhaust manifolds to the intake passages.

15. The combination according to claim 13, said exhaust manifolds being of generally rectangular cross-sectional shape with their side walls substantially parallel to the axes of said valves.

16. In a V-type internal-combustion engine, a cylinder block having a pair of upwardly and outwardly inclined cylinder banks, cylinder heads mounted on the upper portions of said cylinder banks, an intake manifold formed in the upper portion of said engine block and having laterally extending portions connected with intake passages in said cylinder heads, intake and exhaust valves slidably mounted in the outer portions of said cylinder heads, exhaust manifolds extending along said cylinder heads and integrally formed therewith, said exhaust manifolds being disposed inwardly of said valves, the axes of said valves being inclined downwardly and inwardly, rocker arms pivotally mounted above said exhaust manifolds, and water jacket means in said cylinder heads partially surrounding said exhaust manifolds.

17. In a V-type internal-combustion engine, a cylinder block having a pair of upwardly and outwardly inclined cylinder banks, cylinder heads mounted on the upper portions of said cylinder banks, an intake manifold formed in the upper portion of said engine block and having laterally extending portions connected with intake passages in said cylinder heads, intake and exhaust valves slidably mounted in the outer portions of said cylinder heads, and exhaust manifolds extending along said cylinder heads and integrally formed therewith, said exhaust manifolds being disposed inwardly of said valves and leading to a common exhaust discharge conduit at one end of said engine.

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